

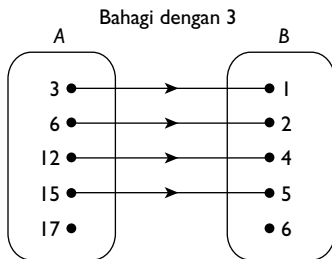
JAWAPAN

BAB 1: FUNGSI

1.1

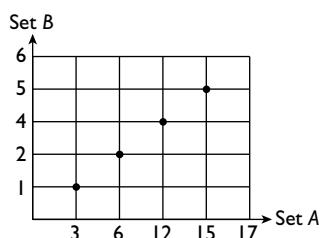
A

1. (a)

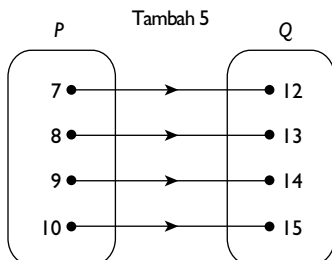


(b) $\{(3, 1), (6, 2), (12, 4), (15, 5)\}$

(c)

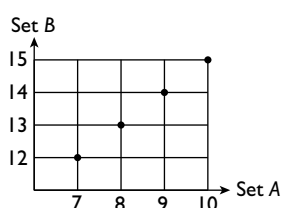


2. (a)



(b) $\{(7, 12), (8, 13), (9, 14), (10, 15)\}$

(c)



B

- $\{3, 6, 9, 12\}$
 - $\{15, 30, 45, 60, 70\}$
 - 3, 6, 9, 12
 - 15, 30, 45, 60
 - 45
 - 12
 - $\{15, 30, 45, 60\}$
- $\{3, 4, 5, 6, 7\}$
 - $\{10, 20, 30, 40, 50\}$
 - 3, 4, 5, 6, 7
 - 10, 30, 40, 50
 - 50
 - Tiada
 - $\{10, 30, 40, 50\}$

C

- Hubungan satu kepada satu
- Hubungan banyak kepada banyak
- Hubungan banyak kepada satu

D

- Hubungan satu kepada banyak
 - $\{2, 3, 4, 5, 6\}$
 - 7
 - 5 dan 6
 - Hubungan banyak kepada banyak
 - $\{(a, 1), (a, 2), (b, 5), (c, 3), (c, 5), (d, 3)\}$
 - $\{1, 2, 3, 5\}$
 - (i) 36
 - (ii) $\{(2, 4), (4, 16), (6, 36), (8, 64), (y, y^2)\}$
- (b) $y = -5$ atau 5

1.2

A

Jenis hubungan	Gambar rajah anak panah
Satu kepada satu	
Satu kepada banyak	
Banyak kepada satu	
Banyak kepada banyak	

B

- Tatatanda fungsi: $f: x \rightarrow -x$
 - 3, -4, -5, -k
 - 10
- Tatatanda fungsi: $f: x \rightarrow x - 3$
 - 33, 44, 55, 68, k
 - $k = 73$

C

- $f(4) = 3(4) - 5 = 7$
 $f(-10) = 3(-10) - 5 = -35$
- $f(3) = 3^2 + 4 = 13$
 $f(-7) = (-7)^2 + 4 = 53$

D

- $3x + 5 = 11$
 $3x = 6$
 $x = 2$
 - $5 - 4x = 9$
 $-4x = 4$
 $x = -1$
- $3x + 5 = -1$
 $3x = -6$
 $x = -2$
 - $5 - 4x = -11$
 $-4x = -16$
 $x = 4$

E

- (a) $f(-4) = 2(-4) + 6$
 $= -8 + 6$
 $= -2$
(b) $2x + 6 = 10$
 $2x = 4$
 $x = 2$
- (a) $f(2) = 10$
 $3(2) - p = 10$
 $-p = 10 - 6$
 $-p = 4$
 $p = -4$
(b) $f(x) = 3x - (-4)$
 $f(x) = 3x + 4$
 $f(x) = -5$
 $3x + 4 = -5$
 $3x = -9$
 $x = -3$
- (a) $f(3) = g(2x)$
 $2(3) + 4 = 2x - 2$
 $10 = 2x - 2$
 $12 = 2x$
 $x = 6$
(b) $f(x) + g(x) = 11$
 $(2x + 4) + (x - 2) = 11$
 $3x + 2 = 11$
 $3x = 9$
 $x = 3$

F

- $f(x) = ax + b$
 $f(1) = a(1) + b = -3$
 $a + b = -3$ ①
 $f(4) = a(4) + b = 6$
 $4a + b = 6$ ②
② - ①: $3a = 9$
 $a = 3$
Gantikan $a = 3$ ke dalam ①.
 $3 + b = -3$
 $b = -6$

- $f(x) = mx + n$
 $f(1) = m(1) + n = 5$
 $m + n = 5$ ①
 $f(6) = m(6) + n = 15$
 $6m + n = 15$ ②
② - ①: $5m = 10$
 $m = 2$

Gantikan $m = 2$ ke dalam ①.

$$2 + n = 5$$

$$n = 3$$

- $g(x) = \frac{4}{x} - 10$

Apabila $g(x) = 8$

$$\frac{4}{x} - 10 = 8$$

$$\frac{4}{x} = 18$$

$$\frac{x}{4} = \frac{1}{18}$$

$$x = \frac{4}{18}$$

$$x = \frac{2}{9}$$

1.3**A**

- $fg(x) = f(2x + 8)$
 $= (2x + 8) + 3$
 $= 2x + 11$
 $gf(x) = g(x + 3)$
 $= 2(x + 3) + 8$
 $= 2x + 6 + 8$
 $= 2x + 14$
 $gf(6) = 2(6) + 14$
 $= 12 + 14$
 $= 26$
- $fg(x) = f(4x + 3)$
 $= 2(4x + 3) - 5$
 $= 8x + 6 - 5$
 $= 8x + 1$
 $gf(x) = g(2x - 5)$
 $= 4(2x - 5) + 3$
 $= 8x - 20 + 3$
 $= 8x - 17$
 $fg(2) = 8(2) + 1$
 $= 16 + 1$
 $= 17$

$$\begin{aligned}
 3. \quad hg(t) &= h(t^2 + 3) \\
 &= 4(t^2 + 3) - 5 \\
 &= 4t^2 + 12 - 5 \\
 &= 4t^2 + 7
 \end{aligned}$$

$$\begin{aligned}
 gh(t) &= g(4t - 5) \\
 &= (4t - 5)^2 + 3 \\
 &= 16t^2 - 40t + 25 + 3 \\
 &= 16t^2 - 40t + 28
 \end{aligned}$$

$$\begin{aligned}
 hg(2) &= 4(2)^2 + 7 \\
 &= 16 + 7 \\
 &= 23
 \end{aligned}$$

$$\begin{aligned}
 4. \quad fg(x) &= f(x + 2) \\
 &= -(x + 2)^2 - 3(x + 2) \\
 &= -(x^2 + 4x + 4) - 3x - 6 \\
 &= -x^2 - 4x - 4 - 3x - 6 \\
 &= -x^2 - 7x - 10
 \end{aligned}$$

$$\begin{aligned}
 gf(x) &= g(-x^2 - 3x) \\
 &= (-x^2 - 3x) + 2 \\
 &= -x^2 - 3x + 2
 \end{aligned}$$

$$\begin{aligned}
 gf(3) &= -(3)^2 - 3(3) + 2 \\
 &= -9 - 9 + 2 \\
 &= -16
 \end{aligned}$$

B

$$\begin{aligned}
 1. \quad fg(x) &= 11 \\
 f(4 - 2x) &= 11 \\
 (4 - 2x) + 3 &= 11 \\
 4 - 2x + 3 &= 11 \\
 -2x &= 4 \\
 x &= -2
 \end{aligned}$$

$$\begin{aligned}
 2. \quad gf(2) &= 25 \\
 g[2(2) + 3] &= 25 \\
 g(7) &= 25 \\
 5(7) + h &= 25 \\
 35 + h &= 25 \\
 h &= -10
 \end{aligned}$$

$$\begin{aligned}
 3. \quad f^2(x) &= 4 \\
 f(2x - 4) &= 4 \\
 2(2x - 4) - 4 &= 4 \\
 4x - 8 - 4 &= 4 \\
 4x &= 16 \\
 x &= 4
 \end{aligned}$$

$$\begin{aligned}
 4. \quad gf(x) &= 6x - 3 \\
 g(ax + 4) &= 6x - 3 \\
 5 - 2(ax + 4) &= 6x - 3 \\
 5 - 2ax - 8 &= 6x - 3 \\
 -2ax - 3 &= 6x - 3 \\
 -2ax &= 6x \\
 -2a &= 6 \\
 a &= -3
 \end{aligned}$$

$$\begin{aligned}
 5. \quad f^2(x) &= gf(x) \\
 f(2 + 3x) &= g(2 + 3x) \\
 2 + 3(2 + 3x) &= 4 - 5(2 + 3x) \\
 2 + 6 + 9x &= 4 - 10 - 15x \\
 8 + 9x &= -6 - 15x \\
 24x &= -14 \\
 x &= -\frac{14}{24} \\
 x &= -\frac{7}{12}
 \end{aligned}$$

C

$$\begin{aligned}
 1. \quad fg(x) &= 37 - 8x \\
 2g(x) - 7 &= 37 - 8x \\
 2g(x) &= 44 - 8x \\
 g(x) &= 22 - 4x
 \end{aligned}$$

$$\begin{aligned}
 2. \quad fg(x) &= 12x + 2 \\
 3g(x) + 5 &= 12x + 2 \\
 3g(x) &= 12x - 3 \\
 g(x) &= 4x - 1
 \end{aligned}$$

$$\begin{aligned}
 3. \quad fg(x) &= 4x^2 - 4x + 9 \\
 2g(x) - 1 &= 4x^2 - 4x + 9 \\
 2g(x) &= 4x^2 - 4x + 10 \\
 g(x) &= 2x^2 - 2x + 5
 \end{aligned}$$

D

$$\begin{aligned}
 1. \quad (a) \quad fg(x) &= \frac{1}{2}x + 7 \\
 g(x) + 3 &= \frac{1}{2}x + 7 \\
 g(x) &= \frac{1}{2}x + 4
 \end{aligned}$$

$$\begin{aligned}
 (b) \quad gf(x) &= g(x + 3) \\
 &= \frac{1}{2}(x + 3) + 4 \\
 &= \frac{1}{2}x + \frac{3}{2} + 4 \\
 &= \frac{1}{2}x + \frac{11}{2}
 \end{aligned}$$

$$\begin{aligned}
 2. \quad (a) \quad fg(x) &= 2x^2 + 7 \\
 2g(x) + 1 &= 2x^2 + 7 \\
 2g(x) &= 2x^2 + 6 \\
 g(x) &= x^2 + 3 \\
 g(x + 3) &= (x + 3)^2 + 3 \\
 &= x^2 + 6x + 9 + 3 \\
 &= x^2 + 6x + 12
 \end{aligned}$$

$$\begin{aligned}
 (b) \quad g(x) &= x^2 + 3 \\
 g(-1) &= (-1)^2 + 3 \\
 &= 4
 \end{aligned}$$

$$\begin{aligned}
 3. \quad fg(2) &= 43 \\
 2g(2) + 9 &= 43 \\
 2g(2) &= 34 \\
 g(2) &= 17
 \end{aligned}$$

E

$$1. \quad fg(x) = -2x - 6$$

$$f(x + 5) = -2x - 6$$

Katakan $y = x + 5$
Maka, $x = y - 5$

$$f(y) = -2(y - 5) - 6$$

$$f(y) = -2y + 10 - 6$$

$$f(y) = 4 - 2y$$

Maka, $f(x) = 4 - 2x$

$$2. \quad fg(x) = 2x^2 + 9$$

$$f(x^2 + 4) = 2x^2 + 9$$

Katakan $y = x^2 + 4$
Maka, $x^2 = y - 4$

$$f(y) = 2(y - 4) + 9$$

$$f(y) = 2y - 8 + 9$$

$$f(y) = 2y + 1$$

Maka, $f(x) = 2x + 1$

$$3. \quad fg(x) = 25x + 34$$

$$f(5x + 6) = 25x + 34$$

Katakan $y = 5x + 6$
 $5x = y - 6$

Maka, $25x = 5y - 30$

$$f(y) = (5y - 30) + 34$$

$$f(y) = 5y - 30 + 34$$

$$f(y) = 5y + 4$$

Maka, $f(x) = 5x + 4$

F

$$1. \quad fg(-2) = 7$$

$$f[2(-2) + 3] = 7$$

$$f(-1) = 7$$

$$a(-1) + 3 = 7$$

$$a(-1) = 4$$

$$a = -4$$

$$f(x) = -4x + 3$$

$$gf(2) = g[-4(2) + 3]$$

$$= g(-5)$$

$$= 2(-5) + 3$$

$$= -7$$

$$2. \quad fg(x) = gf(x)$$

$$f(a - 2x) = g(2x + b)$$

$$2(a - 2x) + b = a - 2(2x + b)$$

$$2a - 4x + b = a - 4x - 2b$$

$$2a - a = -2b - b$$

$$a = -3b$$

$$3. \quad f^2(x) = 4x - 4$$

$$f(b - ax) = 4x - 4$$

$$b - a(b - ax) = 4x - 4$$

$$b - ab + a^2x = 4x - 4$$

Maka, $a^2 = 4$

$$a = 2 \quad (a > 0)$$

dan

$$b - ab = -4$$

$$b - 2b = -4$$

$$-b = -4$$

$$b = 4$$

$$4. \quad (a) \quad fg(4) = 2$$

$$f(4 - 4) = 2$$

$$f(0) = 2$$

$$a(0) + b = 2$$

$$b = 2$$

$$gf(2) = 4$$

$$g(2a + b) = 4$$

$$g(2a + 2) = 4$$

$$(2a + 2) - 4 = 4$$

$$2a = 6$$

$$a = 3$$

$$(b) \quad f(x) = 3x + 2$$

$$gf(-3) = g[3(-3) + 2]$$

$$= g(-7)$$

$$= -7 - 4$$

$$= -11$$

$$fg(-5) = f(-5 - 4)$$

$$= f(-9)$$

$$= 3(-9) + 2$$

$$= -25$$

$$5. \quad fg(x) = \frac{6}{x+1} + 4$$

$$\frac{3}{g(x) + 1} = \frac{6}{x+1} + 4$$

$$= \frac{6 + 4x + 4}{x+1}$$

$$= \frac{4x + 10}{x+1}$$

$$\frac{g(x) + 1}{3} = \frac{x+1}{4x+10}$$

$$g(x) = \frac{3x+3}{4x+10} - \frac{4x+10}{4x+10}$$

$$g(x) = \frac{-x-7}{4x+10}, \quad x \neq -\frac{5}{2}$$

1.4**A**

$$\begin{aligned}
1. \quad f^{-1}(14) &= m \\
ff^{-1}(14) &= f(m) \\
14 &= f(m) \\
14 &= 2m + 6 \\
2m &= 8 \\
m &= 4
\end{aligned}$$

$$\begin{aligned}
f^{-1}(22) &= n \\
ff^{-1}(22) &= f(n) \\
22 &= f(n) \\
22 &= 2n + 6 \\
2n &= 16 \\
n &= 8
\end{aligned}$$

$$\begin{aligned}
2. \quad f^{-1}(6) &= m \\
ff^{-1}(6) &= f(m) \\
6 &= f(m) \\
6 &= \frac{1}{2}m + 4 \\
\frac{1}{2}m &= 2 \\
m &= 4
\end{aligned}$$

$$\begin{aligned}
f^{-1}(9) &= n \\
ff^{-1}(9) &= f(n) \\
9 &= f(n) \\
9 &= \frac{1}{2}n + 4 \\
\frac{1}{2}n &= 5 \\
n &= 10
\end{aligned}$$

$$\begin{aligned}
3. \quad f^{-1}(8) &= m \\
ff^{-1}(8) &= f(m) \\
8 &= f(m) \\
8 &= 10 - 2m \\
2m &= 2 \\
m &= 1
\end{aligned}$$

$$\begin{aligned}
f^{-1}(0) &= n \\
ff^{-1}(0) &= f(n) \\
0 &= f(n) \\
0 &= 10 - 2n \\
2n &= 10 \\
n &= 5
\end{aligned}$$

B

$$\begin{aligned}
1. \quad \text{Katakan } f^{-1}(x) &= y \\
\text{Maka, } ff^{-1}(x) &= f(y) \\
x &= f(y) \\
x &= 4y - 3 \\
y &= \frac{x + 3}{4}
\end{aligned}$$

$$\begin{aligned}
\text{Maka, } f^{-1}(x) &= \frac{x + 3}{4} \\
f^{-1}(2) &= \frac{2 + 3}{4} \\
&= \frac{5}{4} \\
&= 1\frac{1}{4}
\end{aligned}$$

$$\begin{aligned}
2. \quad \text{Katakan } f^{-1}(x) &= y \\
\text{Maka, } ff^{-1}(x) &= f(y) \\
x &= f(y) \\
x &= \frac{1}{2}y + 3 \\
y &= 2(x - 3)
\end{aligned}$$

$$\begin{aligned}
\text{Maka, } f^{-1}(x) &= 2(x - 3) \\
f^{-1}(4) &= 2(4 - 3) \\
&= 2
\end{aligned}$$

$$\begin{aligned}
3. \quad \text{Katakan } f^{-1}(x) &= y \\
\text{Maka, } ff^{-1}(x) &= f(y) \\
x &= f(y) \\
x &= \frac{2y + 3}{4} \\
4x &= 2y + 3 \\
y &= \frac{4x - 3}{2}
\end{aligned}$$

$$\begin{aligned}
\text{Maka, } f^{-1}(x) &= \frac{4x - 3}{2} \\
f^{-1}(6) &= \frac{4(6) - 3}{2} \\
&= \frac{21}{2} \\
&= 10\frac{1}{2}
\end{aligned}$$

$$\begin{aligned}
4. \quad \text{Katakan } f^{-1}(x) &= y \\
\text{Maka, } ff^{-1}(x) &= f(y) \\
x &= f(y) \\
x &= \frac{5}{y + 2} \\
xy + 2x &= 5 \\
xy &= 5 - 2x \\
y &= \frac{5 - 2x}{x}
\end{aligned}$$

$$\begin{aligned}
\text{Maka, } f^{-1}(x) &= \frac{5 - 2x}{x}, x \neq 0 \\
f^{-1}(2) &= \frac{5 - 2(2)}{2} \\
&= \frac{1}{2}
\end{aligned}$$

C

1. (a) $fg(x) = 2x - 2$
 $g(x) + 3 = 2x - 2$
 $g(x) = 2x - 5$
 $g^{-1}(x) = y$
 $x = g(y)$
 $x = 2y - 5$
 $y = \frac{x+5}{2}$
 $g^{-1}(x) = \frac{x+5}{2}$
 $fg^{-1}(x) = f\left(\frac{x+5}{2}\right)$
 $= \frac{x+5}{2} + 3$
 $= \frac{x+11}{2}$

(b) $g^{-1}f(x) = g^{-1}(x+3)$
 $= \frac{(x+3)+5}{2}$
 $= \frac{x+8}{2}$

2. (a) Katakan $g^{-1}(4) = y$
 $4 = g(y)$
 $4 = \frac{4}{3y-2}$
 $3y - 2 = 1$
 $3y = 3$
 $y = 1$

Maka, $g^{-1}(4) = 1$

(b) Katakan $f^{-1}(x) = y$
 $x = f(y)$
 $x = y + 8$
 $y = x - 8$
 $f^{-1}(x) = x - 8$

$f^{-1}g(x) = f^{-1}\left(\frac{4}{3x-2}\right)$
 $= \frac{4}{3x-2} - 8, x \neq \frac{2}{3}$

3. Katakan $h^{-1}(x) = y$
 $x = h(y)$
 $x = 2y + 3$
 $y = \frac{x-3}{2}$

Maka, $h^{-1}(x) = \frac{x-3}{2}$

Katakan $g^{-1}(x) = y$
 $x = g(y)$
 $x = 3y - 1$
 $y = \frac{x+1}{3}$

Maka, $g^{-1}(x) = \frac{x+1}{3}$

(a) $hg^{-1}(x) = h\left(\frac{x+1}{3}\right)$
 $= 2\left(\frac{x+1}{3}\right) + 3$
 $= \frac{2x+2}{3} + 3$
 $= \frac{2x+11}{3}$

(b) $gh^{-1}(x) = g\left(\frac{x-3}{2}\right)$
 $= 3\left(\frac{x-3}{2}\right) - 1$
 $= \frac{3x-11}{2}$

Praktis Formatif: Kertas 1

1. (a) Julat = $\{a, b, d\}$
 (b) Hubungan banyak kepada satu

2. (a) $\{(-1, 5), (0, 2), (1, 5)\}$
 (b) $\{-1, 0, 1\}$

3. $f(6) = 10$
 $6 - 2m = 10$
 $2m = -4$
 $m = -2$

4. (a) $f(x) = x$
 $2x - 4 = x$
 $x = 4$

(b) $f(3h - 1) = 3h$
 $2(3h - 1) - 4 = 3h$
 $6h - 2 - 4 = 3h$
 $6h - 6 = 3h$
 $3h = 6$
 $h = 2$

5. (a) 3

(b) $f(2) = |2 - 4(2)|$
 $= |-6|$
 $= 6$

- (c) $-1 \leq x \leq 2$

6. $hk(x) = 2mx + p$
 $h(2x - 1) = 2mx + p$
 $m(2x - 1) + 3 = 2mx + p$
 $2mx - m + 3 = 2mx + p$
 $-m + 3 = p$
 $m = 3 - p$

7. (a) Fungsi f

(b) $g^{-1}(c) = b$

8. $gf(2) = 8$
 $g(2 \times 2) = 8$
 $g(4) = 8$
 $k(4) + h = 8$
 $4k + h = 8$
 $h = 8 - 4k$

9. (a) Katakan $g^{-1}(x) = y$
 $x = g(y)$
 $x = 2y + 4$
 $2y = x - 4$
 $y = \frac{x - 4}{2}$

Maka, $g^{-1}(x) = \frac{x - 4}{2}$

(b) $fg(x) = 4x^2 + 16x + 10$
 $f(2x + 4) = 4x^2 + 16x + 10$

Katakan $y = 2x + 4$
 $x = \frac{y - 4}{2}$

$$f(y) = 4\left(\frac{y - 4}{2}\right)^2 + 16\left(\frac{y - 4}{2}\right) + 10$$

$$= (y - 4)^2 + 8(y - 4) + 10$$

$$= y^2 - 8y + 16 + 8y - 32 + 10$$

$$= y^2 - 6$$

Maka, $f(x) = x^2 - 6$

10. (a) Katakan $g^{-1}(x) = y$
 $x = g(y)$
 $x = 3y - 6$
 $3y = x + 6$
 $y = \frac{x + 6}{3}$

Maka, $g^{-1}(x) = \frac{x + 6}{3}$

(b) $g^2\left(\frac{2}{3}p\right) = 12$

$$g\left[3\left(\frac{2}{3}p\right) - 6\right] = 12$$

$$g(2p - 6) = 12$$

$$3(2p - 6) - 6 = 12$$

$$6p - 18 - 6 = 12$$

$$6p = 36$$

$$p = 6$$

Praktis Formatif: Kertas 2

1. (a) (i) Fungsi yang memetakan set B kepada set A ialah $f^{-1}(x)$.

Berdasarkan rajah yang diberi,
 $f(x) = 3x - 2$.

Katakan $y = f^{-1}(x)$

Maka, $f(y) = x$

$$3y - 2 = x$$

$$3y = x + 2$$

$$y = \frac{x + 2}{3}$$

Maka, $f^{-1}(x) = \frac{x + 2}{3}$

- (ii) Berdasarkan rajah yang diberi,

$$gf(x) = 12x - 5$$

Maka, $g(3x - 2) = 12x - 5$

Katakan $u = 3x - 2$.

Maka, $x = \frac{u + 2}{3}$

$$g(u) = 12\left(\frac{u + 2}{3}\right) - 5$$

$$= 4u + 8 - 5$$

$$= 4u + 3$$

Maka, $g(x) = 4x + 3$

(b) $fg(x) = 5x + 14$

$$f(4x + 3) = 5x + 14$$

$$3(4x + 3) - 2 = 5x + 14$$

$$12x + 9 - 2 = 5x + 14$$

$$7x = 7$$

$$x = 1$$

2. (a) Diberi $f(x) = 4x - 5$.

Katakan $y = f^{-1}(x)$

$$f(y) = x$$

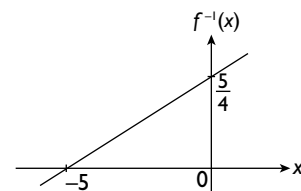
$$4y - 5 = x$$

$$4y = x + 5$$

$$y = \frac{x + 5}{4}$$

Maka, $f^{-1}(x) = \frac{x + 5}{4}$

Lakaran graf $f^{-1}(x)$:



Domain x ialah semua nilai nyata.

(b) $f^{-1}g(x) = f^{-1}\left(\frac{x}{4} - 2\right)$

$$= \frac{\left(\frac{x}{4} - 2\right) + 5}{4}$$

$$= \frac{x + 12}{16}$$

(c) $hg(x) = x - 8$

$$h\left(\frac{x}{4} - 2\right) = x - 8$$

Katakan $u = \frac{x}{4} - 2$

Maka, $x = 4u + 8$

$$h(u) = (4u + 8) - 8$$

$$= 4u$$

Maka, $h(x) = 4x$

FOKUS KBAT

(a) Bukan fungsi.

Kerana hubungan yang memetakan set B kepada set A ialah hubungan satu kepada banyak.

(b) $f(x) = kx^2 - 5x$

$$\begin{aligned}f(6) &= -18 \\k(6^2) - 5(6) &= -18 \\36k - 30 &= -18 \\36k &= 12 \\k &= \frac{1}{3}\end{aligned}$$

(c) $g^{-1}(x) = \frac{18x}{x-1}$

Katakan $g(x) = y$

Maka, $g^{-1}(y) = x$

$$\frac{18y}{y-1} = x$$

$$18y = xy - x$$

$$xy - 18y = x$$

$$y(x-18) = x$$

$$y = \frac{x}{x-18}$$

$$g(x) = \frac{x}{x-18} \quad \text{dan} \quad f(x) = \frac{1}{3}x^2 - 5x$$

$$gf(x) = g\left(\frac{1}{3}x^2 - 5x\right)$$

$$= \frac{\frac{1}{3}x^2 - 5x}{\left(\frac{1}{3}x^2 - 5x\right) - 18}$$

$$= \frac{x^2 - 15x}{x^2 - 15x - 54}$$

$$= \frac{x(x-15)}{(x+3)(x-18)}, x \neq -3, 18$$

JAWAPAN

BAB 2: PERSAMAAN KUADRATIK

2.1

A

- $a = 2, b = -4, c = 5$
- $a = -3, b = 4, c = -7$
- $a = 1, b = -6, c = 0$

B

1. Ya. Kerana kuasa tertinggi x ialah 2.

$$\begin{aligned} 2. \quad 5(x + 3) &= x - 2 \\ 5x + 15 &= x - 2 \\ 4x + 17 &= 0 \end{aligned}$$

Bukan. Kerana kuasa tertinggi x bukan 2.

$$\begin{aligned} 3. \quad \frac{2}{x^2} + x - 3 &= 0 \\ 2x^{-2} + x - 3 &= 0 \end{aligned}$$

Bukan. Kerana kuasa tertinggi x bukan 2.

C

1. Gantikan $x = 3$ ke dalam $mx^2 - 7x + 3 = 0$.

$$\begin{aligned} m(3)^2 - 7(3) + 3 &= 0 \\ 9m - 21 + 3 &= 0 \\ 9m &= 18 \\ m &= 2 \end{aligned}$$

$$\begin{aligned} 2. \quad x = 2: \quad a(2)^2 - 5(2) + c &= 0 \\ 4a + c &= 10 \quad \dots\dots \textcircled{1} \end{aligned}$$

$$\begin{aligned} x = 3: \quad a(3)^2 - 5(3) + c &= 0 \\ 9a + c &= 15 \quad \dots\dots \textcircled{2} \end{aligned}$$

$$\begin{aligned} \textcircled{2} - \textcircled{1}: \quad 5a &= 5 \quad \text{dan} \quad 4(1) + c &= 10 \\ a &= 1 \quad \quad \quad c &= 6 \end{aligned}$$

2.2

A

$$\begin{aligned} 1. \quad x^2 + 4x - 5 &= 0 \\ (x + 5)(x - 1) &= 0 \\ x + 5 = 0 \quad \text{atau} \quad x - 1 &= 0 \\ x = -5 \quad \quad \quad x &= 1 \end{aligned}$$

$$\begin{aligned} 2. \quad 2x^2 + x - 10 &= 0 \\ (2x + 5)(x - 2) &= 0 \\ 2x + 5 = 0 \quad \text{atau} \quad x - 2 &= 0 \\ x = -\frac{5}{2} \quad \quad \quad x &= 2 \end{aligned}$$

$$\begin{aligned} 3. \quad -3x^2 + 2x + 8 &= 0 \\ 3x^2 - 2x - 8 &= 0 \\ (3x + 4)(x - 2) &= 0 \\ 3x + 4 = 0 \quad \text{atau} \quad x - 2 &= 0 \\ x = -\frac{4}{3} \quad \quad \quad x &= 2 \end{aligned}$$

B

$$\begin{aligned} 1. \quad 3x^2 + 10x + 6 &= 0 \\ x^2 + \frac{10}{3}x + 2 &= 0 \\ x^2 + \frac{10}{3}x &= -2 \\ x^2 + \frac{10}{3}x + \left(\frac{5}{3}\right)^2 &= -2 + \left(\frac{5}{3}\right)^2 \\ \left(x + \frac{5}{3}\right)^2 &= \frac{7}{9} \\ x + \frac{5}{3} &= \pm \sqrt{\frac{7}{9}} \\ x &= -\frac{5}{3} \pm \sqrt{\frac{7}{9}} \\ &= -0.7847 \quad \text{atau} \quad -2.5486 \end{aligned}$$

$$\begin{aligned} 2. \quad -3x^2 + 12x - 5 &= 0 \\ 3x^2 - 12x + 5 &= 0 \\ x^2 - 4x + \frac{5}{3} &= 0 \\ x^2 - 4x &= -\frac{5}{3} \\ x^2 - 4x + \left(\frac{4}{2}\right)^2 &= -\frac{5}{3} + \left(\frac{4}{2}\right)^2 \\ (x - 2)^2 &= \frac{7}{3} \\ x - 2 &= \pm \sqrt{\frac{7}{3}} \\ x &= 2 \pm \sqrt{\frac{7}{3}} \\ &= 3.5275 \quad \text{atau} \quad 0.4725 \end{aligned}$$

C

$$\begin{aligned} 1. \quad a = 1, b = 5, c = -6 \\ x &= \frac{-5 \pm \sqrt{5^2 - 4(1)(-6)}}{2(1)} \\ &= \frac{-5 \pm 7}{2} \\ &= -6 \quad \text{atau} \quad 1 \\ 2. \quad a = -1, b = 4, c = -2 \\ x &= \frac{-4 \pm \sqrt{4^2 - 4(-1)(-2)}}{2(-1)} \\ &= \frac{-4 \pm \sqrt{8}}{-2} \\ &= 0.5858 \quad \text{atau} \quad 3.4142 \end{aligned}$$

3. $a = 4, b = -6, c = 1$

$$x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(4)(1)}}{2(4)}$$

$$= \frac{6 \pm \sqrt{20}}{8}$$

= 0.1910 atau 1.3090

4. $a = -2, b = 5, c = 8$

$$x = \frac{-5 \pm \sqrt{5^2 - 4(-2)(8)}}{2(-2)}$$

$$= \frac{-5 \pm \sqrt{89}}{-4}$$

= -1.1085 atau 3.6085

D

1. $(x - 2)(x + 4) = 0$
 $x^2 + 4x - 2x - 8 = 0$
 $x^2 + 2x - 8 = 0$

2. $(x - \frac{1}{2})(x - 3) = 0$
 $x^2 - 3x - \frac{1}{2}x + \frac{3}{2} = 0$
 $2x^2 - 6x - x + 3 = 0$
 $2x^2 - 7x + 3 = 0$

3. $(x + 5)(x + 4) = 0$
 $x^2 + 4x + 5x + 20 = 0$
 $x^2 + 9x + 20 = 0$

E

1. $x^2 - (p + q)x + pq = 0$
 $x^2 - (-1)x + (-2) = 0$
 $x^2 + x - 2 = 0$

2. $x^2 - (p + q)x + pq = 0$
 $x^2 - 4x + (-5) = 0$
 $x^2 - 4x - 5 = 0$

3. $x^2 - (p + q)x + pq = 0$
 $x^2 - \frac{3}{2}x + (-\frac{7}{2}) = 0$
 $x^2 - \frac{3}{2}x - \frac{7}{2} = 0$
 $2x^2 - 3x - 7 = 0$

F

1. $x^2 + 5x + 4 = 0$
 $x^2 - (-5)x + 4 = 0$

Maka, HTP = -5
HDP = 4

2. $x^2 - 8x - 20 = 0$
 $x^2 - 8x + (-20) = 0$

Maka, HTP = 8
HDP = -20

3. $-2x^2 - 6x + 15 = 0$
 $x^2 + \frac{6}{2}x - \frac{15}{2} = 0$
 $x^2 + 3x - \frac{15}{2} = 0$
 $x^2 - (-3)x + (-\frac{15}{2}) = 0$

Maka, HTP = -3

HDP = $-\frac{15}{2}$

4. $5x^2 + 9x - 25 = 0$
 $x^2 + \frac{9}{5}x - \frac{25}{5} = 0$
 $x^2 + \frac{9}{5}x - 5 = 0$
 $x^2 - (-\frac{9}{5})x + (-5) = 0$

Maka, HTP = $-\frac{9}{5}$

HDP = -5

G

1. (a) $x^2 - 7x - k = 0$

HTP = 7

Katakan r ialah punca yang satu lagi.

Maka, $6 + r = 7$

$r = 1$

Jadi, punca yang satu lagi ialah 1.

(b) HDP = $-k$

Maka, $-k = 6 \times 1$

$k = -6$

2. $x^2 + kx + 8 = 0$
 $x^2 - (-k)x + 8 = 0$

HTP : $m + (m - 2) = -k$

$2m - 2 = -k$

$k = 2 - 2m$

HDP : $m(m - 2) = 8$

$m^2 - 2m = 8$

$m^2 - 2m - 8 = 0$

$(m - 4)(m + 2) = 0$

$m = 4$ atau -2

Apabila $m = 4, k = 2 - 2(4)$
 $= -6$

Apabila $m = -2, k = 2 - 2(-2)$
 $= 6$

Nilai k yang mungkin ialah -6 dan 6 .

3. $x^2 + 5x + 3 = 0$
 $x^2 - (-5)x + 3 = 0$

$\alpha + \beta = -5$ dan $\alpha\beta = 3$

Untuk persamaan kuadratik baharu:

$$\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha + \beta}{\alpha\beta} = -\frac{5}{3}$$

$$\frac{1}{\alpha} \times \frac{1}{\beta} = \frac{1}{\alpha\beta} = \frac{1}{3}$$

Persamaan kuadratik baharu ialah

$$x^2 - \left(-\frac{5}{3}\right)x + \frac{1}{3} = 0$$

$$x^2 + \frac{5}{3}x + \frac{1}{3} = 0$$

$$3x^2 + 5x + 1 = 0$$

2.3

A

$$\begin{aligned} 1. \quad b^2 - 4ac &= 3^2 - 4(1)(5) \\ &= 9 - 20 \\ &= -11 < 0 \end{aligned}$$

Tiada punca nyata atau tiada punca.

$$\begin{aligned} 2. \quad b^2 - 4ac &= (-4)^2 - 4(2)(-3) \\ &= 16 + 24 \\ &= 40 > 0 \end{aligned}$$

Dua punca yang berbeza.

$$\begin{aligned} 3. \quad b^2 - 4ac &= (-12)^2 - 4(4)(9) \\ &= 144 - 144 \\ &= 0 \end{aligned}$$

Dua punca yang sama atau satu punca sahaja.

$$\begin{aligned} 4. \quad b^2 - 4ac &= 6^2 - 4(-5)(-2) \\ &= 36 - 40 \\ &= -4 < 0 \end{aligned}$$

Tiada punca nyata atau tiada punca.

$$\begin{aligned} 5. \quad b^2 - 4ac &= 10^2 - 4(3)(8) \\ &= 100 - 96 \\ &= 4 > 0 \end{aligned}$$

Dua punca yang berbeza.

B

$$\begin{aligned} 1. \quad b^2 - 4ac &> 0 \\ 6^2 - 4(3)(m) &> 0 \\ 36 - 12m &> 0 \\ 12m &< 36 \\ m &< 3 \end{aligned}$$

$$\begin{aligned} b^2 - 4ac &= 0 \\ 6^2 - 4(3)(m) &= 0 \\ 36 - 12m &= 0 \\ 12m &= 36 \\ m &= 3 \end{aligned}$$

$$\begin{aligned} b^2 - 4ac &< 0 \\ 6^2 - 4(3)(m) &< 0 \\ 36 - 12m &< 0 \\ 12m &> 36 \\ m &> 3 \end{aligned}$$

$$\begin{aligned} 2. \quad b^2 - 4ac &> 0 \\ 8^2 - 4(m)(6) &> 0 \\ 64 - 24m &> 0 \\ 24m &< 64 \\ m &< \frac{8}{3} \end{aligned}$$

$$\begin{aligned} b^2 - 4ac &= 0 \\ 8^2 - 4(m)(6) &= 0 \\ 64 - 24m &= 0 \\ 24m &= 64 \\ m &= \frac{8}{3} \end{aligned}$$

$$\begin{aligned} b^2 - 4ac &< 0 \\ 8^2 - 4(m)(6) &< 0 \\ 64 - 24m &< 0 \\ 24m &> 64 \\ m &> \frac{8}{3} \end{aligned}$$

$$\begin{aligned} 3. \quad b^2 - 4ac &> 0 \\ 10^2 - 4(-5)(m) &> 0 \\ 100 + 20m &> 0 \\ 20m &> -100 \\ m &> -5 \end{aligned}$$

$$\begin{aligned} b^2 - 4ac &= 0 \\ 10^2 - 4(-5)(m) &= 0 \\ 100 + 20m &= 0 \\ 20m &= -100 \\ m &= -5 \end{aligned}$$

$$\begin{aligned} b^2 - 4ac &< 0 \\ 10^2 - 4(-5)(m) &< 0 \\ 100 + 20m &< 0 \\ 20m &< -100 \\ m &< -5 \end{aligned}$$

$$\begin{aligned} 4. \quad b^2 - 4ac &> 0 \\ (-4)^2 - 4(1)(m) &> 0 \\ 16 - 4m &> 0 \\ 4m &< 16 \\ m &< 4 \end{aligned}$$

$$\begin{aligned} b^2 - 4ac &= 0 \\ (-4)^2 - 4(1)(m) &= 0 \\ 16 - 4m &= 0 \\ 4m &= 16 \\ m &= 4 \end{aligned}$$

$$\begin{aligned} b^2 - 4ac &< 0 \\ (-4)^2 - 4(1)(m) &< 0 \\ 16 - 4m &< 0 \\ 4m &> 16 \\ m &> 4 \end{aligned}$$

Praktis Formatif: Kertas 1

1. (a) Gantikan
- $x = 4$
- ke dalam persamaan.

$$\begin{aligned} 2x^2 + mx - 20 &= 0 \\ 2(4^2) + m(4) - 20 &= 0 \\ 32 + 4m - 20 &= 0 \\ 4m &= -12 \\ m &= -3 \end{aligned}$$

- (b) Hasil tambah punca-punca:

$$\begin{aligned} -\frac{m}{2} &= -2 \\ m &= 4 \end{aligned}$$

- 2.
- $2x^2 - 5x + 9 = 0$

$$x^2 - \frac{5}{2}x + \frac{9}{2} = 0$$

$$\text{Maka, } \alpha + \beta = \frac{5}{2} \text{ dan } \alpha\beta = \frac{9}{2}$$

Untuk persamaan baharu:

$$\begin{aligned} \text{HTP : } 2\alpha + 2\beta &= 2(\alpha + \beta) \\ &= 2\left(\frac{5}{2}\right) \\ &= 5 \end{aligned}$$

$$\begin{aligned} \text{HDP : } 2\alpha \times 2\beta &= 4\alpha\beta \\ &= 4\left(\frac{9}{2}\right) \\ &= 18 \end{aligned}$$

Maka, persamaan kuadratik baharu ialah $x^2 - 5x + 18 = 0$.

- 3.
- $(x + k)^2 = 25$

$$\begin{aligned} (-6 + k)^2 &= 25 \\ -6 + k &= \pm 5 \\ k &= 6 \pm 5 \\ &= 11 \text{ atau } 1 \end{aligned}$$

- 4.
- $b^2 - 4ac = 0$

$$\begin{aligned} (1 - 2m)^2 - 4(m)(m + 1) &= 0 \\ 1 + 4m^2 - 4m - 4m^2 - 4m &= 0 \\ 1 - 8m &= 0 \\ 8m &= 1 \\ m &= \frac{1}{8} \end{aligned}$$

- 5.
- $x(x - 8) = h + 2k$

$$\begin{aligned} x^2 - 8x - (h + 2k) &= 0 \\ b^2 - 4ac &= 0 \\ (-8)^2 - 4(1)(-h - 2k) &= 0 \\ 64 + 4h + 8k &= 0 \\ 16 + h + 2k &= 0 \\ h &= -16 - 2k \end{aligned}$$

6. (a)
- $x(x - 6) = 5$

$$x^2 - 6x - 5 = 0$$

- (b) Hasil tambah punca = 6

$$\begin{aligned} \text{(c) } b^2 - 4ac &= (-6)^2 - 4(1)(-5) \\ &= 36 + 20 \\ &= 56 > 0 \end{aligned}$$

Persamaan ini mempunyai dua punca nyata yang berbeza.

7. Jumlah luas =
- $10 \text{ cm} \times 14 \text{ cm}$
-
- $= 140 \text{ cm}^2$

$$\begin{aligned} \text{Luas kepingan kayu} &= 140 \text{ cm}^2 - 96 \text{ cm}^2 \\ &= 44 \text{ cm}^2 \end{aligned}$$

Katakan lebar kepingan kayu = $x \text{ cm}$

$$\begin{aligned} 2x(14 - 2x) + 2(10x) &= 44 \\ x(14 - 2x) + 10x &= 22 \\ 14x - 2x^2 + 10x &= 22 \\ 2x^2 - 24x + 22 &= 0 \\ x^2 - 12x + 11 &= 0 \\ (x - 1)(x - 11) &= 0 \\ x &= 1 \text{ atau } x = 11 \end{aligned}$$

Abaikan $x = 11$ kerana ini jawapan mustahil.

Maka, lebar kepingan kayu itu ialah 1 cm.

- 8.
- $b^2 - 4ac < 0$

$$\begin{aligned} (-3)^2 - 4(1 - a)(6) &< 0 \\ 9 - 24(1 - a) &< 0 \\ 9 &< 24(1 - a) \\ \frac{3}{8} &< 1 - a \\ a &< \frac{5}{8} \end{aligned}$$

9. (a) Katakan punca persamaan ialah
- m
- dan
- $3m$
- .

$$\begin{aligned} \text{HTP : } m + 3m &= p + 4 \\ 4m &= p + 4 \\ p &= 4m - 4 \end{aligned}$$

$$\begin{aligned} \text{HDP : } m \times 3m &= 3p \\ m^2 &= p \\ m^2 &= 4m - 4 \\ m^2 - 4m + 4 &= 0 \\ (m - 2)(m - 2) &= 0 \\ m &= 2 \end{aligned}$$

$$\begin{aligned} \text{Nilai hasil darab punca} &= m \times 3m \\ &= 2 \times 3 \times 2 \\ &= 12 \end{aligned}$$

- (b) Bagi dua punca yang sama,
- $b^2 - 4ac = 0$
- .

$$\begin{aligned} \text{Maka, } (-7n)^2 - 4(m)(4m) &= 0 \\ 49n^2 - 16m^2 &= 0 \\ 49n^2 &= 16m^2 \\ \frac{m^2}{n^2} &= \frac{49}{16} \\ \frac{m}{n} &= \frac{7}{4} \end{aligned}$$

Maka, $m : n = 7 : 4$.

Praktis Formatif: Kertas 2

1. (a) $(x + 2)(x - 5) = 0$
 $x^2 - 3x - 10 = 0$
 $3x^2 - 9x - 30 = 0$
 Bandingkan dengan $3x^2 + hx + k = 0$.
 Maka, $h = -9$ dan $k = -30$.
- (b) $3x^2 - 9x - 30 = m$
 $3x^2 - 9x - (30 + m) = 0$
 Bagi dua punca yang berbeza, $b^2 - 4ac > 0$.
 $(-9)^2 + 4(3)(30 + m) > 0$
 $81 + 12(30 + m) > 0$
 $12(30 + m) > -81$
 $30 + m > -6\frac{3}{4}$
 $m > -36\frac{3}{4}$

2. (a) Punca persamaan kuadratik ialah p dan $2p$.
 $(x - p)(x - 2p) = 0$
 $x^2 - 3px + 2p^2 = 0$ ①
 Diberi $x^2 + 6(3x + k) = 0$
 $x^2 + 18x + 6k = 0$ ②
 Bandingkan ① dan ②.
 $-3p = 18$ dan $6k = 2p^2$
 $p = -6$ $= 2(-6)^2$
 $= 72$
 $k = 12$

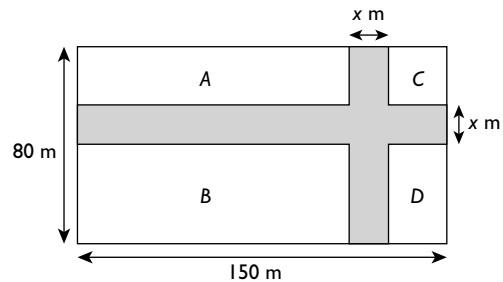
- (b) Punca-punca baharu:
 $p + 2 = -6 + 2 = -4$
 $p - 5 = -6 - 5 = -11$
 Persamaan kuadratik baharu ialah
 $(x + 4)(x + 11) = 0$
 $x^2 + 15x + 44 = 0$

3. (a) $x(x - 9) = 2 - 5h$
 $x^2 - 9x - 2 + 5h = 0$
 $b^2 - 4ac > 0$ (Sebab $\alpha \neq \beta$)
 $(-9)^2 - 4(1)(5h - 2) > 0$
 $81 - 20h + 8 > 0$
 $-20h > -89$
 $h < 4\frac{9}{20}$

- (b) $x^2 - 9x + 5h - 2 = 0$
 $\alpha + \beta = 9$ ①
 $\alpha\beta = 5h - 2$ ②
 $2x^2 + kx + 9 = 0$
 $x^2 + \frac{k}{2}x + \frac{9}{2} = 0$
 HTP: $\frac{\alpha}{2} + \frac{\beta}{2} = -\frac{k}{2}$
 $\alpha + \beta = -k$ ③
 HDP: $\frac{\alpha}{2} \times \frac{\beta}{2} = \frac{9}{2}$
 $\alpha\beta = 18$ ④
 ① = ③: $-k = 9$
 $k = -9$
 ② = ④: $5h - 2 = 18$
 $5h = 20$
 $h = 4$

FOKUS KBAT

Katakan lebar jalan = x m



Luas segi empat tepat - Luas kawasan berlerek
 = Jumlah luas tapak perumahan

$$150(80) - (80x + 150x - x^2) = 10\ 656$$

$$12\ 000 - 80x - 150x + x^2 = 10\ 656$$

$$x^2 - 230x + 1\ 344 = 0$$

$$(x - 6)(x - 224) = 0$$

$$x = 6 \text{ atau } x = 224$$

Berdasarkan rajah, $x < 80$. Maka $x = 6$.

Lebar jalan itu ialah 6 m.

JAWAPAN

BAB 3: FUNGSI KUADRATIK

3.1

A

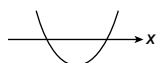
- $f(x)$ ialah fungsi kuadratik.
 $a = 2, b = 0, c = 5$
- $f(x)$ bukan fungsi kuadratik.
- $f(x)$ ialah fungsi kuadratik.
 $a = 5, b = -6, c = 3$
- $f(x) = x(x^2 - 2x - 3)$
 $= x^3 - 2x^2 - 3x$
 $f(x)$ bukan fungsi kuadratik.
- $f(x)$ ialah fungsi kuadratik.
 $a = \frac{1}{4}, b = \frac{1}{6}, c = -5$
- $f(x) = (3x - 2)(x + 3)$
 $= 3x^2 + 7x - 6$
 $f(x)$ ialah fungsi kuadratik.
 $a = 3, b = 7, c = -6$

B

- $b^2 - 4ac > 0$
 $f(x) = 0$ mempunyai dua punca nyata yang berbeza.
- $b^2 - 4ac > 0$
 $f(x) = 0$ mempunyai dua punca nyata yang berbeza.
- $b^2 - 4ac = 0$
 $f(x) = 0$ mempunyai dua punca nyata yang sama.
- $b^2 - 4ac < 0$
 $f(x) = 0$ tiada punca nyata.

C

- $b^2 - 4ac = 2^2 - 4(1)(-3)$
 $= 4 + 12$
 $= 16 > 0$
Dua punca nyata yang berbeza.
 $a = 1 > 0$

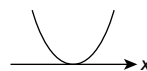


$$2. \quad b^2 - 4ac = (-8)^2 - 4(1)(16)$$

$$= 64 - 64$$

$$= 0$$

Dua punca nyata yang sama.
 $a = 1 > 0$



$$3. \quad b^2 - 4ac = 5^2 - 4(-3)(-6)$$

$$= 25 - 72$$

$$= -47 < 0$$

Tiada punca nyata.
 $a = -3 < 0$

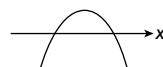


$$4. \quad b^2 - 4ac = (-4)^2 - 4(-1)(6)$$

$$= 16 + 24$$

$$= 40 > 0$$

Dua punca nyata yang berbeza.
 $a = -1 < 0$



D

- $(-3)^2 - 4(1)(-p) > 0$
 $9 + 4p > 0$
 $4p > -9$
 $p < -2\frac{1}{4}$
- $6^2 - 4(p)(4) > 0$
 $36 - 16p > 0$
 $-16p > -36$
 $p < 2\frac{1}{4}$
- $(-6)^2 - 4(1)(p - 1) > 0$
 $36 - 4p + 4 > 0$
 $-4p > -40$
 $p < 10$

E

- $20^2 - 4(10)(p) < 0$
 $400 - 40p < 0$
 $-40p < -400$
 $p > 10$
- $12^2 - 4(p)(12) < 0$
 $144 - 48p < 0$
 $-48p < -144$
 $p > 3$

$$\begin{aligned}
3. \quad & (-6)^2 - 4(3)(p) < 0 \\
& 36 - 12p < 0 \\
& -12p < -36 \\
& p > 3
\end{aligned}$$

F

$$\begin{aligned}
1. \quad & m^2 - 4(3)(3) = 0 \\
& m^2 - 36 = 0 \\
& m^2 = 36 \\
& m = \pm\sqrt{36} \\
& = -6 \text{ atau } 6
\end{aligned}$$

$$\begin{aligned}
2. \quad & m^2 - 4(1)(3 - m) = 0 \\
& m^2 + 4m - 12 = 0 \\
& (m + 6)(m - 2) = 0 \\
& m = -6 \text{ atau } 2
\end{aligned}$$

$$\begin{aligned}
3. \quad & (m + 4)^2 - 4(2)(8) = 0 \\
& m^2 + 8m + 16 - 64 = 0 \\
& m^2 + 8m - 48 = 0 \\
& (m + 12)(m - 4) = 0 \\
& m = -12 \text{ atau } 4
\end{aligned}$$

3.2

A

- (a) $(-3, -8)$
(b) -8
(c) $x + 3 = 0$ atau $x = -3$
- (a) $(-6, 4)$
(b) 4
(c) $x + 6 = 0$ atau $x = -6$

B

$$\begin{aligned}
1. \quad & f(x) = x^2 - 6x + 17 \\
& = (x^2 - 6x) + 17 \\
& = \left[x^2 - 6x + \left(\frac{6}{2}\right)^2 - \left(\frac{6}{2}\right)^2 \right] + 17 \\
& = (x - 3)^2 - 9 + 17 \\
& = (x - 3)^2 + 8
\end{aligned}$$

$$a = 1 > 0$$

Titik minimum = $(3, 8)$

Paksi simetri: $x - 3 = 0$ atau $x = 3$

$$\begin{aligned}
2. \quad & f(x) = 3x^2 + 24x + 50 \\
& = 3(x^2 + 8x) + 50 \\
& = 3\left[x^2 + 8x + \left(\frac{8}{2}\right)^2 - \left(\frac{8}{2}\right)^2 \right] + 50 \\
& = 3[(x + 4)^2 - 16] + 50 \\
& = 3(x + 4)^2 - 48 + 50 \\
& = 3(x + 4)^2 + 2
\end{aligned}$$

$$a = 3 > 0$$

Titik minimum = $(-4, 2)$

Paksi simetri: $x + 4 = 0$ atau $x = -4$

$$\begin{aligned}
3. \quad & f(x) = -2x^2 + 12x - 3 \\
& = -2(x^2 - 6x) - 3 \\
& = -2\left[x^2 - 6x + \left(\frac{6}{2}\right)^2 - \left(\frac{6}{2}\right)^2 \right] - 3 \\
& = -2[(x - 3)^2 - 9] - 3 \\
& = -2(x - 3)^2 + 18 - 3 \\
& = -2(x - 3)^2 + 15
\end{aligned}$$

$$a = -2 < 0$$

Titik maksimum = $(3, 15)$

Paksi simetri: $x - 3 = 0$ atau $x = 3$

C

$$\begin{aligned}
1. \quad & f(x) = x^2 + 8x + 16 - p \\
& = x^2 + 8x + \left(\frac{8}{2}\right)^2 - \left(\frac{8}{2}\right)^2 + 16 - p \\
& = (x + 4)^2 - 16 + 16 - p \\
& = (x + 4)^2 - p
\end{aligned}$$

Diberi nilai minimum $f(x)$ ialah 3.

Maka, $-p = 3$

$$p = -3$$

$$\begin{aligned}
2. \quad & f(x) = x^2 + 2x - 5 \\
& = x^2 + 2x + \left(\frac{2}{2}\right)^2 - \left(\frac{2}{2}\right)^2 - 5 \\
& = (x + 1)^2 - 1 - 5 \\
& = (x + 1)^2 - 6 \quad \dots\dots \textcircled{1}
\end{aligned}$$

Bandingkan $\textcircled{1}$ dengan $f(x) = (x + m)^2 - n$.

Maka, $m = 1$ dan $n = 6$.

$$\begin{aligned}
3. \quad & (a) \quad f(x) = x^2 + 10x - 4 \\
& = x^2 + 10x + \left(\frac{10}{2}\right)^2 - \left(\frac{10}{2}\right)^2 - 4 \\
& = (x + 5)^2 - 25 - 4 \\
& = (x + 5)^2 - 29
\end{aligned}$$

Titik minimum = (p, q)

$$= (-5, -29)$$

Maka, $p = -5$ dan $q = -29$.

(b) Paksi simetri ialah $x + 5 = 0$ atau $x = -5$.

4. (a) Berdasarkan $f(x) = 2(x + p)^2 + 3$, paksi simetri ialah $x = -p$.

Berdasarkan graf, paksi simetri ialah $x = 2$.

Maka, $-p = 2$

$$p = -2$$

Berdasarkan $f(x) = 2(x + p)^2 + 3$,

nilai minimum = 3.

Berdasarkan graf, nilai minimum = q .

Maka, $q = 3$.

(b) Paksi simetri ialah $x = 2$.

3.3

1. $a = 1 > 0$, maka graf berbentuk \cup .

$$\begin{aligned} f(x) &= x^2 + 2x - 3 \\ &= x^2 + 2x + \left(\frac{2}{2}\right)^2 - \left(\frac{2}{2}\right)^2 - 3 \\ &= (x + 1)^2 - 1 - 3 \\ &= (x + 1)^2 - 4 \end{aligned}$$

Maka, titik minimum ialah $(-1, -4)$.

Pintasan- x berlaku apabila $f(x) = 0$.

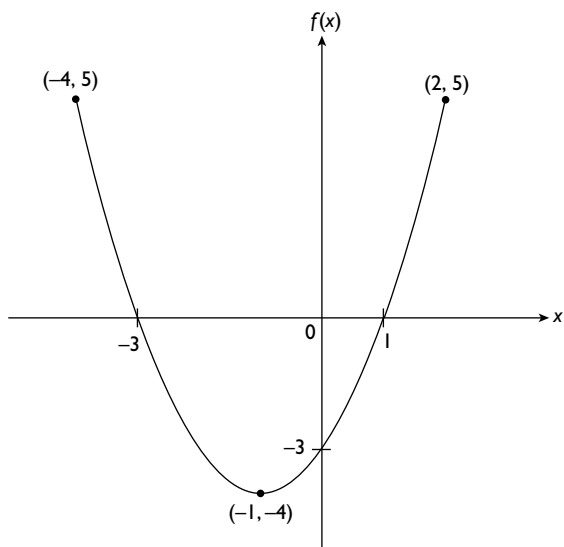
$$\begin{aligned} (x + 1)^2 &= 4 \\ x + 1 &= \pm\sqrt{4} \\ x &= -1 \pm 2 \\ &= -3 \text{ atau } 1 \end{aligned}$$

Pintasan- y berlaku apabila $x = 0$.

$$f(x) = 0^2 + 2(0) - 3 = -3$$

$$\begin{aligned} \text{Apabila } x = -4, f(x) &= (-4)^2 + 2(-4) - 3 \\ &= 16 - 8 - 3 \\ &= 5 \end{aligned}$$

$$\begin{aligned} \text{Apabila } x = 2, f(x) &= 2^2 + 2(2) - 3 \\ &= 5 \end{aligned}$$



2. $a = -1 < 0$, maka graf berbentuk \cap .

$$\begin{aligned} f(x) &= -x^2 + 4x - 3 \\ &= -(x^2 - 4x) - 3 \\ &= -\left[x^2 - 4x + \left(\frac{4}{2}\right)^2 - \left(\frac{4}{2}\right)^2\right] - 3 \\ &= -[(x - 2)^2 - 4] - 3 \\ &= -(x - 2)^2 + 1 \end{aligned}$$

Maka, titik maksimum ialah $(2, 1)$.

Pintasan- x berlaku apabila $f(x) = 0$.

$$\begin{aligned} -(x - 2)^2 + 1 &= 0 \\ (x - 2)^2 &= 1 \\ x - 2 &= \pm 1 \\ x &= 2 \pm 1 \\ &= 3 \text{ atau } 1 \end{aligned}$$

Pintasan- y berlaku apabila $x = 0$.

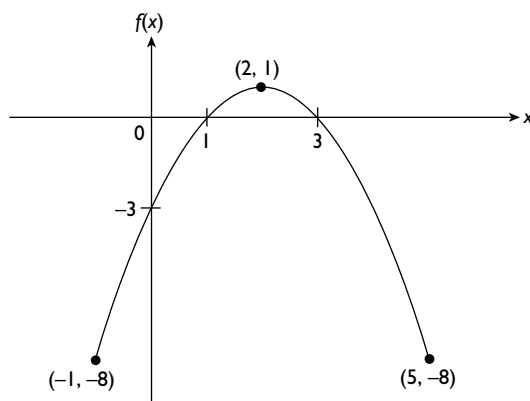
$$f(x) = -0^2 + 4(0) - 3 = -3$$

Apabila $x = -1$,

$$\begin{aligned} f(x) &= -(-1)^2 + 4(-1) - 3 \\ &= -8 \end{aligned}$$

Apabila $x = 5$,

$$\begin{aligned} f(x) &= -(5)^2 + 4(5) - 3 \\ &= -8 \end{aligned}$$



3. $a = 2 > 0$, maka graf berbentuk \cup .

$$\begin{aligned} f(x) &= 2x^2 + 8x - 10 \\ &= 2(x^2 + 4x) - 10 \\ &= 2\left[x^2 + 4x + \left(\frac{4}{2}\right)^2 - \left(\frac{4}{2}\right)^2\right] - 10 \\ &= 2(x + 2)^2 - 8 - 10 \\ &= 2(x + 2)^2 - 18 \end{aligned}$$

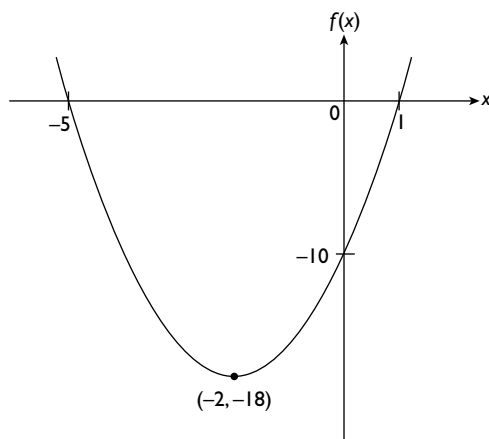
Maka, titik minimum ialah $(-2, -18)$.

Pintasan- x berlaku apabila $f(x) = 0$.

$$\begin{aligned} 2(x + 2)^2 - 18 &= 0 \\ (x + 2)^2 &= 9 \\ x + 2 &= \pm 3 \\ x &= -2 \pm 3 \\ &= -5 \text{ atau } 1 \end{aligned}$$

Pintasan- y berlaku apabila $x = 0$.

$$\begin{aligned} f(x) &= 2(0)^2 + 8(0) - 10 \\ &= -10 \end{aligned}$$

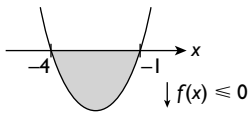


3.4

A

1. $x^2 + 5x + 4 \leq 0$
 $(x + 1)(x + 4) \leq 0$

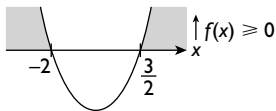
Katakan $(x + 1)(x + 4) = 0$.
 $x = -1$ atau 4



Untuk $x^2 + 5x + 4 \leq 0$,
 $-4 \leq x \leq -1$

2. $2x^2 + x \geq 6$
 $2x^2 + x - 6 \geq 0$
 $(2x - 3)(x + 2) \geq 0$

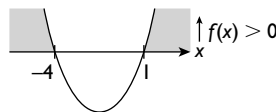
Katakan $(2x - 3)(x + 2) = 0$.
 $x = \frac{3}{2}$ atau -2



Untuk $2x^2 + x \geq 6$,
 $x \leq -2$ atau $x \geq \frac{3}{2}$

3. $x + 4 < (x + 4)(2x - 1)$
 $x + 4 < 2x^2 - x + 8x - 4$
 $0 < 2x^2 + 6x - 8$
 $2x^2 + 6x - 8 > 0$
 $x^2 + 3x - 4 > 0$
 $(x + 4)(x - 1) > 0$

Katakan $(x + 4)(x - 1) = 0$.
 $x = -4$ atau 1

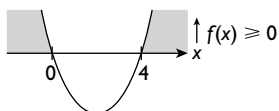


Untuk $x + 4 < (x + 4)(2x - 1)$,
 $x < -4$ atau $x > 1$

B

1. (a) $4x \leq x^2$
 $x^2 - 4x \geq 0$
 $x(x - 4) \geq 0$

Katakan $x(x - 4) = 0$.
 $x = 0$ atau 4

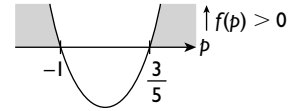


Untuk $4x \leq x^2$, $x \leq 0$ atau $x \geq 4$.

(b) $x^2 - (p + 1)x - p^2 + 1 = 0$
 $b^2 - 4ac > 0$
 $[-(p + 1)]^2 - 4(1)(-p^2 + 1) > 0$
 $p^2 + 2p + 1 + 4p^2 - 4 > 0$
 $5p^2 + 2p - 3 > 0$
 $(5p - 3)(p + 1) > 0$

Katakan $(5p - 3)(p + 1) = 0$.

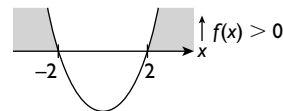
$p = \frac{3}{5}$ atau -1



Maka, $p < -1$ atau $p > \frac{3}{5}$

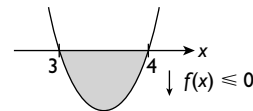
2. (a) Untuk $f(x)$ sentiasa positif, $f(x) > 0$.

Maka, $4x^2 - 16 > 0$
 $x^2 - 4 > 0$
 $(x + 2)(x - 2) > 0$



Untuk $4x^2 - 16 > 0$,
 $x < -2$ atau $x > 2$

(b) $(x - 3)^2 \leq x - 3$
 $x^2 - 6x + 9 \leq x - 3$
 $x^2 - 7x + 12 \leq 0$
 $(x - 3)(x - 4) \leq 0$



Untuk $(x - 3)^2 \leq x - 3$,
 $3 \leq x \leq 4$

Praktis Formatif: Kertas 1

1. $b^2 - 4ac < 0$
 $(-4)^2 - 4(p)(2) < 0$
 $16 - 8p < 0$
 $8p > 16$
 $p > 2$

2. (a) Apabila $x + 5 = 0$
 $x = -5$
 Persamaan paksi simetri ialah $x = -5$.

(b) Nilai minimum $f(x)$ ialah $3k - 4$.
 Maka, $3k - 4 = 11$
 $3k = 15$
 $k = 5$

3. (a) Graf fungsi $f(x) = (x - 3)^2 - 2k$ mempunyai titik minimum $(3, -2k)$.
Maka, $(3, -2k) = (h, -6)$
Jadi, $h = 3$ dan $-2k = -6$
 $k = 3$

(b) $f(x) = (x - 3)^2 - 6$
Apabila $x = 0$, $f(x) = (0 - 3)^2 - 6 = 3$
Maka, $p = 3$

4. (a) $f(x) = x^2 - 6x + h$
 $= x^2 - 6x + \left(\frac{6}{2}\right)^2 - \left(\frac{6}{2}\right)^2 + h$
 $= (x - 3)^2 - 3^2 + h$
 $= (x - 3)^2 - 9 + h$

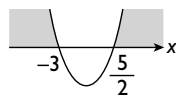
(b) Nilai minimum: $-9 + h = 10$
 $h = 19$

5. (a) Fungsi itu mempunyai titik maksimum, maka $p < 0$.
Jika p ialah integer, maka nilai maksimum p ialah -1 .

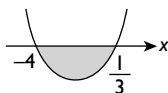
(b) $f(x) = -x^2 - 4x + q$
 $b^2 - 4ac = 0$ jika graf fungsi itu menyentuh paksi- x pada satu titik sahaja.
 $(-4)^2 - 4(-1)q = 0$
 $16 + 4q = 0$
 $4q = -16$
 $q = -4$

6. (a) $(2, -16)$
(b) $x = 2$ atau $x - 2 = 0$
(c) $-2 < x < 6$

7. $f(x) \leq -2$
 $-2x^2 - x + 13 \leq -2$
 $2x^2 + x - 15 \geq 0$
 $(2x - 5)(x + 3) \geq 0$
 $x \leq -3$ atau $x \geq \frac{5}{2}$

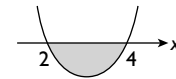


8. $3x^2 + 11x \leq 4$
 $3x^2 + 11x - 4 \leq 0$
 $(3x - 1)(x + 4) \leq 0$
 $-4 \leq x \leq \frac{1}{3}$



9. $f(x) = x^2 + wx + 2w - 3$
 $a = 1, b = w, c = 2w - 3$
 $b^2 - 4ac < 0$
 $w^2 - 4(1)(2w - 3) < 0$
 $w^2 - 8w + 12 < 0$
 $(w - 2)(w - 6) < 0$
 $2 < w < 6$
Maka, $p = 2$ dan $q = 6$.

10. $-8 + 6x - x^2 > 0$
 $x^2 - 6x + 8 < 0$
 $(x - 4)(x - 2) < 0$
 $2 < x < 4$



Praktis Formatif: Kertas 2

1. (a) Lengkung fungsi itu menyalang paksi- x pada $(2, 0)$ dan $(4, 0)$.
Maka, titik minimum lengkung terletak pada $x = \frac{2 + 4}{2} = 3$.

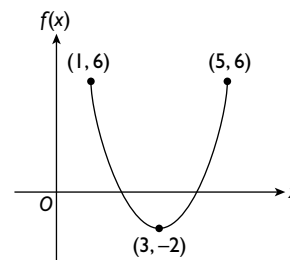
Juga diberi $y = -2$ ialah garis tangen kepada bucu lengkung. Ini bermakna titik $(3, -2)$ ialah bucu lengkung itu.

Daripada fungsi $f(x) = 2(x - h)^2 - 2k$, koordinat bucu lengkung ialah $(h, -2k)$.

Maka, $h = 3$ dan $k = 1$.

(b) $f(x) = 2(x - 3)^2 - 2$
 $f(1) = 2(1 - 3)^2 - 2 = 6$
 $f(5) = 2(5 - 3)^2 - 2 = 6$

Lengkung itu melalui titik $(1, 6)$ dan $(5, 6)$.

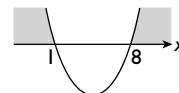


- (c) Persamaan baharu bagi lengkung ialah
 $f(x) = -[2(x - 3)^2 - 2]$
 $f(x) = -2(x - 3)^2 + 2$

2. (a) (i) $x^2 - 9x + 8 = 0$
 $(x - 1)(x - 8) = 0$
 $x = 1$ atau $x = 8$

Oleh sebab $m > n$, maka $m = 8$ dan $n = 1$.

(ii) $x^2 - 9x + 8 > 0$
 $(x - 1)(x - 8) > 0$
 $x < 1$ atau $x > 8$



- (b) Punca-punca baharu:

$m - 2 = 8 - 2 = 6$

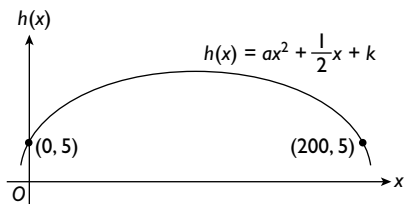
$2n - 3 = 2(1) - 3 = -1$

Persamaan kuadratik baharu ialah

$(x - 6)(x + 1) = 0$
 $x^2 - 5x - 6 = 0$

FOKUS KBAT

$$h(x) = ax^2 + \frac{1}{2}x + k$$



Pada titik (0, 5): $5 = a(0^2) + \frac{1}{2}(0) + k$
 $k = 5$

Maka, $h(x) = ax^2 + \frac{1}{2}x + 5$

$$= a\left(x^2 + \frac{1}{2a}x\right) + 5$$

$$= a\left[x^2 + \frac{1}{2a}x + \left(\frac{1}{4a}\right)^2 - \left(\frac{1}{4a}\right)^2\right] + 5$$

$$= a\left[\left(x + \frac{1}{4a}\right)^2 - \frac{1}{16a^2}\right] + 5$$

$$= a\left(x + \frac{1}{4a}\right)^2 - \frac{1}{16a} + 5$$

Pada titik maksimum, $x = \frac{0 + 200}{2}$
 $= 100$

Maka, $\frac{1}{4a} = -100$
 $a = -\frac{1}{400}$

Panjang tiang paling tinggi

$$= -\frac{1}{16\left(-\frac{1}{400}\right)} + 5$$

$$= 25 + 5$$

$$= 30 \text{ m}$$

JAWAPAN

BAB 4: PERSAMAAN SERENTAK

4.1

A

$$1. \begin{aligned} 2x + y &= 6 && \text{..... ①} \\ x^2 - 3y^2 + 4x + 3 &= 0 && \text{..... ②} \end{aligned}$$

$$\text{Dari ①: } y = 6 - 2x \quad \text{..... ③}$$

Gantikan ③ ke dalam ②.

$$\begin{aligned} x^2 - 3(6 - 2x)^2 + 4x + 3 &= 0 \\ x^2 - 108 + 72x - 12x^2 + 4x + 3 &= 0 \\ 11x^2 - 76x + 105 &= 0 \\ (11x - 21)(x - 5) &= 0 \\ x &= \frac{21}{11} \text{ atau } 5 \end{aligned}$$

Gantikan nilai-nilai x ke dalam ③.

$$\begin{aligned} \text{Apabila } x = \frac{21}{11}, \quad y &= 6 - 2\left(\frac{21}{11}\right) \\ &= \frac{24}{11} \end{aligned}$$

$$\text{Apabila } x = 5, \quad y = 6 - 2(5) = -4$$

Penyelesaian ialah $x = 1\frac{10}{11}$, $y = 2\frac{2}{11}$ dan $x = 5$, $y = -4$.

$$2. \begin{aligned} 2x - \frac{y}{3} &= 1 && \text{..... ①} \\ 4x^2 + y^2 - 10xy &= 7 && \text{..... ②} \end{aligned}$$

$$\text{Dari ①: } y = 6x - 3 \quad \text{..... ③}$$

Gantikan ③ ke dalam ②.

$$\begin{aligned} 4x^2 + (6x - 3)^2 - 10x(6x - 3) &= 7 \\ 4x^2 + 36x^2 - 36x + 9 - 60x^2 + 30x &= 7 \\ -20x^2 - 6x + 2 &= 0 \\ 10x^2 + 3x - 1 &= 0 \\ (2x + 1)(5x - 1) &= 0 \\ x &= -\frac{1}{2} \text{ atau } \frac{1}{5} \end{aligned}$$

Gantikan nilai-nilai x ke dalam ③.

$$\begin{aligned} \text{Apabila } x = -\frac{1}{2}, \quad y &= 6\left(-\frac{1}{2}\right) - 3 \\ &= -6 \end{aligned}$$

$$\begin{aligned} \text{Apabila } x = \frac{1}{5}, \quad y &= 6\left(\frac{1}{5}\right) - 3 \\ &= -\frac{9}{5} \end{aligned}$$

Penyelesaian ialah $x = -\frac{1}{2}$, $y = -6$ dan $x = \frac{1}{5}$, $y = -1\frac{4}{5}$.

B

$$1. \begin{aligned} \frac{3}{y} + \frac{1}{x} &= 4 && \text{..... ①} \\ y - 2x &= 3 && \text{..... ②} \end{aligned}$$

$$\begin{aligned} \text{Dari ①: } \frac{3x + y}{xy} &= 4 \\ 3x + y &= 4xy && \text{..... ③} \end{aligned}$$

$$\text{Dari ②: } y = 2x + 3 \quad \text{..... ④}$$

Gantikan ④ ke dalam ③.

$$\begin{aligned} 3x + (2x + 3) &= 4x(2x + 3) \\ 5x + 3 &= 8x^2 + 12x \\ 8x^2 + 7x - 3 &= 0 \end{aligned}$$

$$\begin{aligned} x &= \frac{-7 \pm \sqrt{7^2 - 4(8)(-3)}}{2(8)} \\ &= \frac{-7 \pm \sqrt{145}}{16} \\ &= 0.315 \text{ atau } -1.190 \end{aligned}$$

Gantikan nilai-nilai x ke dalam ④.

$$\begin{aligned} \text{Apabila } x = 0.315, \quad y &= 2(0.315) + 3 \\ &= 3.630 \end{aligned}$$

$$\begin{aligned} \text{Apabila } x = -1.190, \quad y &= 2(-1.190) + 3 \\ &= 0.620 \end{aligned}$$

Penyelesaian ialah $x = 0.315$, $y = 3.630$ dan $x = -1.190$, $y = 0.620$.

$$2. \begin{aligned} \frac{3x}{2} + \frac{4y}{3} &= x + 1 && \text{..... ①} \\ 5x^2 - 4y &= x + 1 && \text{..... ②} \end{aligned}$$

$$\text{Dari ①: } \frac{9x + 8y}{6} = x + 1$$

$$y = \frac{6 - 3x}{8} \quad \text{..... ③}$$

Gantikan ③ ke dalam ②.

$$5x^2 - 4\left(\frac{6 - 3x}{8}\right) = x + 1$$

$$\begin{aligned} 5x^2 - 3 + \frac{3}{2}x &= x + 1 \\ 10x^2 + x - 8 &= 0 \end{aligned}$$

$$x = \frac{-1 \pm \sqrt{1^2 - 4(10)(-8)}}{2(10)}$$

$$\begin{aligned} &= \frac{-1 \pm \sqrt{321}}{20} \\ &= 0.846 \text{ atau } -0.946 \end{aligned}$$

Gantikan nilai-nilai x ke dalam ③.

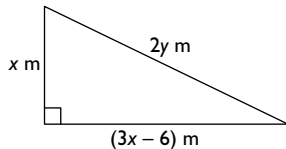
$$\text{Apabila } x = 0.846, \quad y = \frac{6 - 3(0.846)}{8} = 0.433$$

$$\text{Apabila } x = -0.946, \quad y = \frac{6 - 3(-0.946)}{8} = 1.105$$

Penyelesaian ialah $x = 0.846, y = 0.433$ dan $x = -0.946, y = 1.105$.

C

1.



Perimeter tanah = 60 m

$$2y + x + (3x - 6) = 60$$

$$2y + 4x = 66$$

$$y + 2x = 33$$

$$y = 33 - 2x \quad \dots\dots \textcircled{1}$$

Berdasarkan teorem Pythagoras,

$$x^2 + (3x - 6)^2 = (2y)^2 \quad \dots\dots \textcircled{2}$$

Gantikan ① ke dalam ②.

$$\begin{aligned} x^2 + (3x - 6)^2 &= 4(33 - 2x)^2 \\ x^2 + 9x^2 - 36x + 36 &= 4(356 - 528x + 16x^2) \\ 6x^2 - 492x + 4\ 320 &= 0 \\ x^2 - 82x + 720 &= 0 \\ (x - 10)(x - 72) &= 0 \\ x &= 10 \text{ atau } 72 \end{aligned}$$

Tetapi $x < 60$.

Maka, $x = 10$

$$2y = 2[33 - 2(10)] = 26$$

$$3x - 6 = 3(10) - 6 = 24$$

Panjang sempadan tanah itu ialah 10 m, 24 m dan 26 m.

2. Katakan:

Lebar permukaan atas meja = y cm

Panjang permukaan atas meja = $(x + 20)$ cm

Jumlah panjang rod keluli = 500 cm

$$2y + 2(x + 20) + 4x = 500$$

$$2y + 2x + 40 + 4x = 500$$

$$2y + 6x = 460$$

$$y + 3x = 230$$

$$y = 230 - 3x \quad \dots\dots \textcircled{1}$$

Luas permukaan atas meja = 4 000 cm²

$$(x + 20)y = 4\ 000 \quad \dots\dots \textcircled{2}$$

Gantikan ① ke dalam ②.

$$(x + 20)(230 - 3x) = 4\ 000$$

$$230x - 3x^2 + 4\ 600 - 60x = 4\ 000$$

$$-3x^2 + 170x + 600 = 0$$

$$3x^2 - 170x - 600 = 0$$

$$(3x + 10)(x - 60) = 0$$

$$x = -\frac{10}{3} \text{ atau } 60$$

Tetapi $x > 0$.

Maka, $x = 60$

$$x + 20 = 60 + 20 = 80$$

$$y = 230 - 3(60) = 50$$

Maka, panjang permukaan atas meja ialah 80 cm dan lebarnya ialah 50 cm.

Praktis Formatif: Kertas 2

$$\begin{aligned} 1. \quad 3x + y &= 4 \\ y &= 4 - 3x \quad \dots\dots \textcircled{1} \\ x^2 + 3y^2 + 5xy - 9 &= 0 \quad \dots\dots \textcircled{2} \end{aligned}$$

Gantikan ① ke dalam ②.

$$\begin{aligned} x^2 + 3(4 - 3x)^2 + 5x(4 - 3x) - 9 &= 0 \\ x^2 + 3(16 - 24x + 9x^2) + 20x - 15x^2 - 9 &= 0 \\ 13x^2 - 52x + 39 &= 0 \\ x^2 - 4x + 3 &= 0 \\ (x - 3)(x - 1) &= 0 \\ x &= 3 \text{ atau } 1 \end{aligned}$$

$$\begin{aligned} \text{Apabila } x = 3, \quad y &= 4 - 3(3) \\ &= -5 \end{aligned}$$

$$\begin{aligned} \text{Apabila } x = 1, \quad y &= 4 - 3(1) \\ &= 1 \end{aligned}$$

Penyelesaian ialah $x = 3, y = -5$ dan $x = 1, y = 1$.

$$\begin{aligned} 2. \quad 2x - y - 4 &= 0 \\ y &= 2x - 4 \quad \dots\dots \textcircled{1} \\ x^2 - 2y^2 - 3y + 1 &= 0 \quad \dots\dots \textcircled{2} \end{aligned}$$

Gantikan ① ke dalam ②.

$$\begin{aligned} x^2 - 2(2x - 4)^2 - 3(2x - 4) + 1 &= 0 \\ x^2 - 2(4x^2 - 16x + 16) - (6x - 12) + 1 &= 0 \\ x^2 - 8x^2 + 32x - 32 - 6x + 12 + 1 &= 0 \\ -7x^2 + 26x - 19 &= 0 \\ 7x^2 - 26x + 19 &= 0 \\ (7x - 19)(x - 1) &= 0 \\ x &= -2.7143 \text{ atau } 1 \end{aligned}$$

$$\begin{aligned} \text{Apabila } x = 2.7143, \\ y &= 2(2.7143) - 4 \\ &= 1.4286 \end{aligned}$$

$$\begin{aligned} \text{Apabila } x = 1, \\ y &= 2(1) - 4 \\ &= -2 \end{aligned}$$

Penyelesaian ialah $x = 2.714, y = 1.429$ dan $x = 1, y = -2$.

$$\begin{aligned} 3. \quad 3x + y &= 9 \\ y &= 9 - 3x \quad \dots\dots \textcircled{1} \\ 2x^2 - xy - y &= -1 \quad \dots\dots \textcircled{2} \end{aligned}$$

Gantikan ① ke dalam ②.

$$\begin{aligned} 2x^2 - x(9 - 3x) - (9 - 3x) &= -1 \\ 2x^2 - 9x + 3x^2 - 9 + 3x &= -1 \\ 5x^2 - 6x - 8 &= 0 \\ (5x + 4)(x - 2) &= 0 \\ x &= -\frac{4}{5} \text{ atau } 2 \end{aligned}$$

$$\begin{aligned} \text{Apabila } x = -\frac{4}{5}, \quad y &= 9 - 3\left(-\frac{4}{5}\right) \\ &= 11\frac{2}{5} \end{aligned}$$

Apabila $x = 2$, $y = 9 - 3(2)$
 $= 3$

Penyelesaian ialah $x = -\frac{4}{5}$, $y = 11\frac{2}{5}$ dan
 $x = 2$, $y = 3$.

4. $y - 2x = 8$
 $y = 2x + 8$ ①
 $y - xy = 7x$ ②

Gantikan ① ke dalam ②.
 $(2x + 8) - x(2x + 8) = 7x$
 $2x + 8 - 2x^2 - 8x = 7x$
 $2x^2 + 13x - 8 = 0$

$x = \frac{-13 \pm \sqrt{13^2 - 4(2)(-8)}}{2(2)}$
 $= \frac{-13 \pm \sqrt{233}}{4}$
 $= 0.5661$ atau -7.0661

Apabila $x = 0.5661$,
 $y = 2(0.5661) + 8$
 $= 9.1322$

Apabila $x = -7.0661$,
 $y = 2(-7.0661) + 8$
 $= -6.1322$

Penyelesaian ialah $x = 0.57$, $y = 9.13$ dan
 $x = -7.07$, $y = -6.13$.

5. $3x - y + 5 = 0$
 $y = 3x + 5$ ①
 $4x^2 + y^2 - 2xy = 12$ ②

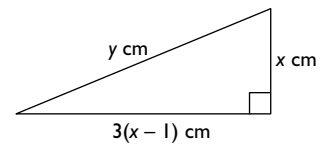
Gantikan ① ke dalam ②.
 $4x^2 + (3x + 5)^2 - 2x(3x + 5) = 12$
 $4x^2 + 9x^2 + 30x + 25 - 6x^2 - 10x - 12 = 0$
 $7x^2 + 20x + 13 = 0$
 $(7x + 13)(x + 1) = 0$
 $x = -\frac{13}{7}$ atau -1

Apabila $x = -\frac{13}{7}$, $y = 3\left(-\frac{13}{7}\right) + 5$
 $= -\frac{4}{7}$

Apabila $x = -1$, $y = 3(-1) + 5$
 $= 2$

Penyelesaian ialah $x = -1\frac{6}{7}$, $y = -\frac{4}{7}$ dan
 $x = -1$, $y = 2$.

6.



Perimeter segi tiga = 30 cm
Maka, $x + 3(x - 1) + y = 30$
 $x + 3x - 3 + y = 30$
 $y = 33 - 4x$ ①

Berdasarkan teorem Pythagoras,
 $x^2 + [3(x - 1)]^2 = y^2$
 $x^2 + 9(x^2 - 2x + 1) = y^2$
 $10x^2 - 18x + 9 = y^2$ ②

Gantikan ① ke dalam ②.
 $10x^2 - 18x + 9 = (33 - 4x)^2$
 $10x^2 - 18x + 9 = 1\,089 - 264x + 16x^2$
 $6x^2 - 246x + 1\,080 = 0$
 $x^2 - 41x + 180 = 0$
 $(x - 5)(x - 36) = 0$
 $x = 5$ atau 36

Tetapi $x < 30$.

Maka, $x = 5$
 $3(x - 1) = 3(5 - 1) = 12$
 $y = 33 - 4(5) = 13$

Maka, panjang sisi segi tiga itu ialah 5 cm,
12 cm dan 13 cm.

7. $x - 3y = 2$
 $x = 3y + 2$ ①
 $x^2 + 2xy + 3y^2 = 6$ ②

Gantikan ① ke dalam ②.
 $(3y + 2)^2 + 2y(3y + 2) + 3y^2 = 6$
 $9y^2 + 12y + 4 + 6y^2 + 4y + 3y^2 = 6$
 $18y^2 + 16y - 2 = 0$
 $9y^2 + 8y - 1 = 0$
 $(9y - 1)(y + 1) = 0$
 $y = \frac{1}{9}$ atau -1

Apabila $y = \frac{1}{9}$, $x = 3\left(\frac{1}{9}\right) + 2$
 $= 2\frac{1}{3}$

Apabila $y = -1$, $x = 3(-1) + 2$
 $= -1$

Penyelesaian ialah $x = 2\frac{1}{3}$, $y = \frac{1}{9}$ dan
 $x = -1$, $y = -1$.

FOKUS KBAT

Panjang kolam renang = $(30 - 2x)$ m

Lebar kolam renang = $(y - 2)$ m

Perimeter kolam renang = 84 m

$$2(30 - 2x) + 2(y - 2) = 84$$

$$(30 - 2x) + (y - 2) = 42$$

$$-2x + y = 14$$

$$y = 2x + 14 \quad \dots\dots \textcircled{1}$$

Luas kolam renang = 416 m^2

$$(30 - 2x)(y - 2) = 416$$

$$(15 - x)(y - 2) = 208 \quad \dots\dots \textcircled{2}$$

Gantikan $\textcircled{1}$ ke dalam $\textcircled{2}$.

$$(15 - x)[(2x + 14) - 2] = 208$$

$$(15 - x)(2x + 12) = 208$$

$$(15 - x)(x + 6) = 104$$

$$15x + 90 - x^2 - 6x = 104$$

$$-x^2 + 9x - 14 = 0$$

$$x^2 - 9x + 14 = 0$$

$$(x - 2)(x - 7) = 0$$

$$x = 2 \text{ atau } 7$$

Diberi panjang kolam renang > 20 m.

$$\text{Maka, } 30 - 2x > 20$$

$$-2x > -10$$

$$2x < 10$$

$$x < 5$$

Jadi, $x = 2$.

$$\text{Apabila } x = 2, y = 2(2) + 14$$

$$= 18$$

Luas kawasan yang ditutupi dengan jubin

$$= 30y - \text{Luas kolam renang}$$

$$= (30 \times 18) - 416$$

$$= 540 - 416$$

$$= 124 \text{ m}^2$$

JAWAPAN

BAB 5: INDEKS DAN LOGARITMA

5.1

A

$$1. k^6 \times k^9 = k^{6+9} \\ = k^{15}$$

$$2. y^7 \div y^5 = y^{7-5} \\ = y^2$$

$$3. m^3 n^2 \times m^5 n = m^{3+5} n^{2+1} \\ = m^8 n^3$$

$$4. (2a^3 b^2)^5 = 2^5 \times a^{3 \times 5} b^{2 \times 5} \\ = 32a^{15} b^{10}$$

$$5. (h^6)^2 \div h^9 \times h^4 = h^{12} \div h^9 \times h^4 \\ = h^{12-9+4} \\ = h^7$$

$$6. \frac{r^8 s^3 \times r s^2}{r^7 s} = r^{8+1-7} s^{3+2-1} \\ = r^2 s^4$$

$$7. \frac{ab^7 \times (6a)^3}{24a^2 b^6} = \frac{ab^7 \times 216a^3}{24a^2 b^6} \\ = \frac{216}{24} a^{1+3-2} b^{7-6} \\ = 9a^2 b$$

$$8. \frac{20p^7 q \times p^8 q}{(2p^3)^4 \times pq^5} = \frac{20p^7 q \times p^8 q}{16p^{12} \times pq^5} \\ = \frac{20}{16} p^{7+8-(12+1)} q^{1+1-5} \\ = \frac{5}{4} p^2 q^{-3} \\ = \frac{5p^2}{4q^3}$$

$$9. \frac{(x^4 y \times xy^3)^2}{x^{11} y^5} = \frac{(x^{4+1} y^{1+3})^2}{x^{11} y^5} \\ = \frac{(x^5 y^4)^2}{x^{11} y^5} \\ = \frac{x^{10} y^8}{x^{11} y^5} \\ = x^{10-11} y^{8-5} \\ = x^{-1} y^3 \\ = \frac{y^3}{x}$$

B

$$1. 5^5 \times 125^2 \div 25^4 = 5^5 \times (5^3)^2 \div (5^2)^4 \\ = 5^5 \times 5^6 \div 5^8 \\ = 5^{5+6-8} \\ = 5^3 \\ = 125$$

$$2. 216^{\frac{1}{3}} \times 4^{-1} \times 9^{\frac{3}{2}} = (6^3)^{\frac{1}{3}} \times \frac{1}{4} \times (3^2)^{\frac{3}{2}} \\ = 6 \times \frac{1}{4} \times 3^3 \\ = \frac{3}{2} \times 27 \\ = 40\frac{1}{2}$$

$$3. \frac{\sqrt{8} \times 16^2}{32^{\frac{3}{2}}} = \frac{(2^3)^{\frac{1}{2}} \times (2^4)^2}{(2^5)^{\frac{3}{2}}} \\ = \frac{2^{\frac{3}{2}} \times 2^8}{2^{\frac{15}{2}}} \\ = 2^{\frac{3}{2}+8-\frac{15}{2}} \\ = 2^2 \\ = 4$$

C

$$1. \frac{21^{y+1} \times 3^{1-y}}{7y} = \frac{(3 \times 7)^{y+1} \times 3^{1-y}}{7y} \\ = \frac{3^{y+1} \times 7^{y+1} \times 3^{1-y}}{7y} \\ = 3^{y+1+(1-y)} \times 7^{y+1-y} \\ = 3^2 \times 7^1 \\ = 63$$

$$2. \frac{45^{n+1} \times 3^{-2n}}{5^{n-1}} = \frac{(3^2 \times 5)^{n+1} \times 3^{-2n}}{5^{n-1}} \\ = \frac{3^{2n+2} \times 5^{n+1} \times 3^{-2n}}{5^{n-1}} \\ = 3^{2n+2+(-2n)} \times 5^{n+1-(n-1)} \\ = 3^2 \times 5^2 \\ = 225$$

$$3. \frac{56^x}{7^{x+1} \times 4^{\frac{3}{2}x-1}} = \frac{(2^3 \times 7)^x}{7^{x+1} \times (2^2)^{\frac{3}{2}x-1}} \\ = \frac{2^{3x} \times 7^x}{7^{x+1} \times 2^{3x-2}} \\ = 2^{3x-(3x-2)} \times 7^{x-(x+1)} \\ = 2^2 \times 7^{-1} \\ = \frac{4}{7}$$

D

- $9^n + 32^n = (3^2)^n + (2^5)^n$
 $= (3^n)^2 + (2^n)^5$
 $= y^2 + x^5$
- $6^n - 81^{3n} = (2 \times 3)^n - (3^4)^{3n}$
 $= 2^n \times 3^n - 3^{12n}$
 $= xy - y^{12}$
- $54^n \times 32^n = (2 \times 3^3)^n \times (2^5)^n$
 $= 2^n \times 3^{3n} \times 2^{5n}$
 $= 2^n \times (3^n)^3 \times (2^n)^5$
 $= x \times y^3 \times x^5$
 $= x^6 y^3$
- $24^{n+1} \times 243^n = 24^n \times 24^1 \times (3^5)^n$
 $= (2^3 \times 3)^n \times 24 \times 3^{5n}$
 $= 2^{3n} \times 3^n \times 24 \times 3^{5n}$
 $= x^3 \times y \times 24 \times y^5$
 $= 24x^3 y^6$

E

- $2^{n+5} - 2^{n+2} = 2^n (2^5) - 2^n (2^2)$
 $= 2^n (32) - 2^n (4)$
 $= 2^n (32 - 4)$
 $= 2^n (28)$
 $= 2^n (2^2 \times 7)$
 $= 7(2^{n+2})$
- $3^y + 4(3^{y+2}) - 3^{y+3} = 3^y + 4(3^y)(3^2) - 3^y (3^3)$
 $= 3^y + 3^y (36) - 3^y (27)$
 $= 3^y (1 + 36 - 27)$
 $= 10(3^y)$
- $7(6^n) + 36^{\frac{n}{2}} + 6^{n+1} = 7(6^n) + (6^2)^{\frac{n}{2}} + 6^n (6)$
 $= 7(6^n) + 6^n + 6^n (6)$
 $= 6^n (7 + 1 + 6)$
 $= 14(6^n)$
- $5^{x+1} + 5^{x-1} = 5^x (5) + \frac{5x}{5}$
 $= 5x \left(5 + \frac{1}{5}\right)$
 $= 5x \left(\frac{26}{5}\right)$
 $= 26(5^{x-1})$
- $4^{n+1} - 2^{2n+1} + 8^{\frac{2}{3}n}$
 $= 4^n (4) - 2^{2n} (2) + (2^3)^{\frac{2}{3}n}$
 $= 4^n (4) - 4^n (2) + 2^{2n}$
 $= 4^n (4) - 4^n (2) + 4^n$
 $= 4^n (4 - 2 + 1)$
 $= 3(4^n)$

5.2**A**

- $343 = 7^3$
 $\log_7 343 = 7$
- $32 = 2^5$
 $\log_2 32 = 5$
- $\frac{1}{9} = 3^{-2}$
 $\log_3 \frac{1}{9} = -2$
- $M = x^9$
 $\log_x M = 9$
- $8^n = k$
 $\log_8 k = n$

B

- $\log_5 25 = 2$
 $25 = 5^2$
- $\log_3 243 = 5$
 $243 = 3^5$
- $\log_5 \frac{1}{125} = -3$
 $\frac{1}{125} = 5^{-3}$
- $\log_a 5 = n$
 $5 = a^n$
- $x = \log_7 y$
 $y = 7^x$

C

- $\log_{10} 13.8 = 1.140$
- $\log_{10} \frac{5}{8} = -0.2041$
- $\log_2 128 = \log_2 2^7$
 $= 7 \log_2 2$
 $= 7$
- $\log_5 0.2 = \log_5 \frac{1}{5}$
 $= \log_5 5^{-1}$
 $= (-1) \log_5 5$
 $= -1$

D

- $\log_3 x = 4$
 $x = 3^4$
 $= 81$
- $\log_{32} x = \frac{1}{5}$
 $x = 32^{\frac{1}{5}}$
 $= (2^5)^{\frac{1}{5}}$
 $= 2$

$$\begin{aligned}
 3. \log_x 125 &= 3 \\
 125 &= x^3 \\
 5^3 &= x^3 \\
 x &= 5
 \end{aligned}$$

$$\begin{aligned}
 4. \log_x 7 &= -\frac{1}{2} \\
 7 &= x^{-\frac{1}{2}} \\
 x &= 7^{-2} \\
 &= \frac{1}{49}
 \end{aligned}$$

E

$$\begin{aligned}
 1. 2 \log_a 12 + \log_a 10 - \log_a 15 \\
 &= \log_a 12^2 + \log_a 10 - \log_a 15 \\
 &= \log_a \left(\frac{12^2 \times 10}{15} \right) \\
 &= \log_a 96
 \end{aligned}$$

$$\begin{aligned}
 2. \frac{1}{3} \log_x 8 - 2 \log_x 6 + \frac{3}{2} \log_x 9 \\
 &= \log_x (2^3)^{\frac{1}{3}} - \log_x 6^2 + \log_x (3^2)^{\frac{3}{2}} \\
 &= \log_x 2 - \log_x 36 + \log_x 27 \\
 &= \log_x \left(\frac{2}{36} \times 27 \right) \\
 &= \log_x \left(\frac{3}{2} \right)
 \end{aligned}$$

$$\begin{aligned}
 3. 6 \log_m xy - 3 \log_m x - 2 \log_m y \\
 &= \log_m (xy)^6 - \log_m x^3 - \log_m y^2 \\
 &= \log_m \left(\frac{x^6 y^6}{x^3 y^2} \right) \\
 &= \log_m (x^3 y^4) \\
 &= \log_m x^3 y^4
 \end{aligned}$$

$$\begin{aligned}
 4. \log_b \sqrt{b} + 2 \log_c c^3 - \log_2 32 \\
 &= \log_b b^{\frac{1}{2}} + 3(2) \log_c c - \log_2 2^5 \\
 &= \frac{1}{2} \log_b b + 6 \log_c c - 5 \log_2 2 \\
 &= \frac{1}{2} + 6 - 5 \\
 &= \frac{3}{2}
 \end{aligned}$$

F

$$\begin{aligned}
 1. (a) \log_a 63 &= \log_a (3^2 \times 7) \\
 &= \log_a 3^2 + \log_a 7 \\
 &= 2 \log_a 3 + \log_a 7 \\
 &= 2x + y
 \end{aligned}$$

$$\begin{aligned}
 (b) \log_a \frac{49a}{81} &= \log_a 49 + \log_a a - \log_a 81 \\
 &= \log_a 7^2 + \log_a a - \log_a 3^4 \\
 &= 2 \log_a 7 + 1 - 4 \log_a 3 \\
 &= 2y + 1 - 4x
 \end{aligned}$$

$$\begin{aligned}
 (c) \log_a \frac{\sqrt{343a^5}}{3} \\
 &= \log_a \sqrt{343} + \log_a \sqrt{a^5} - \log_a 3 \\
 &= \log_a 7^{\frac{3}{2}} + \log_a a^{\frac{5}{2}} - \log_a 3 \\
 &= \frac{3}{2} \log_a 7 + \frac{5}{2} \log_a a - \log_a 3 \\
 &= \frac{3}{2} y + \frac{5}{2} - x
 \end{aligned}$$

$$\begin{aligned}
 2. (a) \log_3 90 &= \log_3 (2 \times 5 \times 3^2) \\
 &= \log_3 2 + \log_3 5 + \log_3 3^2 \\
 &= \log_3 2 + \log_3 5 + 2(1) \\
 &= m + n + 2
 \end{aligned}$$

$$\begin{aligned}
 (b) \log_3 0.3 &= \log_3 \frac{3}{10} \\
 &= \log_3 \frac{3}{2 \times 5} \\
 &= \log_3 3 - \log_3 2 - \log_3 5 \\
 &= 1 - m - n
 \end{aligned}$$

$$\begin{aligned}
 (c) \log_3 3.75 &= \log_3 \frac{15}{4} \\
 &= \log_3 \frac{3 \times 5}{2^2} \\
 &= \log_3 3 + \log_3 5 - \log_3 2^2 \\
 &= 1 + \log_3 5 - 2 \log_3 2 \\
 &= 1 + n - 2m
 \end{aligned}$$

$$\begin{aligned}
 3. (a) \log_x 100 &= \log_x (4 \times 5^2) \\
 &= \log_x 4 + \log_x 5^2 \\
 &= \log_x 4 + 2 \log_x 5 \\
 &= p + 2q
 \end{aligned}$$

$$\begin{aligned}
 (b) \log_x 0.8x^3 &= \log_x \frac{4}{5} x^3 \\
 &= \log_x 4 - \log_x 5 + \log_x x^3 \\
 &= \log_x 4 - \log_x 5 + 3 \log_x x \\
 &= p - q + 3
 \end{aligned}$$

$$\begin{aligned}
 (c) \log_x \frac{12.5}{\sqrt{x}} &= \log_x \frac{25}{2\sqrt{x}} \\
 &= \log_x 25 - \log_x 2 - \log_x x^{\frac{1}{2}} \\
 &= \log_x 5^2 - \log_x 4^{\frac{1}{2}} - \frac{1}{2} \log_x x \\
 &= 2 \log_x 5 - \frac{1}{2} \log_x 4 - \frac{1}{2} (1) \\
 &= 2q - \frac{1}{2} p - \frac{1}{2}
 \end{aligned}$$

G

- $$3 \log_2 x + 2 \log_2 y = 1$$

$$\log_2 x^3 + \log_2 y^2 = 1$$

$$\log_2 x^3 y^2 = 1$$

$$x^3 y^2 = 2^1$$

$$y^2 = \frac{2}{x^3}$$

$$y = \sqrt{\frac{2}{x^3}}$$
- $$\log_3 xy - 2 = 3 \log_3 x - \log_3 y$$

$$\log_3 xy - \log_3 3^2 = \log_3 x^3 - \log_3 y$$

$$\log_3 xy - \log_3 9 = \log_3 x^3 - \log_3 y$$

$$\log_3 \frac{xy}{9} = \log_3 \frac{x^3}{y}$$

$$\frac{xy}{9} = \frac{x^3}{y}$$

$$y^2 = 9x^2$$

$$y = 3x$$
- $$\log_4 (x + y) - 5 \log_4 x = 3$$

$$\log_4 (x + y) - \log_4 x^5 = 3$$

$$\log_4 \frac{x + y}{x^5} = 3$$

$$\frac{x + y}{x^5} = 4^3$$

$$x + y = 64x^5$$

$$y = 64x^5 - x$$

H

- $$\log_2 xy = 3$$

$$\log_2 x + \log_2 y = 3 \quad \dots\dots \textcircled{1}$$

$$(\times 2) \quad 2 \log_2 x + 2 \log_2 y = 6 \quad \dots\dots \textcircled{2}$$

$$\log_2 \frac{x^3}{y^2} = -5$$

$$\log_2 x^3 - \log_2 y^2 = -5$$

$$3 \log_2 x - 2 \log_2 y = -5 \quad \dots\dots \textcircled{3}$$

$$\textcircled{2} + \textcircled{3}: \quad 5 \log_2 x = 1$$

$$\log_2 x = \frac{1}{5}$$

Gantikan $\log_2 x = \frac{1}{5}$ ke dalam $\textcircled{1}$.

$$\frac{1}{5} + \log_2 y = 3$$

$$\log_2 y = 3 - \frac{1}{5}$$

$$= \frac{14}{5}$$

5.3**A**

- $$\log_5 13 = \frac{\log_{10} 13}{\log_{10} 5}$$

$$= 1.594$$
- $$\log_8 4.53 = \frac{\log_{10} 4.53}{\log_{10} 8}$$

$$= 0.7265$$

$$3. \log_6 \frac{7}{9} = \frac{\log_{10} \left(\frac{7}{9}\right)}{\log_{10} 6}$$

$$= -0.1403$$

B

- $$\log_2 P + \log_8 Q = 1$$

$$\log_2 P + \frac{\log_2 Q}{\log_2 8} = \log_2 2$$

$$\log_2 P + \frac{\log_2 Q}{3} = \log_2 2$$

$$\log_2 P + \frac{1}{3} \log_2 Q = \log_2 2$$

$$\log_2 P + \log_2 Q^{\frac{1}{3}} = \log_2 2$$

$$\log_2 P = \log_2 2 - \log_2 \sqrt[3]{Q}$$

$$\log_2 P = \log_2 \frac{2}{\sqrt[3]{Q}}$$

$$P = \frac{2}{\sqrt[3]{Q}}$$
- $$\log_5 P - 6 \log_{25} Q = 3$$

$$\log_5 P - \frac{6 \log_5 Q}{\log_5 25} = \log_5 5^3$$

$$\log_5 P - \frac{6 \log_5 Q}{2} = \log_5 125$$

$$\log_5 P - 3 \log_5 Q = \log_5 125$$

$$\log_5 P - \log_5 Q^3 = \log_5 125$$

$$\log_5 P = \log_5 125 + \log_5 Q^3$$

$$\log_5 P = \log_5 125Q^3$$

$$P = 125Q^3$$
- $$4 \log_{49} P - 2 \log_7 Q - 1 = 0$$

$$\frac{4 \log_7 P}{\log_7 49} - 2 \log_7 Q - \log_7 7 = 0$$

$$\frac{4 \log_7 P}{2} - \log_7 Q^2 - \log_7 7 = 0$$

$$2 \log_7 P - \log_7 Q^2 - \log_7 7 = 0$$

$$\log_7 P^2 - \log_7 Q^2 - \log_7 7 = 0$$

$$\log_7 P^2 = \log_7 7 + \log_7 Q^2$$

$$\log_7 P^2 = \log_7 7Q^2$$

$$P^2 = 7Q^2$$

$$P = \sqrt{7}Q$$

C

- $$\log_9 27h^4 = \frac{\log_3 27h^4}{\log_3 9}$$

$$= \frac{\log_3 27 + \log_3 h^4}{\log_3 3^2}$$

$$= \frac{\log_3 3^3 + 4 \log_3 h}{2 \log_3 3}$$

$$= \frac{3 \log_3 3 + 4k}{2}$$

$$= \frac{3 + 4k}{2}$$

$$\begin{aligned}
2. \log_{24} 49 &= \frac{\log_7 49}{\log_7 24} \\
&= \frac{\log_7 7^2}{\log_7 (2^3 \times 3)} \\
&= \frac{2 \log_7 7}{\log_7 2^3 + \log_7 3} \\
&= \frac{2}{3 \log_7 2 + y} \\
&= \frac{2}{3x + y}
\end{aligned}$$

$$\begin{aligned}
3. \log_m \frac{m^2}{125} &= \log_m m^2 - \log_m 125 \\
&= 2 \log_m m - \frac{\log_{25} 125}{\log_{25} m} \\
&= 2 - \frac{\log_{25} 25^{\frac{3}{2}}}{n} \\
&= 2 - \frac{\frac{3}{2} \log_{25} 25}{n} \\
&= 2 - \frac{3}{2n} \\
&= \frac{4n - 3}{2n}
\end{aligned}$$

$$\begin{aligned}
4. \log_2 1.8 &= \log_2 \frac{3^2}{5} \\
&= \log_2 3^2 - \log_2 5 \\
&= 2 \log_2 3 - \log_2 5 \\
&= \frac{2}{\log_3 2} - \frac{1}{\log_5 2} \\
&= \frac{2}{\log_3 4^{\frac{1}{2}}} - \frac{1}{\log_5 4^{\frac{1}{2}}} \\
&= \frac{2}{\frac{1}{2} \log_3 4} - \frac{1}{\frac{1}{2} \log_5 4} \\
&= \frac{4}{b} - \frac{2}{a}
\end{aligned}$$

5.4

A

$$\begin{aligned}
1. \quad &343^{x-1} = 49 \\
&(7^3)^{x-1} = 7^2 \\
&7^{3x-3} = 7^2 \\
&3x - 3 = 2 \\
&3x = 5 \\
&x = \frac{5}{3}
\end{aligned}$$

$$\begin{aligned}
2. \quad &16^y + 2 = 32 \\
&(2^4)^y + 2 = 2^5 \\
&2^{4y+8} = 2^5 \\
&4y + 8 = 5 \\
&4y = -3 \\
&y = -\frac{3}{4}
\end{aligned}$$

$$\begin{aligned}
3. \quad &\frac{27^x}{3} = \frac{1}{9^x} \\
&(3^{3x})(3^{-1}) = (3^{-2})^x \\
&3^{3x-1} = 3^{-2x} \\
&3x - 1 = -2x \\
&5x = 1 \\
&x = \frac{1}{5}
\end{aligned}$$

$$\begin{aligned}
4. \quad &2^n \times 8^{n+1} = 4 \\
&2^n \times (2^3)^{n+1} = 2^2 \\
&2^n \times 2^{3n+3} = 2^2 \\
&2^{n+3n+3} = 2^2 \\
&4n + 3 = 2 \\
&4n = -1 \\
&n = -\frac{1}{4}
\end{aligned}$$

$$\begin{aligned}
5. \quad &6^x + 6^{x+1} = 252 \\
&6^x + (6^x)(6^1) = 252 \\
&6^x(1 + 6) = 252 \\
&6^x(7) = 252 \\
&6^x = 36 \\
&6^x = 6^2 \\
&x = 2
\end{aligned}$$

$$\begin{aligned}
6. \quad &3^{x+2} - 2(3^x + 1) = 1 \\
&(3^x)(3^2) - 2(3^x)(3^1) = 1 \\
&3^x(9 - 6) = 1 \\
&3^x(3) = 1 \\
&3^x = \frac{1}{3} \\
&3^x = 3^{-1} \\
&x = -1
\end{aligned}$$

B

$$\begin{aligned}
1. \quad &6^{x+1} = 9^x \\
&\log_{10} 6^{x+1} = \log_{10} 9^x \\
&(x+1) \log_{10} 6 = x \log_{10} 9 \\
&x \log_{10} 6 + \log_{10} 6 = x \log_{10} 9 \\
&\log_{10} 6 = x \log_{10} 9 - x \log_{10} 6 \\
&\log_{10} 6 = x(\log_{10} 9 - \log_{10} 6) \\
&x = \frac{\log_{10} 6}{\log_{10} 9 - \log_{10} 6} \\
&= 4.419
\end{aligned}$$

$$\begin{aligned}
2. \quad &5^{2x} = 4^{x-1} \\
&\log_{10} 5^{2x} = \log_{10} 4^{x-1} \\
&2x \log_{10} 5 = (x-1) \log_{10} 4 \\
&2x \log_{10} 5 = x \log_{10} 4 - \log_{10} 4 \\
&\log_{10} 4 = x \log_{10} 4 - 2x \log_{10} 5 \\
&\log_{10} 4 = x(\log_{10} 4 - 2 \log_{10} 5) \\
&x = \frac{\log_{10} 4}{\log_{10} 4 - 2 \log_{10} 5} \\
&= -0.7565
\end{aligned}$$

C

- $$\log_2 (5x + 2) = \log_2 (x - 2) + 3$$

$$\log_2 (5x + 2) = \log_2 (x - 2) + \log_2 2^3$$

$$\log_2 (5x + 2) = \log_2 (x - 2) + \log_2 8$$

$$\log_2 (5x + 2) = \log_2 8(x - 2)$$

$$5x + 2 = 8(x - 2)$$

$$5x + 2 = 8x - 16$$

$$3x = 18$$

$$x = 6$$
- $$\log_4 x + 1 = \log_4 (x + 9)$$

$$\log_4 x + \log_4 4 = \log_4 (x + 9)$$

$$\log_4 4x = \log_4 (x + 9)$$

$$4x = x + 9$$

$$3x = 9$$

$$x = 3$$
- $$\log_3 (x - 8) + \log_3 x = 2$$

$$\log_3 (x - 8)x = 2$$

$$x(x - 8) = 3^2$$

$$x^2 - 8x = 9$$

$$x^2 - 8x - 9 = 0$$

$$(x + 1)(x - 9) = 0$$

Disebabkan $x > 0$, maka $x = 9$.

D

- $$\log_6 (3x + 4) - 2 \log_{36} x = 1$$

$$\log_6 (3x + 4) - \frac{2 \log_6 x}{\log_6 36} = 1$$

$$\log_6 (3x + 4) - \frac{2 \log_6 x}{\log_6 6^2} = 1$$

$$\log_6 (3x + 4) - \frac{2 \log_6 x}{2} = 1$$

$$\log_6 (3x + 4) - \log_6 x = 1$$

$$\log_6 \frac{3x + 4}{x} = 1$$

$$\frac{3x + 4}{x} = 6^1$$

$$3x + 4 = 6x$$

$$3x = 4$$

$$x = \frac{4}{3}$$
- $$\log_2 (4x + 3) - 6 \log_8 x = 2$$

$$\log_2 (4x + 3) - \frac{6 \log_2 x}{\log_2 8} = 2$$

$$\log_2 (4x + 3) - \frac{6 \log_2 x}{\log_2 2^3} = 2$$

$$\log_2 (4x + 3) - \frac{6 \log_2 x}{3} = 2$$

$$\log_2 (4x + 3) - 2 \log_2 x = 2$$

$$\log_2 (4x + 3) - \log_2 x^2 = 2$$

$$\log_2 \frac{4x + 3}{x^2} = 2$$

$$\frac{4x + 3}{x^2} = 2^2$$

$$4x + 3 = 4x^2$$

$$4x^2 - 4x - 3 = 0$$

$$(2x + 1)(2x - 3) = 0$$

Disebabkan $x > 0$, maka $x = \frac{3}{2}$.

Praktis Formatif: Kertas 1

- $$\frac{(6x^3y^2)^2}{4x^2y} = \frac{36x^6y^4}{4x^2y}$$

$$= \frac{36}{4} \times x^{6-2} \times y^{4-1}$$

$$= 9x^4y^3$$
- $$2^y - 3x = 6 + 8^x$$

$$\frac{2^y}{2^{3x}} = 6 + (2^3)^x$$

$$\frac{h}{k} = 6 + 2^{3x}$$

$$\frac{h}{k} = 6 + k$$

$$h = k(6 + k)$$
- $$\log_x a = \log_x \frac{1}{x^4}$$

$$= \log_x x^{-4}$$

$$= -4 \log_x x$$

$$= -4(1)$$

$$= -4$$
 - $$8 \log_a x = 8 \left(\frac{1}{\log_x a} \right)$$

$$= 8 \left(\frac{1}{-4} \right)$$

$$= -2$$
- $$\log_k 27 = 3$$

$$27 = k^3$$

$$3^3 = k^3$$

$$k = 3$$
 - $$\log_{27} \left(\frac{1}{k} \right) = \log_{27} k^{-1}$$

$$= -\log_{27} k$$

$$= -\frac{\log_k k}{\log_k 27}$$

$$= -\frac{1}{3}$$
- $$\log_a 36 = \log_a 6^2$$

$$= 2 \log_a 6$$

$$= 2m$$
 - $$\log_6 1296a^3 = \log_6 1296 + \log_6 a^3$$

$$= \log_6 6^4 + \frac{\log_a a^3}{\log_a 6}$$

$$= 4 + \frac{3}{m}$$

$$= \frac{4m + 3}{m}$$

$$\begin{aligned}
6. \log_6 27p^3 &= \log_6 27 + \log_6 p^3 \\
&= \frac{\log_p 27}{\log_p 6} + \frac{\log_p p^3}{\log_p 6} \\
&= \frac{\log_p 3^3}{\log_p 6} + \frac{3 \log_p p}{\log_p 6} \\
&= \frac{y}{y} + \frac{3(1)}{y} \\
&= \frac{3x}{y} + \frac{3}{y} \\
&= \frac{3(x+1)}{y}
\end{aligned}$$

$$\begin{aligned}
7. \log_4 75 &= \frac{\log_2 75}{\log_2 4} \\
&= \frac{\log_2 (3 \times 5^2)}{\log_2 2^2} \\
&= \frac{\log_2 3 + 2 \log_2 5}{2 \log_2 2} \\
&= \frac{m + 2n}{2}
\end{aligned}$$

$$\begin{aligned}
8. \quad 3^{2x} - 3^{2x-2} &= 24 \\
3^{2x} - \frac{3^{2x}}{3^2} &= 24 \\
3^{2x} - \frac{3^{2x}}{9} &= 24 \\
\left(1 - \frac{1}{9}\right)(3^{2x}) &= 24 \\
\frac{8}{9}(3^{2x}) &= 24 \\
3^{2x} &= 27 = 3^3 \\
2x &= 3 \\
x &= 1\frac{1}{2}
\end{aligned}$$

$$\begin{aligned}
9. \quad 2^p &= 5^k \\
\log_2 2^p &= \log_2 5^k \\
p \log_2 2 &= k \log_2 5 \\
p &= k \log_2 5 \\
\log_2 5 &= \frac{p}{k} \\
2^p &= 10^r \\
\log_2 2^p &= \log_2 10^r \\
p \log_2 2 &= r \log_2 10 \\
p &= r \log_2 (2 \times 5) \\
p &= r (\log_2 2 + \log_2 5) \\
p &= r \left(1 + \frac{p}{k}\right) \\
p &= r \left(\frac{k+p}{k}\right) \\
pk &= kr + pr \\
pk - pr &= kr \\
p(k-r) &= kr \\
p &= \frac{kr}{k-r}
\end{aligned}$$

$$\begin{aligned}
10. \quad 1 + \log_3 x &= \log_3 (x+6) \\
\log_3 (x+6) - \log_3 x &= 1 \\
\log_3 \left(\frac{x+6}{x}\right) &= 1 \\
\frac{x+6}{x} &= 3^1 \\
x+6 &= 3x \\
2x &= 6 \\
x &= 3
\end{aligned}$$

$$\begin{aligned}
11. \quad \frac{16^{h-3}}{64^{p+2}} &= 1 \\
16^{h-3} &= 64^{p+2} \\
4^{2(h-3)} &= 4^{3(p+2)} \\
2(h-3) &= 3(p+2) \\
2h-6 &= 3p+6 \\
2h &= 3p+12 \\
h &= \frac{3}{2}p+6
\end{aligned}$$

$$\begin{aligned}
12. \log_m 256 - \log_{\sqrt{m}} 2m &= 1 \\
\log_m 256 - \frac{\log_m 2m}{\log_m \sqrt{m}} &= 1 \\
\log_m 256 - \frac{\log_m 2m}{\log_m m^{\frac{1}{2}}} &= 1 \\
\log_m 256 - \frac{\log_m 2m}{\frac{1}{2}} &= 1 \\
\log_m 256 - 2 \log_m 2m &= 1 \\
\log_m 256 - \log_m (2m)^2 &= 1 \\
\log_m \frac{256}{(2m)^2} &= 1 \\
\frac{256}{4m^2} &= m \\
256 &= 4m^3 \\
m^3 &= 64 \\
m &= 4
\end{aligned}$$

Praktis Formatif: Kertas 2

$$\begin{aligned}
 1. (a) \quad \frac{27^{x+y}}{9^y} &= \frac{3^{3(x+y)}}{3^{2y}} \\
 &= 3^{3x+3y-2y} \\
 &= 3^{3x+y} \\
 &= (3^x)^3 \times 3^y \\
 &= p^3 q
 \end{aligned}$$

$$\begin{aligned}
 (b) \quad p &= 3^x \quad \text{dan} \quad q = 3^y \\
 \log_3 p &= x \quad \log_3 q = y
 \end{aligned}$$

$$\begin{aligned}
 \log_9 \frac{9q^2}{p} &= \log_9 9q^2 - \log_9 p \\
 &= \log_9 9 + \log_9 q^2 - \frac{\log_3 p}{\log_3 9} \\
 &= 1 + \frac{\log_3 q^2}{\log_3 3^2} - \frac{\log_3 p}{\log_3 3^2} \\
 &= 1 + \frac{2 \log_3 q}{2} - \frac{\log_3 p}{2} \\
 &= 1 + y - \frac{x}{2}
 \end{aligned}$$

$$\begin{aligned}
 2. (a) \quad \log_2 (2x+3) - 3 \log_4 x^2 + 2 \log_2 x \\
 &= \log_2 (2x+3) - 3 \left(\frac{\log_2 x^2}{\log_2 4} \right) + \log_2 x^2 \\
 &= \log_2 (2x+3) - 3 \left(\frac{\log_2 x^2}{2} \right) + \log_2 x^2 \\
 &= \log_2 (2x+3) - \frac{3}{2} \log_2 x^2 + \log_2 x^2 \\
 &= \log_2 (2x+3) - \frac{1}{2} \log_2 x^2 \\
 &= \log_2 (2x+3) - \log_2 (x^2)^{\frac{1}{2}} \\
 &= \log_2 (2x+3) - \log_2 x \\
 &= \log_2 \frac{2x+3}{x}
 \end{aligned}$$

$$(b) \log_2 (2x+3) - 3 \log_4 x^2 + 2 \log_2 x = 3$$

$$\begin{aligned}
 \text{Maka, } \log_2 \frac{2x+3}{x} &= 3 \\
 \frac{2x+3}{x} &= 2^3 \\
 2x+3 &= 8x \\
 6x &= 3 \\
 x &= \frac{1}{2}
 \end{aligned}$$

FOKUS KBAT

$$1. \text{ Katakan } 2^x = 9^y = 24^z = k$$

$$\begin{aligned}
 \text{Maka, } 2^x &= k, \quad 9^y = k, \quad 24^z = k \\
 2 &= k^{\frac{1}{x}}, \quad 9 = k^{\frac{1}{y}}, \quad 24 = k^{\frac{1}{z}}
 \end{aligned}$$

$$\text{Daripada } 3 \times 8 = 24$$

$$9^{\frac{1}{2}} \times 2^3 = 24$$

$$\left(k^{\frac{1}{y}}\right)^{\frac{1}{2}} \times \left(k^{\frac{1}{x}}\right)^3 = k^{\frac{1}{z}}$$

$$k^{\frac{1}{2y}} \times k^{\frac{3}{x}} = k^{\frac{1}{z}}$$

$$k^{\frac{1}{2y} + \frac{3}{x}} = k^{\frac{1}{z}}$$

Bandingkan indeks di kedua-dua belah persamaan.

$$\frac{1}{2y} + \frac{3}{x} = \frac{1}{z}$$

$$\frac{1}{2y} = \frac{1}{z} - \frac{3}{x}$$

$$\frac{1}{2y} = \frac{x-3z}{xz}$$

$$y = \frac{xz}{2x-6z}$$

$$2. \text{ Diberi } y = x^{n+4}$$

$$\text{Pada } x = 7, y = 6^{2n}$$

$$\text{Maka, } 6^{2n} = 7^{n+4}$$

$$\log_{10} 6^{2n} = \log_{10} 7^{n+4}$$

$$2n \log_{10} 6 = (n+4) \log_{10} 7$$

$$2n \log_{10} 6 = n \log_{10} 7 + 4 \log_{10} 7$$

$$2n \log_{10} 6 - n \log_{10} 7 = 4 \log_{10} 7$$

$$n(2 \log_{10} 6 - \log_{10} 7) = 4 \log_{10} 7$$

$$n = \frac{4 \log_{10} 7}{2 \log_{10} 6 - \log_{10} 7}$$

$$= 4.753$$

$$\text{Keuntungan syarikat} = 6^{2(4.753)}$$

$$= \text{RM}24\,952\,024$$

$$\approx \text{RM}24\,950\,000$$

Atau

$$\text{Keuntungan syarikat} = 7^{(4.753+4)}$$

$$= \text{RM}24\,954\,171$$

$$\approx \text{RM}24\,950\,000$$

JAWAPAN

BAB 6: GEOMETRI KOORDINAT

6.1

A

$$\begin{aligned} 1. \text{ Jarak } PQ &= \sqrt{[8 - (-4)]^2 + (1 - 6)^2} \\ &= \sqrt{12^2 + (-5)^2} \\ &= \sqrt{144 + 25} \\ &= \sqrt{169} \\ &= 13 \text{ unit} \end{aligned}$$

$$\begin{aligned} 2. \text{ Jarak } MN &= \sqrt{[-5 - (-11)]^2 + (13 - 4)^2} \\ &= \sqrt{6^2 + 9^2} \\ &= \sqrt{36 + 81} \\ &= \sqrt{117} \\ &= 10.817 \text{ unit} \end{aligned}$$

$$\begin{aligned} 3. \text{ Jarak } ST &= \sqrt{(1 - 9)^2 + (14 - 12)^2} \\ &= \sqrt{(-8)^2 + 2^2} \\ &= \sqrt{64 + 4} \\ &= \sqrt{68} \\ &= 8.246 \text{ unit} \end{aligned}$$

B

$$\begin{aligned} 1. \quad \quad \quad EF &= 5 \text{ unit} \\ \sqrt{[3 - (-1)]^2 + (h - 7)^2} &= 5 \\ 4^2 + (h - 7)^2 &= 25 \\ 16 + h^2 - 14h + 49 &= 25 \\ h^2 - 14h + 40 &= 0 \\ (h - 4)(h - 10) &= 0 \\ h &= 4 \text{ atau } 10 \end{aligned}$$

$$\begin{aligned} 2. \quad \quad \quad KL &= \sqrt{41} \text{ unit} \\ \sqrt{[h - (-3)]^2 + (1 - 6)^2} &= \sqrt{41} \\ (h + 3)^2 + (-5)^2 &= 41 \\ h^2 + 6h + 9 + 25 &= 41 \\ h^2 + 6h - 7 &= 0 \\ (h - 1)(h + 7) &= 0 \\ h &= 1 \text{ atau } -7 \end{aligned}$$

$$\begin{aligned} 3. \quad \sqrt{(0 - 7)^2 + (6 - 2h)^2} &= 25 \\ (-7)^2 + (6 - 2h)^2 &= 625 \\ 49 + 36 - 24h + 4h^2 &= 625 \\ 4h^2 - 24h - 540 &= 0 \\ h^2 - 6h - 135 &= 0 \\ (h + 9)(h - 15) &= 0 \\ h &= -4 \text{ atau } 15 \\ 2h > 6, \text{ maka } h &= 15. \end{aligned}$$

6.2

A

$$\begin{aligned} 1. \text{ Titik tengah } AB &= \left(\frac{4 + 10}{2}, \frac{-7 + (-3)}{2} \right) \\ &= \left(\frac{14}{2}, \frac{-10}{2} \right) \\ &= (7, -5) \end{aligned}$$

$$\begin{aligned} 2. \text{ Titik tengah } AB &= \left(\frac{-2 + 9}{2}, \frac{-11 + (-5)}{2} \right) \\ &= \left(\frac{7}{2}, \frac{-16}{2} \right) \\ &= \left(3\frac{1}{2}, -8 \right) \end{aligned}$$

B

$$1. \left(\frac{11 + (-1)}{2}, \frac{-9 + r}{2} \right) = (5, 4)$$

$$\begin{aligned} \text{Maka, } \frac{-9 + r}{2} &= 4 \\ -9 + r &= 8 \\ r &= 17 \end{aligned}$$

$$2. \left(\frac{-2 + 0}{2}, \frac{3r + (-4)}{2} \right) = (-1, 10)$$

$$\begin{aligned} \text{Maka, } \frac{3r - 4}{2} &= 10 \\ 3r - 4 &= 20 \\ 3r &= 24 \\ r &= 8 \end{aligned}$$

C

$$1. \left(\frac{7 + 3k}{2}, \frac{h + 9}{2} \right) = (r, 5r)$$

$$\frac{7 + 3k}{2} = r \quad \text{dan} \quad \frac{h + 9}{2} = 5r$$

$$\begin{aligned} \text{Maka, } \frac{h + 9}{2} &= 5 \left(\frac{7 + 3k}{2} \right) \\ h + 9 &= 35 + 15k \\ h &= 15k + 26 \end{aligned}$$

$$2. \left(\frac{2h + (-6)}{2}, \frac{k + (-2)}{2} \right) = (3n, n)$$

$$\frac{2h - 6}{2} = 3n \quad \text{dan} \quad \frac{k - 2}{2} = n$$

$$\begin{aligned} \text{Maka, } \frac{2h - 6}{2} &= 3 \left(\frac{k - 2}{2} \right) \\ 2h - 6 &= 3k - 6 \\ h &= \frac{3}{2}k \end{aligned}$$

D1. Koordinat titik P

$$= \left(\frac{1(5) + 2(11)}{2 + 1}, \frac{1(8) + 2(-7)}{2 + 1} \right)$$

$$= \left(\frac{5 + 22}{3}, \frac{8 - 14}{3} \right)$$

$$= (9, -2)$$

2. Koordinat titik P

$$= \left(\frac{7(-1) + 3(9)}{3 + 7}, \frac{7(-5) + 3(3)}{3 + 7} \right)$$

$$= \left(\frac{-7 + 27}{10}, \frac{-35 + 9}{10} \right)$$

$$= \left(2, -\frac{13}{5} \right)$$

3. Diberi $AB : PB = 5 : 3$, maka $AP : PB = 2 : 3$.
Koordinat titik P

$$= \left(\frac{3(-2) + 2(-7)}{2 + 3}, \frac{3(4) + 2(19)}{2 + 3} \right)$$

$$= \left(\frac{-6 - 14}{5}, \frac{12 + 38}{5} \right)$$

$$= (-4, 10)$$

4. Diberi $2AP = 5PB$, maka $AP : PB = 5 : 2$.
Koordinat titik P

$$= \left(\frac{2(1) + 5(-2)}{5 + 2}, \frac{2(-3) + 5(-17)}{5 + 2} \right)$$

$$= \left(\frac{2 - 10}{7}, \frac{-6 - 85}{7} \right)$$

$$= \left(-\frac{8}{7}, -13 \right)$$

E

1. $\left(\frac{2(h) + 1(5)}{1 + 2}, \frac{2(-1) + 1(k)}{1 + 2} \right) = (7, 4)$

$$\left(\frac{2h + 5}{3}, \frac{-2 + k}{3} \right) = (7, 4)$$

Maka, $\frac{2h + 5}{3} = 7$ dan $\frac{-2 + k}{3} = 4$

$$2h + 5 = 21 \quad -2 + k = 12$$

$$h = 8 \quad k = 14$$

2. $\left(\frac{1(0) + 4(2k)}{4 + 1}, \frac{1(h) + 4(8)}{4 + 1} \right) = (12, 3)$

$$\left(\frac{8k}{5}, \frac{h + 32}{5} \right) = (12, 3)$$

Maka, $\frac{8k}{5} = 12$ dan $\frac{h + 32}{5} = 3$

$$8k = 60 \quad h + 32 = 15$$

$$k = 7.5 \quad h = -17$$

3. $\left(\frac{9(3h) + 2(-4)}{2 + 9}, \frac{9(k) + 2(-3)}{2 + 9} \right) = (-13, 6)$

$$\left(\frac{27h - 8}{11}, \frac{9k - 6}{11} \right) = (-13, 6)$$

Maka, $\frac{27h - 8}{11} = -13$ dan $\frac{9k - 6}{11} = 6$

$$27h - 8 = -143 \quad 9k - 6 = 66$$

$$h = -5 \quad k = 8$$

6.3**A**1. Luas segi tiga PQR

$$= \frac{1}{2} \begin{vmatrix} 7 & -1 & 8 & 7 \\ 2 & -2 & 0 & 2 \end{vmatrix}$$

$$= \frac{1}{2} |(-14 + 0 + 16) - (-2 - 16 + 0)|$$

$$= \frac{1}{2} |20|$$

$$= 10 \text{ unit}^2$$

2. Luas segi tiga EFG

$$= \frac{1}{2} \begin{vmatrix} 2 & -5 & -2 & 2 \\ -4 & 6 & 3 & -4 \end{vmatrix}$$

$$= \frac{1}{2} |(12 - 15 + 8) - (20 - 12 + 6)|$$

$$= \frac{1}{2} |-9|$$

$$= 4.5 \text{ unit}^2$$

3. Luas sisi empat $KLMN$

$$= \frac{1}{2} \begin{vmatrix} 0 & 4 & 8 & -1 & 0 \\ -1 & -3 & -2 & 10 & -1 \end{vmatrix}$$

$$= \frac{1}{2} |(0 - 8 + 80 + 1) - (-4 - 24 + 2 + 0)|$$

$$= \frac{1}{2} |99|$$

$$= 49.5 \text{ unit}^2$$

4. Luas sisi empat $PQRS$

$$= \frac{1}{2} \begin{vmatrix} 5 & 6 & 3 & -5 & 5 \\ 9 & 0 & -1 & -2 & 9 \end{vmatrix}$$

$$= \frac{1}{2} |(0 - 6 - 6 - 45) - (54 + 0 + 5 - 10)|$$

$$= \frac{1}{2} |-106|$$

$$= 53 \text{ unit}^2$$

B

1. $\frac{1}{2} \begin{vmatrix} 5 & 2 & 3 & 5 \\ k & 0 & -4 & k \end{vmatrix} = 0$

$$|(0 - 8 + 3k) - (2k + 0 - 20)| = 0$$

$$|-8 + 3k - 2k + 20| = 0$$

$$|k + 12| = 0$$

$$k + 12 = 0$$

$$k = -12$$

2. $\frac{1}{2} \begin{vmatrix} 6 & 3 & n & 6 \\ -2 & 1 & 2 & -2 \end{vmatrix} = 0$

$$|(6 + 6 - 2n) - (-6 + n + 12)| = 0$$

$$|12 - 2n - (n + 6)| = 0$$

$$|-3n + 6| = 0$$

$$-3n + 6 = 0$$

$$3n = 6$$

$$n = 2$$

$$3. \quad \frac{1}{2} \begin{vmatrix} r & 2 & -1 & r \\ 6 & 0 & -2 & 6 \end{vmatrix} = 7$$

$$|(0 - 4 - 6) - (12 + 0 - 2r)| = 14$$

$$|-10 - (12 - 2r)| = 14$$

$$|2r - 22| = 14$$

$$2r - 22 = 14 \quad \text{atau} \quad 2r - 22 = -14$$

$$2r = 36 \qquad \qquad \qquad 2r = 8$$

$$r = 18 \qquad \qquad \qquad r = 4$$

$$4. \quad \frac{1}{2} \begin{vmatrix} 3 & -1 & 4 & 3 \\ -5 & q & -8 & -5 \end{vmatrix} = 10$$

$$|(3q + 8 - 20) - (5 + 4q - 24)| = 20$$

$$|3q - 12 - (4q - 19)| = 20$$

$$|7 - q| = 20$$

$$7 - q = 20 \quad \text{atau} \quad 7 - q = -20$$

$$q = -13 \qquad \qquad \qquad q = 27$$

6.4

A

$$1. \quad m_{AB} = \frac{2 - 8}{5 - (-3)}$$

$$= \frac{-6}{8}$$

$$= -\frac{3}{4}$$

$$2. \quad m_{CD} = \frac{9 - 1}{-4 - (-6)}$$

$$= \frac{8}{2}$$

$$= 4$$

$$3. \quad m_{GH} = \frac{-10 - (-3)}{-1 - 2}$$

$$= \frac{-7}{-3}$$

$$= \frac{7}{3}$$

$$4. \quad m_{PQ} = -\frac{6}{7}$$

$$5. \quad m_{KL} = -\frac{(-10)}{6}$$

$$= \frac{5}{3}$$

$$6. \quad m_{AB} = -\frac{(-9)}{(-12)}$$

$$= -\frac{3}{4}$$

B

$$1. \quad \frac{k - 7}{4 - 2} = 2$$

$$k - 7 = 4$$

$$k = 11$$

$$2. \quad \frac{8 - (-3)}{1 - 2k} = -1$$

$$11 = -1 + 2k$$

$$12 = 2k$$

$$k = 6$$

C

$$1. \quad y - 3 = 4[x - (-1)]$$

$$y - 3 = 4(x + 1)$$

$$y - 3 = 4x + 4$$

$$y = 4x + 7$$

$$2. \quad y - (-6) = -\frac{2}{3}(x - 7)$$

$$y + 6 = -\frac{2}{3}x + \frac{14}{3}$$

$$y = -\frac{2}{3}x - \frac{4}{3}$$

$$3. \quad \frac{y - (-10)}{x - 9} = \frac{-4 - (-10)}{7 - 9}$$

$$\frac{y + 10}{x - 9} = -3$$

$$y + 10 = -3(x - 9)$$

$$y = -3x + 27 - 10$$

$$y = -3x + 17$$

$$4. \quad \frac{y - (-4)}{x - (-3)} = \frac{-1 - (-4)}{2 - (-3)}$$

$$\frac{y + 4}{x + 3} = \frac{3}{5}$$

$$y + 4 = \frac{3}{5}(x + 3)$$

$$y = \frac{3}{5}x + \frac{9}{5} - 4$$

$$y = \frac{3}{5}x - \frac{11}{5}$$

D

$$1. \quad \frac{x}{4} + \frac{y}{9} = 1$$

$$2. \quad \frac{x}{(-4)} + \frac{y}{3} = 1$$

$$-\frac{x}{4} + \frac{y}{3} = 1$$

$$3. \quad \frac{x}{(-10)} + \frac{y}{(-7)} = 1$$

$$-\frac{x}{10} - \frac{y}{7} = 1$$

E

Bentuk am	Bentuk pintasan	Bentuk kecerunan
$3x + 2y - 12 = 0$	$3x + 2y = 12$ $\frac{3x}{12} + \frac{2y}{12} = 1$ $\frac{x}{4} + \frac{y}{6} = 1$	$2y = -3x + 12$ $y = \frac{1}{2}(-3x + 12)$ $y = -\frac{3}{2}x + 6$
$6\left(-\frac{x}{3} + \frac{y}{6}\right) = 6$ $-2x + y = 6$ $-2x + y - 6 = 0$	$-\frac{x}{3} + \frac{y}{6} = 1$	$\frac{y}{6} = \frac{x}{3} + 1$ $y = 6\left(\frac{x}{3} + 1\right)$ $y = 2x + 6$
$\frac{1}{4}x + y + 3 = 0$ $4\left(\frac{1}{4}x + y + 3\right) = 0$ $x + 4y + 12 = 0$	$\frac{1}{4}x + y = -3$ $\frac{x}{4(-3)} + \frac{y}{(-3)} = 1$ $-\frac{x}{12} - \frac{y}{3} = 1$	$y = -\frac{1}{4}x - 3$

F

- Pintasan- $x = 4$
 Pintasan- $y = 10$
 Kecerunan, $m = -\frac{10}{4}$
 $= -\frac{5}{2}$
- Pintasan- $x = -3$
 Pintasan- $y = 12$
 Kecerunan, $m = -\frac{12}{(-3)}$
 $= 4$
- $-8y = -6x - 3$
 $y = \frac{6}{8}x + \frac{3}{8}$
 $y = \frac{3}{4}x + \frac{3}{8}$
 Kecerunan, $m = \frac{3}{4}$
- $-3y = -5x + 6$
 $y = \frac{5}{3}x - \frac{6}{3}$
 $y = \frac{5}{3}x - 2$
 Kecerunan, $m = \frac{5}{3}$

G

- $2x + 3y = 18$ ①
 $x - 2y = 2$ ②
 Dari ②: $x = 2y + 2$ ③
 Gantikan ③ ke dalam ①.
 $2(2y + 2) + 3y = 18$
 $4y + 4 + 3y = 18$
 $7y = 14$
 $y = 2$
 Gantikan $y = 2$ ke dalam ③.
 $x = 2(2) + 2$
 $= 6$
 Titik persilangan ialah (6, 2).
- $4x + 3y = 12$ ①
 $\frac{x}{8} - \frac{y}{6} = 1$ ②
 Dari ②: $y = \frac{3}{4}x - 6$ ③
 Gantikan ③ ke dalam ①.
 $4x + 3\left(\frac{3}{4}x - 6\right) = 12$
 $4x + \frac{9}{4}x - 18 = 12$
 $\frac{25}{4}x = 30$
 $x = \frac{24}{5}$
 Gantikan $x = \frac{24}{5}$ ke dalam ③.
 $y = \frac{3}{4}\left(\frac{24}{5}\right) - 6 = -\frac{12}{5}$
 Titik persilangan ialah $\left(\frac{24}{5}, -\frac{12}{5}\right)$.

$$3. \quad 10y - 4x + 5 = 0 \quad \dots\dots \textcircled{1}$$

Bagi garis lurus yang menyalang paksi koordinat:

$$\begin{aligned} \frac{x}{6} + \frac{y}{9} &= 1 \\ \frac{y}{9} &= -\frac{x}{6} + 1 \\ y &= -\frac{3}{2}x + 9 \quad \dots\dots \textcircled{2} \end{aligned}$$

Gantikan $\textcircled{2}$ ke dalam $\textcircled{1}$.

$$\begin{aligned} 10\left(-\frac{3}{2}x + 9\right) - 4x + 5 &= 0 \\ -15x + 90 - 4x + 5 &= 0 \\ -19x &= -95 \\ x &= 5 \end{aligned}$$

Gantikan $x = 5$ ke dalam $\textcircled{2}$.

$$y = -\frac{3}{2}(5) + 9 = \frac{3}{2}$$

Titik persilangan ialah $\left(5, \frac{3}{2}\right)$.

6.5

A

1. Bagi $px - 4y = 5$:

$$\begin{aligned} 4y &= px - 5 \\ y &= \frac{p}{4}x - \frac{5}{4} \end{aligned}$$

$$m_1 = \frac{p}{4}$$

Bagi $(q - 2)x + 6y = 3$:

$$\begin{aligned} 6y &= -(q - 2)x + 3 \\ y &= -\frac{q - 2}{6}x + \frac{1}{2} \end{aligned}$$

$$m_2 = -\frac{q - 2}{6}$$

$$\text{Maka, } \frac{p}{4} = -\frac{q - 2}{6}$$

$$p = -\frac{2q}{3} + \frac{4}{3}$$

2. Bagi $(2p + 3)x - 8y = 7$:

$$\begin{aligned} 8y &= (2p + 3)x - 7 \\ y &= \frac{2p + 3}{8}x - \frac{7}{8} \end{aligned}$$

$$m_1 = \frac{2p + 3}{8}$$

Bagi $2y - qx - 4 = 0$:

$$\begin{aligned} 2y &= qx + 4 \\ y &= \frac{q}{2}x + 2 \end{aligned}$$

$$m_2 = \frac{q}{2}$$

$$\text{Maka, } \frac{2p + 3}{8} = \frac{q}{2}$$

$$p = 2q - \frac{3}{2}$$

B

$$\begin{aligned} 1. \quad \frac{x}{3} - \frac{y}{6} &= 1 \\ -\frac{y}{6} &= -\frac{x}{3} + 1 \\ y &= 2x - 6 \end{aligned}$$

Maka, $m = 2$

Persamaan garis lurus yang dicari ialah

$$\begin{aligned} y - (-4) &= 2(x - 5) \\ y + 4 &= 2x - 10 \\ y &= 2x - 14 \end{aligned}$$

2. $2y - x + 4 = 0$

$$2y = x - 4$$

$$y = \frac{1}{2}x - 2$$

Maka, $m = \frac{1}{2}$

Persamaan garis lurus yang dicari ialah

$$y - 5 = \frac{1}{2}(x - 8)$$

$$y - 5 = \frac{1}{2}x - 4$$

$$y = \frac{1}{2}x + 1$$

3. $5x + 7y = 9$

$$7y = -5x + 9$$

$$y = -\frac{5}{7}x + \frac{9}{7}$$

Maka, $m = -\frac{5}{7}$

Persamaan garis lurus yang dicari ialah

$$y - (-2) = -\frac{5}{7}[x - (-1)]$$

$$y + 2 = -\frac{5}{7}x - \frac{5}{7}$$

$$y = -\frac{5}{7}x - \frac{19}{7}$$

C

1. Bagi $y + 2x = 9$:

$$y = -2x + 9$$

$$m = -2$$

$$m_{PQ} = \frac{1}{2}$$

Persamaan garis lurus PQ ialah

$$y - (-7) = \frac{1}{2}(x - 2)$$

$$y + 7 = \frac{1}{2}x - 1$$

$$y = \frac{1}{2}x - 8$$

2. Bagi $x - 3y + 12 = 0$:
 $3y = x + 12$
 $y = \frac{1}{3}x + 4$

$m = \frac{1}{3}$
 $m_{PQ} = -3$

Persamaan garis lurus PQ ialah
 $y - 8 = -3[x - (-5)]$
 $y - 8 = -3x - 15$
 $y = -3x - 7$

3. $m_{RS} = -\frac{6}{8} = -\frac{3}{4}$

$m_{PQ} = \frac{4}{3}$

Titik tengah RS = $\left(\frac{0+8}{2}, \frac{6+0}{2}\right)$
 $= (4, 3)$

Persamaan garis lurus PQ ialah

$y - 3 = \frac{4}{3}(x - 4)$
 $y - 3 = \frac{4}{3}x - \frac{16}{3}$
 $y = \frac{4}{3}x - \frac{7}{3}$

D

1. (a) Persamaan garis lurus PQ:
 $2y - x = 11$

$y = \frac{1}{2}x + \frac{11}{2}$

Maka, $m_{PQ} = \frac{1}{2}$ dan $m_{QR} = -2$.

Persamaan garis lurus QR ialah

$y - 4 = -2(x - 12)$
 $y - 4 = -2x + 24$
 $y = -2x + 28$

(b) Q ialah titik persilangan PQ dan QR.

$2y - x = 11$ ①
 $y = -2x + 28$ ②

Gantikan ② ke dalam ①.

$2(-2x + 28) - x = 11$
 $-4x + 56 - x = 11$
 $-5x = -45$
 $x = 9$

Gantikan $x = 9$ ke dalam ②.

$y = -2(9) + 28 = 10$

Koordinat titik Q ialah (9, 10).

(c) PQ dan SR adalah selari. Maka, $m_{SR} = \frac{1}{2}$

$\frac{s-4}{0-12} = \frac{1}{2}$
 $s-4 = -6$
 $s = -2$

Koordinat titik S ialah (0, -2).

Luas segi empat tepat PQRS
 $= 2 \times \text{Luas segi tiga QRS}$
 $= 2 \times \frac{1}{2} \left| \begin{matrix} 0 & 12 & 9 & 0 \\ -2 & 4 & 10 & -2 \end{matrix} \right|$
 $= |(0 + 120 - 18) - (-24 + 36 + 0)|$
 $= 90 \text{ unit}^2$

2. (a) Katakan P = Rumah Phua
 dan S = Stesen petrol
 Dari $3y + 2x = 16$ ①

$y = -\frac{2}{3}x + \frac{16}{3}$

Maka, $m_{AB} = -\frac{2}{3}$ dan $m_{PS} = \frac{3}{2}$.

Persamaan garis lurus PS ialah

$y - 13 = \frac{3}{2}(x - 8)$
 $y - 13 = \frac{3}{2}x - 12$
 $y = \frac{3}{2}x + 1$ ②

Gantikan ② ke dalam ①.

$3\left(\frac{3}{2}x + 1\right) + 2x = 16$

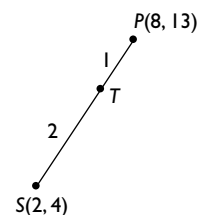
$\frac{13}{2}x = 13$
 $x = 2$

Gantikan $x = 2$ ke dalam ②.

$y = \frac{3}{2}(2) + 1 = 4$

Maka, lokasi stesen petrol diwakili oleh koordinat (2, 4).

(b) Katakan T = Lampu isyarat
 $PS = 3PT$, maka $PT : TS = 1 : 2$



Koordinat titik T

$= \left(\frac{2(8) + 1(2)}{2+1}, \frac{2(13) + 1(4)}{2+1}\right)$

$= \left(\frac{18}{3}, \frac{30}{3}\right)$

$= (6, 10)$

Maka, lokasi lampu isyarat diwakili oleh koordinat (6, 10).

(c) $PT = \sqrt{(8-6)^2 + (13-10)^2}$
 $= \sqrt{13}$
 $= 3.606 \text{ unit}$

Jarak di antara lampu isyarat dan rumah Phua
 $= 3.606 \times 50 \text{ m}$
 $= 180.3 \text{ m}$

6.6

A

1. $PQ = 4$ unit

$$\begin{aligned} \sqrt{[x - (-2)]^2 + (y - 9)^2} &= 4 \\ (x + 2)^2 + (y - 9)^2 &= 16 \\ x^2 + 4x + 4 + y^2 - 18y + 81 &= 16 \\ x^2 + y^2 + 4x - 18y + 69 &= 0 \end{aligned}$$

2. $PT = 7$ unit

$$\begin{aligned} \sqrt{(x - 1)^2 + (y - 4)^2} &= 7 \\ (x - 1)^2 + (y - 4)^2 &= 49 \\ x^2 - 2x + 1 + y^2 - 8y + 16 &= 49 \\ x^2 + y^2 - 2x - 8y - 32 &= 0 \end{aligned}$$

3. $PA = PB$

$$\begin{aligned} \sqrt{[x - (-3)]^2 + (y - 0)^2} &= \sqrt{(x - 8)^2 + (y - 1)^2} \\ (x + 3)^2 + y^2 &= (x - 8)^2 + (y - 1)^2 \\ x^2 + 6x + 9 + y^2 &= x^2 - 16x + 64 + y^2 - 2y + 1 \\ 22x + 2y - 56 &= 0 \\ 11x + y - 28 &= 0 \end{aligned}$$

4. $PA = PB$

$$\begin{aligned} \sqrt{[x - (-1)]^2 + [y - (-4)]^2} &= \sqrt{(x - 3)^2 + [y - (-2)]^2} \\ (x + 1)^2 + (y + 4)^2 &= (x - 3)^2 + (y + 2)^2 \\ x^2 + 2x + 1 + y^2 + 8y + 16 &= x^2 - 6x + 9 + y^2 + 4y + 4 \\ 8x + 4y + 4 &= 0 \\ 2x + y + 1 &= 0 \end{aligned}$$

B

1. $\frac{PM}{PN} = \frac{3}{2}$
 $2PM = 3PN$

$$\begin{aligned} 2\sqrt{(x - 1)^2 + (y - 5)^2} &= 3\sqrt{[x - (-2)]^2 + [y - (-3)]^2} \\ 4[(x - 1)^2 + (y - 5)^2] &= 9[(x + 2)^2 + (y + 3)^2] \\ 4(x^2 - 2x + 1 + y^2 - 10y + 25) &= 9(x^2 + 4x + 4 + y^2 + 6y + 9) \\ 4x^2 - 8x + 4 + 4y^2 - 40y + 100 &= 9x^2 + 36x + 36 + 9y^2 + 54y + 81 \\ 4x^2 + 4y^2 - 8x - 40y + 104 &= 9x^2 + 9y^2 + 36x + 54y + 117 \\ 5x^2 + 5y^2 + 44x + 94y + 13 &= 0 \end{aligned}$$

Persamaan lokus bagi titik P ialah $5x^2 + 5y^2 + 44x + 94y + 13 = 0$.

2. $PA = 3PB$

$$\begin{aligned} \sqrt{[x - (-7)]^2 + (y - 2)^2} &= 3\sqrt{(x - 0)^2 + (y - 3)^2} \\ (x + 7)^2 + (y - 2)^2 &= 9[x^2 + (y - 3)^2] \\ x^2 + 14x + 49 + y^2 - 4y + 4 &= 9(x^2 + y^2 - 6y + 9) \\ x^2 + y^2 + 14x - 4y + 53 &= 9x^2 + 9y^2 - 54y + 81 \\ 8x^2 + 8y^2 - 14x - 50y + 28 &= 0 \\ 4x^2 + 4y^2 - 7x - 25y + 14 &= 0 \end{aligned}$$

Persamaan lokus bagi titik P ialah $4x^2 + 4y^2 - 7x - 25y + 14 = 0$.

C

1. (a) Lokus titik P ialah pembahagi dua sama serenjang bagi EH . Maka,

$$\begin{aligned} PE &= PH \\ \sqrt{[x - (-7)]^2 + (y - 4)^2} &= \sqrt{(x - 1)^2 + (y - 6)^2} \\ (x + 7)^2 + (y - 4)^2 &= (x - 1)^2 + (y - 6)^2 \\ x^2 + 14x + 49 + y^2 - 8y + 16 &= x^2 - 2x + 1 + y^2 - 12y + 36 \\ 16x + 4y + 28 &= 0 \\ 4x + y + 7 &= 0 \end{aligned}$$

(b) Bagi $4x + y + 7 = 0$:
 $y = -4x - 7 \rightarrow m_1 = -4$

Bagi $4y - x = 5$:
 $y = \frac{1}{4}x + \frac{5}{4} \rightarrow m_2 = \frac{1}{4}$

$m_1 m_2 = -4 \times \frac{1}{4} = -1$

Maka, lokus bagi titik P berserenjang dengan $4y - x = 5$.

2. (a) Apabila $\angle SPT = 90^\circ$, PS berserenjang dengan PT . Maka,

$$\begin{aligned} m_{PS} \times m_{PT} &= -1 \\ \left(\frac{y - (-7)}{x - 4}\right)\left(\frac{y - 1}{x - 8}\right) &= -1 \\ \frac{(y + 7)(y - 1)}{(x - 4)(x - 8)} &= -1 \\ \frac{y^2 + 6y - 7}{x^2 - 12x + 32} &= -1 \\ y^2 + 6y - 7 &= -x^2 + 12x - 32 \\ x^2 + y^2 - 12x + 6y + 25 &= 0 \end{aligned}$$

- (b) Pada paksi- y , $x = 0$.

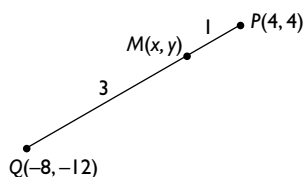
Gantikan $x = 0$ ke dalam persamaan locus titik P .

$$\begin{aligned} \text{Maka, } y^2 + 6y + 25 &= 0 \\ b^2 - 4ac &= 6^2 - 4(1)(25) \\ &= -64 (< 0) \end{aligned}$$

Maka, locus bagi titik P tidak menyilang paksi- y .

Praktis Formatif: Kertas 1

1. Andaikan lebah P dan lebah Q bertemu di titik M . Maka, jarak QM adalah 3 kali jarak PM .

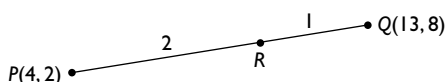


$$\begin{aligned} M(x, y) &= \left(\frac{3(4) + (1)(-8)}{3 + 1}, \frac{3(4) + (1)(-12)}{3 + 1}\right) \\ &= \left(\frac{12 - 8}{4}, \frac{12 - 12}{4}\right) \\ &= (1, 0) \end{aligned}$$

$$\begin{aligned} \text{Jarak } QM &= \sqrt{[1 - (-8)]^2 + [0 - (-12)]^2} \\ &= \sqrt{9^2 + 12^2} \\ &= \sqrt{225} \\ &= 15 \text{ unit} \end{aligned}$$

2. $2PQ = 3PR$
 $\frac{PQ}{PR} = \frac{3}{2}$

Maka, $PR : RQ = 2 : 1$



$$\begin{aligned} \text{Koordinat titik } R &= \left(\frac{2(13) + 1(4)}{2 + 1}, \frac{2(8) + 1(2)}{2 + 1}\right) \\ &= \left(\frac{30}{3}, \frac{18}{3}\right) \\ &= (10, 6) \end{aligned}$$

3. (a) Pintasan- $y = 5$

- (b) Katakan koordinat titik B ialah (x, y) .

$$\begin{aligned} (7, 0) &= \left(\frac{x + 2(4)}{1 + 2}, \frac{y + 2(-3)}{1 + 2}\right) \\ &= \left(\frac{x + 8}{3}, \frac{y - 6}{3}\right) \end{aligned}$$

$$\begin{aligned} \text{Maka, } \frac{x + 8}{3} &= 7 & \text{ dan } & \frac{y - 6}{3} = 0 \\ x + 8 &= 21 & & y - 6 = 0 \\ x &= 13 & & y &= 6 \end{aligned}$$

Koordinat titik B ialah $(13, 6)$.

4. Pada titik $(4k, 0)$,

$$\begin{aligned} 3(0) &= 5(4k) + h - 6 \\ 0 &= 20k + h - 6 \\ h &= 6 - 20k \end{aligned}$$

5. (a) Koordinat titik $M = \left(\frac{0 + 2}{2}, \frac{6 + 0}{2}\right) = (1, 3)$

- (b) Kecerunan $AB = \frac{6 - 0}{0 - 2} = -3$

Kecerunan garis lurus yang berserenjang dengan AB ialah $\frac{1}{3}$.

Persamaan garis lurus yang berserenjang dengan AB dan melalui M ialah

$$\begin{aligned} y - 3 &= \frac{1}{3}(x - 1) \\ y - 3 &= \frac{1}{3}x - \frac{1}{3} \\ y &= \frac{1}{3}x + \frac{8}{3} \end{aligned}$$

6. (a) $qx - py = 1$

$$\begin{aligned} py &= qx - 1 \\ y &= \frac{q}{p}x - \frac{1}{p} \end{aligned}$$

Maka, kecerunan garis lurus = $\frac{q}{p}$

- (b) Kecerunan = $-\frac{1}{\frac{q}{p}} = -\frac{p}{q}$

7. (a) Titik tengah $AB = \left(\frac{-2 + 14}{2}, \frac{4 + 8}{2}\right) = (6, 6)$

- (b) $m_{AB} = \frac{8 - 4}{14 - (-2)} = \frac{4}{16} = \frac{1}{4}$

Kecerunan pembahagi dua sama serenjang bagi garis AB ialah -4 .

Persamaan pembahagi dua sama serenjang bagi garis AB ialah

$$\begin{aligned} y - 6 &= -4(x - 6) \\ y - 6 &= -4x + 24 \\ y + 4x &= 30 \end{aligned}$$

$$8. (a) \text{Kecerunan} = -\left(\frac{4}{-8}\right) \\ = \frac{1}{2}$$

(b) Koordinat titik P ialah $(-8, 0)$.
Koordinat titik Q ialah $(0, 4)$.

$$\text{Kecerunan } PQ = \frac{1}{2}$$

$$\text{Titik tengah } PQ = \left(\frac{-8+0}{2}, \frac{0+4}{2}\right) \\ = (-4, 2)$$

Kecerunan garis lurus yang berserenjang dengan garis PQ ialah -2 .

Persamaan pembahagi dua sama serenjang bagi garis PQ ialah

$$y - 2 = -2(x + 4) \\ y - 2 = -2x - 8 \\ y = -2x - 6$$

9. $PB = 2$ unit

Persamaan lokus bagi P ialah

$$\sqrt{(x-4)^2 + (y-0)^2} = 2 \\ x^2 - 8x + 16 + y^2 = 4 \\ x^2 + y^2 - 8x + 16 - 4 = 0 \\ x^2 + y^2 - 8x + 12 = 0$$

10. (a) Dua garis lurus itu adalah berserenjang.

$$\text{Maka, } m_1 m_2 = -1 \\ \frac{1}{2}(-q) = -1 \\ q = 2$$

(b) Persamaan dua garis lurus itu ialah

$$y = \frac{1}{2}x - 2 \quad \dots\dots \textcircled{1} \\ y = 4 - 2x \quad \dots\dots \textcircled{2}$$

$$\textcircled{1} = \textcircled{2}: \quad \frac{1}{2}x - 2 = 4 - 2x$$

$$\frac{1}{2}x + 2x = 4 + 2$$

$$\frac{5}{2}x = 6$$

$$x = \frac{12}{5}$$

$$= 2\frac{2}{5}$$

Gantikan $x = \frac{12}{5}$ ke dalam $\textcircled{2}$.

$$y = 4 - 2\left(\frac{12}{5}\right) = -\frac{4}{5}$$

Koordinat titik M ialah $\left(2\frac{2}{5}, -\frac{4}{5}\right)$.

Praktis Formatif: Kertas 2

$$1. (a) \text{ Pada titik } A: x = 0, \quad y + 6 = 0 \\ y = -6$$

$$\text{ Pada titik } B: y = 0, \quad 2x + 6 = 0 \\ 2x = -6 \\ x = -3$$

Koordinat titik A ialah $(0, -6)$.

Koordinat titik B ialah $(-3, 0)$.

$$\text{Koordinat titik } P = \left(\frac{2(-3) + 0}{2 + 1}, \frac{0 + 1(-6)}{2 + 1}\right) \\ = \left(\frac{-6}{3}, \frac{-6}{3}\right) \\ = (-2, -2)$$

$$(b) m_{AB} = \frac{0 - (-6)}{-3 - 0} = -2$$

Kecerunan garis lurus yang berserenjang dengan $AB = \frac{1}{2}$

Persamaan garis lurus yang melalui titik P dan berserenjang dengan AB ialah

$$y - (-2) = \frac{1}{2}[x - (-2)] \\ y + 2 = \frac{1}{2}(x + 2) \\ y = \frac{1}{2}x - 1$$

$$2. (a) \text{ Luas segi tiga } AOB = \frac{1}{2} \begin{vmatrix} 0 & -3 & 6 & 0 \\ 0 & -4 & 2 & 0 \end{vmatrix} \\ = \frac{1}{2} |-6 - (-24)| \\ = 9 \text{ unit}^2$$

(b) Koordinat titik C

$$= \left(\frac{3(6) + 2(-3)}{3 + 2}, \frac{3(2) + 2(-4)}{3 + 2}\right) \\ = \left(\frac{12}{5}, -\frac{2}{5}\right)$$

(c) Katakan koordinat titik P ialah (x, y) .

$$PB = 2PA$$

Persamaan lokus bagi P ialah

$$\sqrt{(x+3)^2 + (y+4)^2} = 2\sqrt{(x-6)^2 + (y-2)^2}$$

$$x^2 + 6x + 9 + y^2 + 8y + 16 \\ = 4(x^2 - 12x + 36 + y^2 - 4y + 4)$$

$$x^2 + y^2 + 6x + 8y + 25 \\ = 4x^2 - 48x + 144 + 4y^2 - 16y + 16$$

$$= 4x^2 + 4y^2 - 48x - 16y + 160$$

$$3x^2 + 3y^2 - 54x - 24y + 135 = 0$$

3. (a) $m_{CD} = m_{AB} = 3$

Persamaan garis lurus CD ialah

$$\begin{aligned} y - 6 &= 3(x - 8) \\ y - 6 &= 3x - 24 \\ y &= 3x - 18 \end{aligned}$$

(b) Kecerunan garis lurus $AD = -\frac{1}{3}$

Persamaan garis lurus AD ialah

$$\begin{aligned} y - (-1) &= -\frac{1}{3}[x - (-1)] \\ y + 1 &= -\frac{1}{3}x - 1 \\ y &= -\frac{1}{3}x - \frac{4}{3} \end{aligned}$$

(c) $y = 3x - 18$ ①

$y = -\frac{1}{3}x - \frac{4}{3}$ ②

① - ②: $0 = \frac{10}{3}x - \frac{50}{3}$

$$\begin{aligned} \frac{10}{3}x &= \frac{50}{3} \\ x &= 5 \end{aligned}$$

Gantikan $x = 5$ ke dalam ①.

$$y = 3(5) - 18 = -3$$

Koordinat titik D ialah $(5, -3)$.

(d) Luas segi empat tepat $ABCD$

$= 2 \times \text{Luas } \triangle ACD$

$$\begin{aligned} &= 2 \times \frac{1}{2} \begin{vmatrix} -1 & 5 & 8 & -1 \\ -1 & -3 & 6 & -1 \end{vmatrix} \\ &= |(3 + 30 - 8) - (-5 - 24 - 6)| \\ &= |25 + 35| \\ &= 60 \text{ unit}^2 \end{aligned}$$

4. (a) (i) Persamaan garis lurus PS :

$$2y = 5x - 23$$

$$y = \frac{5}{2}x - \frac{23}{2}$$

Kecerunan garis lurus PS , $m_{PS} = \frac{5}{2}$

Maka, $m_{PQ} = -\frac{2}{5}$

Persamaan garis lurus PQ :

$$y - (-2) = -\frac{2}{5}[x - (-2)]$$

$$y + 2 = -\frac{2}{5}(x + 2)$$

$$5y + 10 = -2x - 4$$

$$5y = -2x - 14$$

(ii) P ialah titik persilangan garis lurus PQ dan garis lurus PS .

Bagi PQ : $5y = -2x - 14$ ①

Bagi PS : $2y = 5x - 23$ ②

① $\times 2$: $10y = -4x - 28$ ③

② $\times 5$: $10y = 25x - 115$ ④

④ - ③: $0 = 29x - 87$

$$29x = 87$$

$$x = 3$$

Gantikan $x = 3$ ke dalam ①.

$$5y = -2(3) - 14$$

$$5y = -20$$

$$y = -4$$

Koordinat titik P ialah $(3, -4)$.

(b) Pada titik S , $y = 1$.

Gantikan $y = 1$ ke dalam ②.

$$2(1) = 5x - 23$$

$$5x = 25$$

$$x = 5$$

Koordinat titik S ialah $(5, 1)$.

Katakan koordinat titik T ialah (x, y) dan $ST = 6$ unit.

Persamaan lokus bagi T ialah

$$(y - 1)^2 + (x - 5)^2 = 6^2$$

$$y^2 - 2y + 1 + x^2 - 10x + 25 = 36$$

$$x^2 + y^2 - 10x - 2y - 10 = 0$$

5. (a) (i) Luas $OPQR$

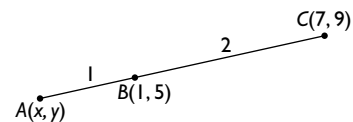
$$= \frac{1}{2} \begin{vmatrix} 0 & 12 & 8 & -5 & 0 \\ 0 & 5 & 14 & 4 & 0 \end{vmatrix}$$

$$= \frac{1}{2} [(0 + 168 + 32 - 0) - (0 + 40 - 70 + 0)]$$

$$= \frac{1}{2} |230|$$

$$= 115 \text{ m}^2$$

(ii)



$$(1, 5) = \left(\frac{2x + 7}{3}, \frac{2y + 9}{3} \right)$$

$$\frac{2x + 7}{3} = 1 \quad \text{dan} \quad \frac{2y + 9}{3} = 5$$

$$2x + 7 = 3 \quad \quad \quad 2y + 9 = 15$$

$$2x = -4 \quad \quad \quad 2y = 6$$

$$x = -2 \quad \quad \quad y = 3$$

Maka, koordinat titik A ialah $(-2, 3)$.

(b) Persamaan laluan serbuk belerang ialah

$$\sqrt{(x - 7)^2 + (y - 9)^2} = 2$$

$$(x - 7)^2 + (y - 9)^2 = 4$$

$$x^2 - 14x + 49 + y^2 - 18y + 81 = 4$$

$$x^2 + y^2 - 14x - 18y + 126 = 0$$

6. (a) (i) Katakan koordinat titik P ialah (x, y) .

Maka, $\left(\frac{1(10) + 2x}{1 + 2}, \frac{1(19) + 2y}{1 + 2} \right) = (0, 9)$

$$10 + 2x = 0 \quad \text{dan} \quad 19 + 2y = 3 \times 9$$

$$2x = -10 \quad \quad \quad 2y = 8$$

$$x = -5 \quad \quad \quad y = 4$$

Koordinat titik P ialah $(-5, 4)$.

$$(ii) \text{ Kecerunan garis lurus } PR = \frac{-5 - 4}{4 - (-5)}$$

$$= \frac{-9}{9}$$

$$= -1$$

Persamaan garis lurus PR ialah

$$y - (-5) = -1(x - 4)$$

$$y + 5 = -x + 4$$

$$y = -x - 1$$

(iii) Luas segi tiga PQR

$$= \frac{1}{2} \begin{vmatrix} -5 & 4 & 10 & -5 \\ 4 & -5 & 19 & 4 \end{vmatrix}$$

$$= \frac{1}{2} |(25 + 76 + 40) - (16 - 50 - 95)|$$

$$= \frac{1}{2} |141 - (-129)|$$

$$= 135 \text{ unit}^2$$

(b) Katakan koordinat titik B ialah (x, y) .
 $BQ = BR$

Persamaan lokus bagi B ialah

$$\sqrt{(x - 10)^2 + (y - 19)^2} = \sqrt{(x - 4)^2 + (y + 5)^2}$$

$$x^2 - 20x + 100 + y^2 - 38y + 361$$

$$= x^2 - 8x + 16 + y^2 + 10y + 25$$

$$x^2 + y^2 - 20x - 38y + 461$$

$$= x^2 + y^2 - 8x + 10y + 41$$

$$12x + 48y - 420 = 0$$

$$x + 4y - 35 = 0$$

7. (a) Katakan $M(x, y)$ ialah suatu titik di atas jalan raya PQ . Maka,

$$MA = MB$$

$$(x + 5)^2 + (y + 1)^2 = (x - 3)^2 + (y - 1)^2$$

$$x^2 + 10x + 25 + y^2 + 2y + 1 = x^2 - 6x + 9 + y^2 - 2y + 1$$

$$16x + 4y + 16 = 0$$

$$4x + y + 4 = 0$$

Persamaan bagi PQ ialah $4x + y + 4 = 0$.

(b) (i) $PQ: 4x + y + 4 = 0$ ①
 $ST: y = 3x + 10$ ②

Gantikan ② ke dalam ①.

$$4x + 3x + 10 + 4 = 0$$

$$7x + 14 = 0$$

$$7x = -14$$

$$x = -2$$

dan $y = 3(-2) + 10$
 $= 4$

Koordinat bagi lampu isyarat ialah $(-2, 4)$.

(ii) Gantikan $x = -3$ ke dalam ① dan ②.

Bagi $y = 3x + 10$:
 $y = 3(-3) + 10 = 1$

Bagi $4x + y + 4 = 0$:
 $4(-3) + y + 4 = 0$
 $-12 + y + 4 = 0$
 $y = 8$

Maka, jalan raya ST yang melalui kedai C .

FOKUS KBAT

Katakan: Kedudukan Norita = $N(-4, -2)$
 Kedudukan Ruthra = $R(2, 10)$
 Kedudukan Cheng Wei = $C(12, 5)$
 Kedudukan Shafiq = $S(x, y)$

Kecerunan garis lurus $NR = \frac{10 - (-2)}{2 - (-4)}$

$$= \frac{12}{6}$$

$$= 2$$

Kecerunan pembahagi dua sama serenjang bagi $NR = -\frac{1}{2}$

Titik tengah $NR = \left(\frac{2 + (-4)}{2}, \frac{10 + (-2)}{2} \right)$

$$= (-1, 4)$$

Persamaan pembahagi dua sama serenjang bagi NR ialah

$$y - 4 = -\frac{1}{2}[x - (-1)]$$

$$y - 4 = -\frac{1}{2}x - \frac{1}{2}$$

$$y = -\frac{1}{2}x + \frac{7}{2} \quad \dots\dots \text{①}$$

Persamaan garis lurus CS ialah

$$y - 5 = 2(x - 12)$$

$$y - 5 = 2x - 24$$

$$y = 2x - 19 \quad \dots\dots \text{②}$$

Kedudukan Shafiq ialah titik persilangan antara garis lurus ① dan garis lurus ②.

Selesaikan ① dan ② secara serentak.

Maka, $2x - 19 = -\frac{1}{2}x + \frac{7}{2}$

$$\frac{5}{2}x = \frac{45}{2}$$

$$5x = 45$$

$$x = 9$$

$$y = 2(9) - 19 = -1$$

Kedudukan Shafiq ialah pada titik $(9, -1)$.

JAWAPAN

BAB 7: STATISTIK

7.1

A

1. Susun semula semua nilai:

2, 4, 5, 6, 7, 7, 8, 9, 10

↓
Median

$$N = 9$$

$$\Sigma x = 2 + 4 + 5 + 6 + 7 + 7 + 8 + 9 + 10 = 58$$

$$\text{Min, } \bar{x} = \frac{\Sigma x}{N} = \frac{58}{9} = 6.444$$

$$\text{Mod} = 7$$

$$\text{Median} = \text{Nilai ke-5} = 7$$

2. Susun semula semua nilai:

2, 4, 5, 8, 9, 9, 11, 13

↓
Median

$$N = 8$$

$$\Sigma x = 2 + 4 + 5 + 8 + 9 + 9 + 11 + 13 = 61$$

$$\text{Min, } \bar{x} = \frac{\Sigma x}{N} = \frac{61}{8} = 7.625$$

$$\text{Mod} = 9$$

$$\begin{aligned} \text{Median} &= \text{Min nilai ke-4 dan nilai ke-5} \\ &= \frac{8 + 9}{2} \\ &= 8.5 \end{aligned}$$

B

1. $\Sigma fx = 5(13) + 6(14) + 8(15) + 7(16) + 3(17) + 2(18) = 468$

$$\Sigma f = 5 + 6 + 8 + 7 + 3 + 2 = 31$$

$$\text{Min, } \bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{468}{31} = 15.10 \text{ cm}$$

$$\text{Mod} = 15 \text{ cm}$$

$$\text{Median} = \text{Nilai ke-16} = 15 \text{ cm}$$

C

1. (a) Diberi min = 7.

$$\frac{8 + 5 + 12 + 9 + 4 + m + 1 + 7}{8} = 7$$

$$46 + m = 56$$

$$m = 10$$

- (b) Susun semula set data mengikut tertib menaik:

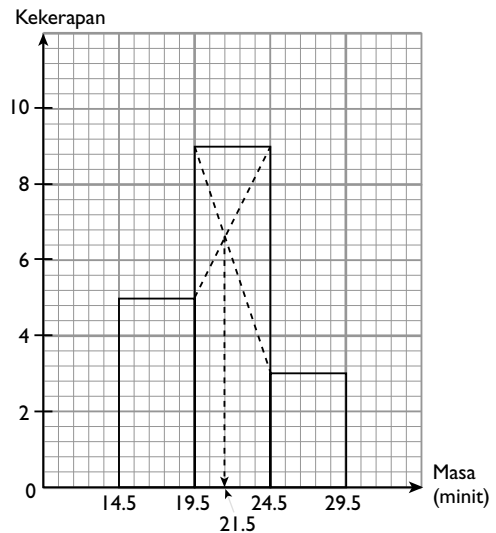
1, 4, 5, 7, 8, 9, 10, 12

Set data ini tiada mod sebab tiada nilai yang berulang.

$$\text{Median} = \frac{7 + 8}{2} = 7.5$$

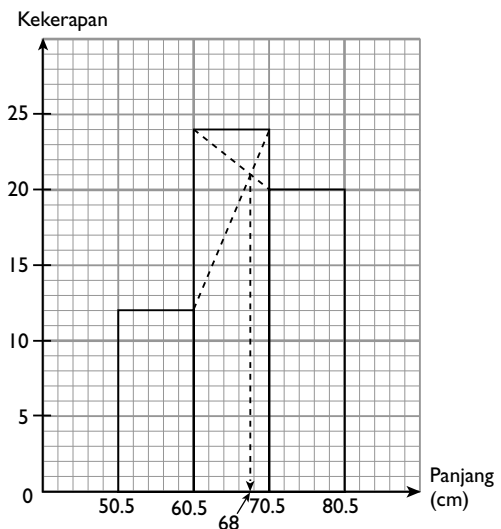
D

1. Kelas mod = 20 – 24 minit



$$\text{Mod} = 21.5 \text{ minit}$$

2. Kelas mod = 61 – 70 cm



$$\text{Mod} = 68 \text{ cm}$$

E

1.

Upah (RM)	Titik tengah x	Kekerapan f	fx
51 – 55	53	8	424
56 – 60	58	8	464
61 – 65	63	12	756
66 – 70	68	7	476
71 – 75	73	5	365
		$\Sigma f = 40$	$\Sigma fx = 2\,485$

$$\text{Min, } x = \frac{2\,485}{40} = \text{RM}62.13$$

2.

Markah	Titik tengah x	Kekerapan f	fx
10 – 19	14.5	8	116
20 – 29	24.5	19	465.5
30 – 39	34.5	50	1\,725
40 – 49	44.5	45	2\,002.5
50 – 59	54.5	28	1\,526
		$\Sigma f = 150$	$\Sigma fx = 5\,835$

$$\text{Min, } x = \frac{5\,835}{150} = 38.9 \text{ markah}$$

3.

Masa (saat)	Titik tengah x	Kekerapan f	fx
1 – 5	3	1	3
6 – 10	8	5	40
11 – 15	13	15	195
16 – 20	18	17	306
21 – 25	23	12	276
		$\Sigma f = 50$	$\Sigma fx = 820$

$$\text{Min, } x = \frac{820}{50} = 16.4 \text{ saat}$$

F

1.

Jisim (kg)	Kekerapan	Kekerapan longgokan	Sempadan atas
31 – 35	3	3	35.5
36 – 40	8	11	40.5
41 – 45	10	21 } F	45.5
46 – 50	18 } f_m	39	50.5
51 – 55	9	48	55.5
56 – 60	2	50	60.5

(a) Median, $m = L + \left(\frac{\frac{N}{2} - F}{f_m} \right) C$

Jumlah kekerapan, $N = 50$

dan $\frac{N}{2} = 25$

Kelas median = 46 – 50 kg

$L = 45.5$

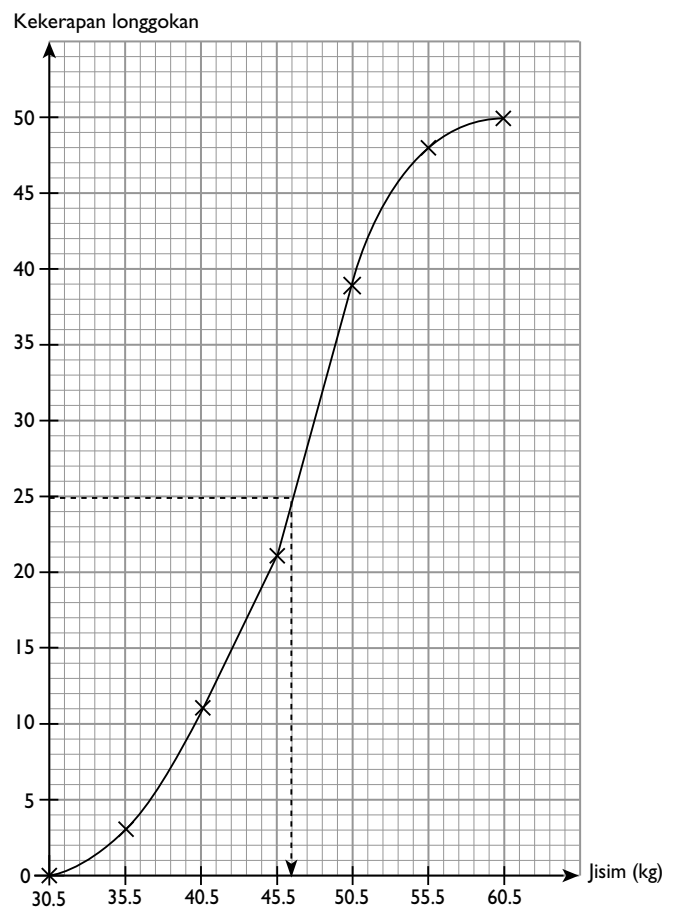
$F = 21$

$f_m = 18$

$C = 5$

$$\begin{aligned} \text{Median} &= 45.5 + \left(\frac{25 - 21}{18} \right) (5) \\ &= 46.6 \text{ kg} \end{aligned}$$

(b)



Berdasarkan ogif, median = 46.5 kg

Tinggi (cm)	Kekerapan	Kekerapan longgokan	Sempadan atas
110 – 119	7	7	119.5
120 – 129	11	18	129.5
130 – 139	16	34 } F	139.5
140 – 149	26 } f_m	60	149.5
150 – 159	13	73	159.5
160 – 169	7	80	169.5

(a) $N = 80$

$$\frac{N}{2} = 40$$

Kelas median = 140 – 149 cm

$$L = 139.5$$

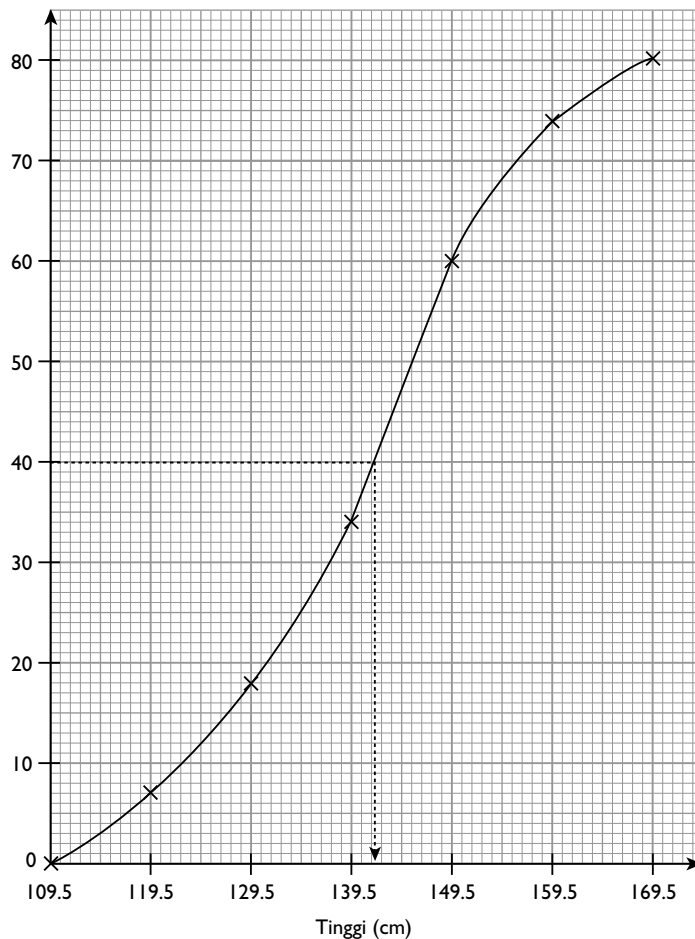
$$F = 34$$

$$f_m = 26$$

$$C = 10$$

$$\begin{aligned} \text{Median} &= 139.5 + \left(\frac{40 - 34}{26} \right) (10) \\ &= 141.8 \text{ cm} \end{aligned}$$

(b) Kekerapan longgokan



Berdasarkan ogif, median = 141.5 cm

G

1. (a) Mod baharu = $(20 + 2.1) \div 2$
 $= 11.05$
- Median baharu = $(22.5 + 2.1) \div 2$
 $= 12.3$
- Min baharu = $(21.2 + 2.1) \div 2$
 $= 11.65$
- (b) $(22.5 - u) \times 3 = 60$
 $22.5 - u = 20$
 $u = 2.5$

2. $\frac{\Sigma x}{7} = 17$
 $\Sigma x = 119$

Apabila x_4 dikeluarkan, min = 15.

$$\frac{\Sigma x - x_4}{6} = 15$$

$$119 - x_4 = 90$$

$$x_4 = 119 - 90$$

$$= 29$$

7.2**A**

1. Julat = $50 - 34$
 $= 16$

Susun semula semua nilai:

$$34, 39, 40, 41, 45, 46, 50$$

$$\begin{array}{ccc} \downarrow & & \downarrow \\ Q_1 & \text{Median} & Q_3 \end{array}$$

Julat antara kuartil
 $= Q_3 - Q_1$
 $= 46 - 39$
 $= 7$

2. Julat = $22 - 9$
 $= 13$

Susun semula semua nilai:

$$9, 11, 13, 14, 15, 18, 20, 22$$

$$\begin{array}{ccc} \downarrow & & \downarrow \\ Q_1 & \text{Median} & Q_3 \end{array}$$

$$Q_1 = \frac{11 + 13}{2} = 12$$

$$Q_3 = \frac{18 + 20}{2} = 19$$

Julat antara kuartil
 $= Q_3 - Q_1$
 $= 19 - 12$
 $= 7$

B

1.

Skor	Kekerapan	Kekerapan longgokan
0	15	15
$Q_1 \rightarrow 1$	17	32
2	23	55
3	29	84
$Q_3 \rightarrow 4$	24	108
5	12	120

$$Q_1 = \text{Nilai ke-} \left(\frac{1}{4} \times 120 \right)$$

$$= \text{Nilai ke-30}$$

$$= 1$$

$$Q_3 = \text{Nilai ke-} \left(\frac{3}{4} \times 120 \right)$$

$$= \text{Nilai ke-90}$$

$$= 4$$

Julat antara kuartil
 $= 4 - 1$
 $= 3$

2.

Umur (tahun)	Kekerapan	Kekerapan longgokan
40	12	12
41	13	25
$Q_1 \rightarrow 42$	20	45
43	30	75
$Q_3 \rightarrow 44$	18	93
45	17	110

$$Q_1 = \text{Nilai ke-} \left(\frac{1}{4} \times 110 \right)$$

$$= \text{Nilai ke-27.5}$$

$$= \text{Nilai ke-28}$$

$$= 42 \text{ tahun}$$

$$Q_3 = \text{Nilai ke-} \left(\frac{3}{4} \times 110 \right)$$

$$= \text{Nilai ke-82.5}$$

$$= \text{Nilai ke-83}$$

$$= 44 \text{ tahun}$$

Julat antara kuartil
 $= 44 - 42$
 $= 2 \text{ tahun}$

C

Panjang (mm)	Kekerapan	Kekerapan longgokan	Sempadan atas
10 – 13	8	8	13.5
14 – 17	15	23	17.5
$Q_1 \rightarrow$ 18 – 21	49	72	21.5
$Q_3 \rightarrow$ 22 – 25	73	145	25.5
26 – 29	32	177	29.5
30 – 33	3	180	33.5

(a) Julat = Titik tengah kelas tertinggi – Titik tengah kelas terendah

$$\begin{aligned}
 &= \left(\frac{30 + 33}{2} \right) - \left(\frac{10 + 13}{2} \right) \\
 &= 31.5 - 11.5 \\
 &= 20 \text{ mm}
 \end{aligned}$$

(b) (i) $N = 180$

$$\frac{N}{4} = \frac{180}{4} = 45$$

Q_1 berada dalam kelas 18 – 21 mm.

$$\begin{aligned}
 Q_1 &= L_1 + \left(\frac{\frac{N}{4} - F_1}{f_1} \right) C \\
 &= 17.5 + \left(\frac{45 - 23}{49} \right) (4) \\
 &= 17.5 + 1.80 \\
 &= 19.3 \text{ mm}
 \end{aligned}$$

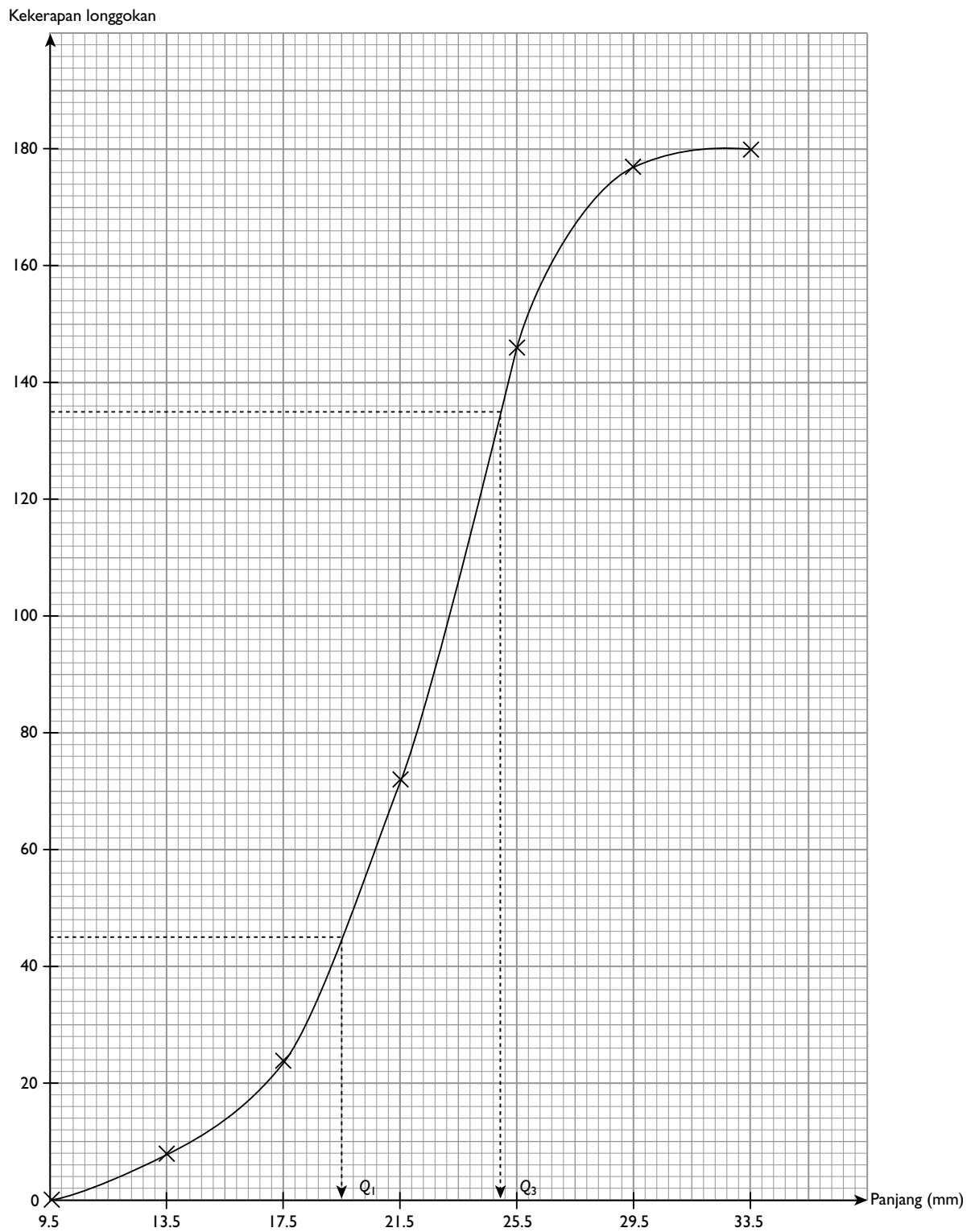
$$\frac{3N}{4} = \frac{3 \times 180}{4} = 135$$

Q_3 berada dalam kelas 22 – 25 mm.

$$\begin{aligned}
 Q_3 &= L_3 + \left(\frac{\frac{3N}{4} - F_3}{f_3} \right) C \\
 &= 21.5 + \left(\frac{135 - 72}{73} \right) (4) \\
 &= 21.5 + 3.45 \\
 &= 25.0 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 \text{Julat antara kuartil} &= Q_3 - Q_1 \\
 &= 25.0 - 19.3 \\
 &= 5.7 \text{ mm}
 \end{aligned}$$

(b) (ii)



Berdasarkan ogif, $Q_1 = 19.5$ mm

$$Q_3 = 24.9$$
 mm

Julat antara kuartil = $Q_3 - Q_1$

$$= 24.9 - 19.5$$

$$= 5.4$$
 mm

D

$$1. \text{ Min, } \bar{x} = \frac{19 + 14 + 16 + 18 + 10 + 12}{6}$$

$$= 14.83$$

$$\text{Varians, } \sigma^2$$

$$= \frac{19^2 + 14^2 + 16^2 + 18^2 + 10^2 + 12^2}{6} - 14.83^2$$

$$= \frac{1\ 381}{6} - 14.83^2$$

$$= 10.24$$

$$\text{Sisihan piawai, } \sigma = \sqrt{10.24}$$

$$= 3.2$$

$$2. \text{ Min, } \bar{x} = \frac{101 + 112 + 124 + 131 + 98}{5}$$

$$= 113.2$$

$$\text{Varians, } \sigma^2$$

$$= \frac{101^2 + 112^2 + 124^2 + 131^2 + 98^2}{5} - 113.2^2$$

$$= \frac{64\ 886}{5} - 113.2^2$$

$$= 162.96$$

$$\text{Sisihan piawai, } \sigma = \sqrt{162.96}$$

$$= 12.77$$

$$3. \text{ Min, } \bar{x}$$

$$= \frac{1.3 + 2.5 + 4.6 + 3.0 + 3.4 + 4.1 + 2.8}{7}$$

$$= 3.1$$

$$\text{Varians, } \sigma^2$$

$$= \frac{1.3^2 + 2.5^2 + 4.6^2 + 3.0^2 + 3.4^2 + 4.1^2 + 2.8^2}{7} - 3.1^2$$

$$= \frac{74.31}{7} - 3.1^2$$

$$= 1.006$$

$$\text{Sisihan piawai, } \sigma = \sqrt{1.006}$$

$$= 1.003$$

E

1.

x	f	fx	x^2	fx^2
55	5	275	3 025	15 125
60	10	600	3 600	36 000
65	20	1 300	4 225	84 500
70	5	350	4 900	24 500
75	10	750	5 625	56 250
	$\Sigma f = 50$	$\Sigma fx = 3\ 275$		$\Sigma fx^2 = 216\ 375$

$$\text{Min, } \bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{3\ 275}{50} = 65.5$$

$$\text{Varians, } \sigma^2 = \frac{\Sigma fx^2}{\Sigma f} - \bar{x}^2$$

$$= \frac{216\ 375}{50} - 65.5^2$$

$$= 37.25$$

$$\text{Sisihan piawai, } \sigma = \sqrt{37.25} = 6.103$$

2.

x	f	fx	x^2	fx^2
16	16	256	256	4 096
17	20	340	289	5 780
18	22	396	324	7 128
19	27	513	361	9 747
20	15	300	400	6 000
	$\Sigma f = 100$	$\Sigma fx = 1\ 805$		$\Sigma fx^2 = 32\ 751$

$$\text{Min, } \bar{x} = \frac{1\ 805}{100} = 18.05$$

$$\text{Varians, } \sigma^2 = \frac{32\ 751}{100} - 18.05^2 = 1.708$$

$$\text{Sisihan piawai, } \sigma = \sqrt{1.708} = 1.307$$

F

1.	Bilangan durian	Titik tengah, x	f	fx	fx^2
	10 – 14	12	18	216	2 592
	15 – 19	17	30	510	8 670
	20 – 24	22	32	704	15 488
	25 – 29	27	26	702	18 954
	30 – 34	32	14	448	14 336
			$\Sigma f = 120$	$\Sigma fx = 2\ 580$	$\Sigma fx^2 = 60\ 040$

$$\begin{aligned} \text{Min, } \bar{x} &= \frac{2\ 580}{120} \\ &= 21.5 \end{aligned}$$

$$\begin{aligned} \text{Varians, } \sigma^2 &= \frac{60\ 040}{120} - 21.5^2 \\ &= 38.08 \end{aligned}$$

$$\begin{aligned} \text{Sisihan piawai, } \sigma &= \sqrt{38.08} \\ &= 6.171 \end{aligned}$$

2.	Harga (RM)	Titik tengah, x	f	fx	fx^2
	20 – 23	21.5	7	150.5	3 235.75
	24 – 27	25.5	8	204.0	5 202.00
	28 – 31	29.5	10	295.0	8 702.50
	32 – 35	33.5	16	536.0	17 956.00
	36 – 39	37.5	17	637.5	23 906.25
	40 – 43	41.5	6	249.0	10 333.50
			$\Sigma f = 64$	$\Sigma fx = 2\ 072$	$\Sigma fx^2 = 69\ 336$

$$\begin{aligned} \text{Min, } \bar{x} &= \frac{2\ 072}{64} \\ &= \text{RM}32.38 \end{aligned}$$

$$\begin{aligned} \text{Varians, } \sigma^2 &= \frac{69\ 336}{35.23} - 32.375^2 \\ &= 35.23 \end{aligned}$$

$$\begin{aligned} \text{Sisihan piawai, } \sigma &= \sqrt{35.23} \\ &= \text{RM}5.94 \end{aligned}$$

G

1. (a) Julat baharu = $10 \div 4$
= 2.5
- (b) Julat antara kuartil baharu = $6 \div 4$
= 1.5
- (c) Sisihan piawai baharu = $1.8 \div 4$
= 0.45
- (d) Varians asal = 1.8^2
= 3.24
Varians baharu = $3.24 \div 4^2$
= 0.2025

2. (a) $\text{Min, } \bar{x} = \frac{4 + 6 + 8 + 9 + 12 + 15}{6} = 9$
Julat = $15 - 4 = 11$
Varians, σ^2
= $\frac{4^2 + 6^2 + 8^2 + 9^2 + 12^2 + 15^2}{6} - 9^2$
= 13.33
- (b) Min baharu = $9 \times 2 + 5$
= 23
Julat baharu = 11×2
= 22
Varians baharu = $2^2 \times 13.33$
= 53.33

Praktis Formatif: Kertas 1

1. (a)
$$\text{Min} = \frac{7 + 0 + 5 + (x^2 - 3) + 2}{5} = 4$$

$$\frac{11 + x^2}{5} = 4$$

$$11 + x^2 = 20$$

$$x^2 = 9$$

$$x = 3$$

(b) Susun semula data mengikut tertib menaik:
 $0, 2, 5, 6, 7$
 \uparrow
 Maka, median = 5

2. (a) Jika mod ialah 3, maka nilai $k < 12$.
 Jadi, nilai maksimum $k = 11$.

(b) Kes 1:
 Jika median ialah skor 3 yang pertama, maka
 $4 + k = (12 - 1) + 9 + 8$
 $4 + k = 28$
 $k = 24$

Kes 2:
 Jika median ialah skor 3 yang terakhir, maka
 $4 + k + (12 - 1) = 9 + 8$
 $k + 15 = 17$
 $k = 2$

Julat nilai k ialah $2 \leq k \leq 24$, dengan keadaan k ialah integer.

3. (a) Jumlah bilangan peserta
 $= 3 + 6 + 8 + 10 + 4$
 $= 31$ orang

(b)

Titik tengah	f	fx
5.5	3	16.5
7.5	6	45
9.5	8	76
11.5	10	115
13.5	4	54
	$\Sigma f = 31$	$\Sigma fx = 306.5$

Skor min = $\frac{\Sigma fx}{\Sigma f}$
 $= \frac{306.5}{31}$
 $= 9.89$

4. (a) Bagi selang kelas 40 – 59:
 Bilangan murid = $30 - (3 + 10 + 4 + 3)$
 $= 30 - 20$
 $= 10$
 Terdapat dua kelas mod, iaitu 20 – 39 dan 40 – 59.

(b)

Markah	Kekerapan	Kekerapan longgokan
0 – 19	3	3
20 – 39	10	13
40 – 59	10	23
60 – 79	4	27
80 – 99	3	30

Lima orang murid terbaik ialah murid yang ke-26, ke-27, ke-28, ke-29 dan ke-30.

Murid ke-26 berada dalam kelas 60 – 79.

Markah Athira berada dalam kelas 60 – 79. Maka, dia layak menerima ganjaran itu.

5. $N = 12, \sigma^2 = 30, \Sigma x^2 = 840$

(a) $\sigma^2 = \frac{\Sigma x^2}{N} - \bar{x}^2$

$30 = \frac{840}{12} - \bar{x}^2$

$30 = 70 - \bar{x}^2$

$\bar{x}^2 = 40$

$\bar{x} = 6.325$

(b) $\frac{\Sigma x}{12} = 6.325$

$\Sigma x = 12 \times 6.325$
 $= 75.90$

6. $N = 8, \Sigma x = 120, \Sigma x^2 = 1\ 816$

(a) Min umur, $\bar{x} = \frac{120}{8}$
 $= 15$ tahun

(b) Sisihan piawai, $\sigma = \sqrt{\frac{\Sigma x^2}{N} - \bar{x}^2}$
 $= \sqrt{\frac{1\ 816}{8} - 15^2}$
 $= 1.414$ tahun

7. (a) Hasil tambah jisim murid-murid
 $= 8 \times 50$ kg
 $= 400$ kg

(b) $4^2 = \frac{\Sigma x^2}{8} - 50^2$

$\frac{\Sigma x^2}{8} = 16 + 2\ 500$

$\Sigma x^2 = 8 \times 2\ 516 = 20\ 128$

Hasil tambah kuasa dua jisim murid-murid itu ialah 20 128 kg².

8. Katakan min bagi dua set nombor itu ialah m .

Bagi set 6 nombor:

$$m = \frac{\Sigma x_1}{6}$$

$$\Sigma x_1 = 6m \quad \dots\dots \textcircled{1}$$

$$\sigma^2 = \frac{\Sigma x_1^2}{N} - \bar{x}^2$$

$$2^2 = \frac{\Sigma x_1^2}{6} - m^2$$

$$24 = \Sigma x_1^2 - 6m^2$$

$$\Sigma x_1^2 = 24 + 6m^2 \quad \dots\dots \textcircled{2}$$

Bagi set 4 nombor:

$$m = \frac{\Sigma x_2}{4}$$

$$\Sigma x_2 = 4m \quad \dots\dots \textcircled{3}$$

$$3^2 = \frac{\Sigma x_2^2}{4} - m^2$$

$$36 = \Sigma x_2^2 - 4m^2$$

$$\Sigma x_2^2 = 36 + 4m^2 \quad \dots\dots \textcircled{4}$$

Dua set nombor itu digabungkan.

$$\textcircled{1} + \textcircled{3}: \Sigma x_1 + \Sigma x_2 = 10m$$

$$\textcircled{2} + \textcircled{4}: \Sigma x_1^2 + \Sigma x_2^2 = 60 + 10m^2$$

Varians baharu, σ^2

$$= \frac{\Sigma x_1^2 + \Sigma x_2^2}{10} - \left(\frac{\Sigma x_1 + \Sigma x_2}{10} \right)^2$$

$$= \frac{60 + 10m^2}{10} - \left(\frac{10m}{10} \right)^2$$

$$= 6 + m^2 - m^2$$

$$= 6$$

9. Jangka hayat bateri Elgi adalah paling konsisten. Sebab sisihan piawai jangka hayatnya paling rendah.

10. Bagi set data asal:

$$\text{Min, } \bar{x} = \frac{4 + 5 + 6 + 7 + 8}{5}$$

$$= \frac{30}{5}$$

$$= 6$$

$$\Sigma x^2 = 4^2 + 5^2 + 6^2 + 7^2 + 8^2 = 190$$

$$\text{Varians} = \frac{\Sigma x^2}{N} - \bar{x}^2$$

$$= \frac{190}{5} - 6^2$$

$$= 2$$

$$\text{Sisihan piawai} = \sqrt{2}$$

Bagi set data baharu:

Min baharu = 27

$$\text{Maka, } 6m + n = 27 \quad \dots\dots \textcircled{1}$$

Sisihan piawai baharu = 5.657

$$\text{Maka, } m \times \sqrt{2} = 5.657$$

$$m = 4$$

Gantikan $m = 4$ ke dalam $\textcircled{1}$.

$$6(4) + n = 27$$

$$24 + n = 27$$

$$n = 3$$

Praktis Formatif: Kertas 2

1. (a) Min gaji mingguan = RM546.60

$$\frac{12(349.50) + 13(449.50) + 20(549.50) + m(649.50) + 10(749.50)}{12 + 13 + 20 + m + 10} = 546.60$$

$$\frac{28\ 522.5 + 649.5m}{55 + m} = 546.6$$

$$28\ 522.5 + 649.5m = 30\ 063 + 546.6m$$

$$649.5m - 546.6m = 30\ 063 - 28\ 522.5$$

$$102.9m = 1\ 540.5$$

$$m = 15$$

(b) Jumlah bilangan pekerja = 55 + 15
= 70 orang

Kelas median = 500 - 599

Median gaji mingguan

$$= 499.5 + \left[\frac{\frac{1}{2}(70) - 25}{20} \right] (100)$$

$$= \text{RM}524.50$$

2. (a) (i) Min = 9

$$\frac{1 + y + 7 + 2y + 2 + 13 + 16}{6} = 9$$

$$\frac{3y + 39}{6} = 9$$

$$3y + 39 = 54$$

$$3y = 15$$

$$y = 5$$

(ii) Varians

$$= \frac{1^2 + 5^2 + 7^2 + 12^2 + 13^2 + 16^2}{6} - 9^2$$

$$= \frac{644}{6} - 81$$

$$= 26 \frac{1}{3}$$

(b) (i) Min baharu = 9(2) + 3
= 21

$$\text{(ii) Sisihan piawai asal} = \sqrt{26 \frac{1}{3}}$$

$$= 5.1316$$

$$\text{Sisihan piawai baharu} = 5.1316 \times 2$$

$$= 10.26$$

$$3. (a) \bar{x} = \frac{\Sigma x}{N} = \frac{16\,800}{8} = 2\,100$$

$$\begin{aligned}\sigma^2 &= \frac{\Sigma x^2}{N} - \bar{x}^2 \\ &= \frac{35\,385\,000}{8} - 2\,100^2 \\ &= 13\,125 \\ \sigma &= 114.56\end{aligned}$$

Maka, sisihan piawai bagi pendapatan bulanannya ialah RM114.56.

$$(b) \text{Min baharu} = \text{RM}2\,100 + \text{RM}300 \\ = \text{RM}2\,400$$

Tiada perubahan pada sisihan piawai.

Maka, sisihan piawai baharu = RM114.56

$$4. (a) (i) \text{Min} = 6$$

$$\begin{aligned}\frac{\Sigma x}{15} &= 6 \\ \Sigma x &= 6 \times 15 \\ &= 90\end{aligned}$$

$$(ii) \text{Varians} = 3^2$$

$$\begin{aligned}\frac{\Sigma x^2}{15} - 6^2 &= 3^2 \\ \Sigma x^2 &= (9 + 36) \times 15 \\ &= 675\end{aligned}$$

(b) Jumlah bilangan buku yang dibaca oleh murid perempuan = 105

Maka, $\Sigma x = 105$

$$\text{Diberi min} = \frac{\Sigma x}{N} = 7.$$

$$\text{Maka, } \frac{105}{N} = 7$$

$$\begin{aligned}N &= \frac{105}{7} \\ &= 15\end{aligned}$$

Jumlah bilangan murid perempuan ialah 15 orang.

Apabila murid perempuan dan murid lelaki diambil kira,

$$N = 15 + 15 = 30$$

$$\Sigma x = 105 + 90 = 195$$

$$\Sigma x^2 = 720 + 675 = 1\,395$$

Min bilangan buku yang dibaca oleh semua

$$\text{murid} = \frac{195}{30}$$

Varians bagi bilangan buku yang dibaca oleh

$$\begin{aligned}\text{semua murid} &= \frac{\Sigma x^2}{N} - \bar{x}^2 \\ &= \frac{1\,395}{30} - \left(\frac{195}{30}\right)^2 \\ &= 4.25\end{aligned}$$

FOKUS KBAT

Min asal = 2 700

$$\begin{aligned}\frac{\Sigma x}{N} &= 2\,700 \\ \Sigma x &= 2\,700N \quad \dots\dots \textcircled{1}\end{aligned}$$

Setelah seorang pekerja baharu menyertai syarikat itu:

$$\begin{aligned}\text{Min baharu} &= 2\,700 + 50 \\ &= 2\,750\end{aligned}$$

$$\frac{\Sigma x + 3\,350}{N + 1} = 2\,750 \quad \dots\dots \textcircled{2}$$

Gantikan $\textcircled{1}$ ke dalam $\textcircled{2}$.

$$\begin{aligned}\frac{2\,700N + 3\,350}{N + 1} &= 2\,750 \\ 2\,700N + 3\,350 &= 2\,750N + 2\,750 \\ 3\,350 - 2\,750 &= 2\,750N - 2\,700N \\ 600 &= 50N \\ N &= 12\end{aligned}$$

$$\begin{aligned}\text{Jumlah bilangan pekerja sekarang} &= 12 + 1 \\ &= 13 \text{ orang}\end{aligned}$$

JAWAPAN

BAB 8: SUKATAN MEMBULAT

8.1

A

$$1. \frac{\pi}{4} \text{ rad} = \frac{\pi}{4} \times \frac{180^\circ}{\pi} \\ = 45^\circ$$

$$2. 0.45 \text{ rad} = 0.45 \times \frac{180^\circ}{\pi} \\ = 25^\circ 47'$$

$$3. 2.12 \text{ rad} = 2.12 \times \frac{180^\circ}{\pi} \\ = 121^\circ 27'$$

B

$$1. 90^\circ = 90^\circ \times \frac{\pi}{180^\circ} \\ = \frac{\pi}{2} \text{ rad}$$

$$2. 150^\circ = 150^\circ \times \frac{\pi}{180^\circ} \\ = \frac{5}{6} \pi \text{ rad}$$

$$3. 270^\circ = 270^\circ \times \frac{\pi}{180^\circ} \\ = \frac{3}{2} \pi \text{ rad}$$

C

$$1. 55^\circ = 55^\circ \times \frac{\pi}{180^\circ} \\ = 0.960 \text{ rad}$$

$$2. 88.3^\circ = 88.3^\circ \times \frac{\pi}{180^\circ} \\ = 1.541 \text{ rad}$$

$$3. 115^\circ 21' = 115^\circ 21' \times \frac{\pi}{180^\circ} \\ = 2.013 \text{ rad}$$

$$4. 283^\circ 25' = 283^\circ 25' \times \frac{\pi}{180^\circ} \\ = 4.947 \text{ rad}$$

8.2

A

$$1. s = j\theta \\ = 10 \times 33^\circ \times \frac{\pi}{180^\circ} \\ = 5.760 \text{ cm}$$

$$2. s = j\theta \\ = 4 \times \frac{2}{3} \pi \\ = 8.378 \text{ cm}$$

$$3. s = j\theta \\ = 8 \times 300^\circ \times \frac{\pi}{180^\circ} \\ = 41.89 \text{ cm}$$

B

$$1. (a) (i) \text{ Panjang lengkok } AB = 8 \times 0.4 \\ = 3.2 \text{ cm}$$

$$(ii) \text{ Panjang lengkok } AB = 8 \times 0.8 \\ = 6.4 \text{ cm}$$

$$(iii) \text{ Panjang lengkok } AB = 8 \times 0.65 \\ = 5.2 \text{ cm}$$

$$(b) (i) \text{ Panjang lengkok } AB = j\theta \\ 10 = 8\theta \\ \theta = \frac{10}{8} \\ = 1.25 \text{ rad}$$

$$(ii) 18 = 8\theta \\ \theta = \frac{18}{8} \\ = 2.25 \text{ rad}$$

$$(iii) 15 = 8\theta \\ \theta = \frac{15}{8} \\ = 1.875 \text{ rad}$$

$$2. (a) \text{ Panjang lengkok } AB = 10 \times 0.78 \\ = 7.8 \text{ cm}$$

$$\angle BOC = 3.142 - 0.78 \\ = 2.362 \text{ rad}$$

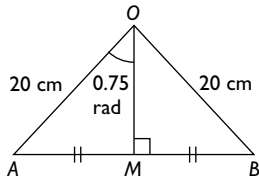
$$\text{Panjang lengkok } BC = 10 \times 2.362 \\ = 23.62 \text{ cm}$$

$$(b) \text{ Panjang lengkok } AB = 12 \text{ cm} \\ 12 = 10\theta \\ \theta = \frac{12}{10} \\ = 1.2 \text{ rad}$$

$$\angle BOC = 3.142 - 1.2 \\ = 1.942 \text{ rad} \\ = \frac{1.942 \times 180^\circ}{3.142} \\ = 111.25^\circ$$

C

1.



$$0.75 \text{ rad} = 0.75 \times \frac{180^\circ}{\pi} = 42.97^\circ$$

$$\text{Dalam } \triangle OAM, \sin 42.97^\circ = \frac{AM}{20}$$

$$AM = 20 \sin 42.97^\circ$$

$$AB = 2 \times 20 \sin 42.97^\circ$$

$$= 27.26 \text{ cm}$$

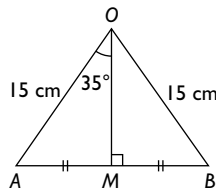
$$\text{Panjang lengkok } AB = 20 \times 1.5$$

$$= 30 \text{ cm}$$

$$\text{Perimeter tembereng berlorek} = 27.26 + 30$$

$$= 57.26 \text{ cm}$$

2.



$$\text{Dalam } \triangle OAM, \sin 35^\circ = \frac{AM}{15}$$

$$AM = 15 \sin 35^\circ$$

$$AB = 2 \times 15 \sin 35^\circ$$

$$= 17.21 \text{ cm}$$

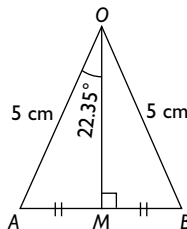
$$\text{Panjang lengkok } AB = 15 \times 70^\circ \times \frac{\pi}{180^\circ}$$

$$= 18.33 \text{ cm}$$

$$\text{Perimeter tembereng berlorek} = 17.21 + 18.33$$

$$= 35.54 \text{ cm}$$

3.



$$\angle AOB = \frac{3.9}{5}$$

$$= 0.78 \text{ rad}$$

$$= 44.69^\circ$$

$$\text{Dalam } \triangle OAM, \sin 22.35^\circ = \frac{AM}{5}$$

$$AM = 5 \sin 22.35^\circ$$

$$AB = 2 \times 5 \sin 22.35^\circ$$

$$= 3.803 \text{ cm}$$

$$\text{Perimeter tembereng berlorek} = 3.803 + 3.9$$

$$= 7.703 \text{ cm}$$

D

1. (a) Katakan $OA = j$, maka $AB = 2j$, $OB = 3j$ dan panjang lengkok $BC = j$.

$$\text{Panjang lengkok } BC = OB \times \theta$$

$$j = 3j \times \theta$$

$$\theta = \frac{1}{3} \text{ rad}$$

- (b) Jika $AB = 18 \text{ cm}$, maka $OA = 9 \text{ cm}$.

$$\text{Panjang lengkok } AD = 9 \times \frac{1}{3}$$

$$= 3 \text{ cm}$$

2. (a) $OB = \frac{7}{1.4} = 5 \text{ cm}$

$$\frac{OA}{OB} = \frac{3}{3+2}$$

$$OA = \frac{3}{5} \times 5$$

$$= 3 \text{ cm}$$

$$\text{Maka, } AB = 5 - 3$$

$$= 2 \text{ cm}$$

- (b) Panjang lengkok $AD = 3 \times 1.4$
 $= 4.2 \text{ cm}$

$$\text{Perimeter kawasan berlorek}$$

$$= 7 + 4.2 + 2 + 2$$

$$= 15.2 \text{ cm}$$

3. (a) OAB ialah segi tiga sama sisi. Maka,

$$\angle AOB = 60^\circ \times \frac{\pi}{180^\circ}$$

$$= \frac{\pi}{3} \text{ rad}$$

- (b) $AB = 12 \text{ cm}$

$$\text{Panjang lengkok } AB = 12 \times \frac{\pi}{3}$$

$$= 4\pi \text{ cm}$$

$$\text{Perimeter tembereng berlorek}$$

$$= (12 + 4\pi) \text{ cm}$$

8.3**A**

1. Luas = $\frac{1}{2} \times 10^2 \times \frac{\pi}{3}$
 $= 52.36 \text{ cm}^2$

2. Luas = $\frac{1}{2} \times 20^2 \times (360^\circ - 45^\circ) \times \frac{\pi}{180^\circ}$
 $= \frac{1}{2} \times 400 \times 315^\circ \times \frac{\pi}{180^\circ}$
 $= 1\,099.6 \text{ cm}^2$

B

1. (a) (i) Luas sektor $OAB = \frac{1}{2} \times 10^2 \times 0.5$
 $= 25 \text{ cm}^2$

(ii) Luas sektor $OAB = \frac{1}{2} \times 10^2 \times 1.1$
 $= 55 \text{ cm}^2$

(b) (i) $\frac{1}{2}j^2\theta = 61.5$

$$\frac{1}{2} \times 10^2 \times \theta = 61.5$$

$$\theta = \frac{61.5}{50}$$

$$= 1.23 \text{ rad}$$

(ii) $\frac{1}{2}j^2\theta = 67.5$

$$\frac{1}{2} \times 10^2 \times \theta = 67.5$$

$$\theta = \frac{67.5}{50}$$

$$= 1.35 \text{ rad}$$

2. (a) (i) Luas sektor $POQ = \frac{1}{2} \times 8^2 \times 1.05$
 $= 33.6 \text{ cm}^2$

(ii) Luas sektor $POQ = \frac{1}{2} \times 18^2 \times 1.05$
 $= 170.1 \text{ cm}^2$

(b) (i) $\frac{1}{2} \times j^2 \times 1.05 = 42.525$

$$j^2 = \frac{42.525 \times 2}{1.05}$$

$$= 81$$

$$j = 9 \text{ cm}$$

(ii) $\frac{1}{2} \times j^2 \times 1.05 = 134.4$

$$j^2 = \frac{134.4 \times 2}{1.05}$$

$$= 256$$

$$j = 16 \text{ cm}$$

C

1. Dalam ΔOAM ,

$$AM^2 = 13^2 - 5^2 = 144$$

$$AM = 12 \text{ cm}$$

$$AB = 2 \times 12 = 24 \text{ cm}$$

$$\cos \angle AOM = \frac{5}{13}$$

$$\angle AOM = 67.38^\circ$$

$$\angle AOB = 2 \times 67.38^\circ = 134.76^\circ$$

Luas tembereng berlorek

$$= \frac{1}{2}j^2\theta - \frac{1}{2}(AB)(OM)$$

$$= \frac{1}{2}(13^2)\left(134.76^\circ \times \frac{\pi}{180^\circ}\right) - \frac{1}{2}(24)(12)$$

$$= 138.74 \text{ cm}^2$$

2. Dalam ΔOAM ,

$$\sin 30^\circ = \frac{AM}{13}$$

$$AM = 13 \sin 30^\circ$$

$$AB = 2 \times 13 \sin 30^\circ$$

$$= 13 \text{ cm}$$

$$\cos 30^\circ = \frac{OM}{13}$$

$$OM = 13 \cos 30^\circ$$

$$= 11.258 \text{ cm}$$

Luas tembereng berlorek

$$= \frac{1}{2}(13^2)\left(60^\circ \times \frac{\pi}{180^\circ}\right) - \frac{1}{2}(13)(11.258)$$

$$= 15.31 \text{ cm}^2$$

3. Dalam ΔOAM ,

$$\sin 50^\circ = \frac{AM}{15}$$

$$AM = 15 \sin 50^\circ$$

$$AB = 2 \times 15 \sin 50^\circ$$

$$= 22.98 \text{ cm}$$

$$\cos 50^\circ = \frac{OM}{15}$$

$$OM = 15 \cos 50^\circ$$

$$= 9.642 \text{ cm}$$

Luas tembereng berlorek

$$= \frac{1}{2}(15^2)\left(100^\circ \times \frac{\pi}{180^\circ}\right) - \frac{1}{2}(22.98)(9.642)$$

$$= 85.56 \text{ cm}^2$$

D

1. (a) Luas sektor $OAB = 72.11 \text{ cm}^2$

$$\frac{1}{2}(OA^2)\left(102^\circ \times \frac{\pi}{180^\circ}\right) = 72.11$$

$$OA^2 = \frac{72.11 \times 180 \times 2}{102 \times \pi}$$

$$OA = \sqrt{81.012}$$

$$= 9.001 \text{ cm}$$

(b) Luas ΔOAB

$$= \text{Luas sektor } OAB$$

$$- \text{Luas tembereng berlorek}$$

$$= 72.11 - 32.49$$

$$= 39.62 \text{ cm}^2$$

$$\frac{1}{2}(AB)(\text{Tinggi}) = 39.62$$

$$\text{Tinggi} = \frac{2 \times 39.62}{14}$$

$$= 5.66 \text{ cm}$$

2. Katakan $\angle AOB = \theta$

$$12 \times \theta = 14.4$$

$$\theta = 1.2 \text{ rad}$$

$$\begin{aligned} \text{Dalam } \triangle OAM, \frac{AM}{12} &= \sin 0.6 \text{ rad} \\ AM &= 12 \sin 0.6 \text{ rad} \\ &= 6.778 \text{ cm} \end{aligned}$$

$$AB = 2 \times AM = 13.556 \text{ cm}$$

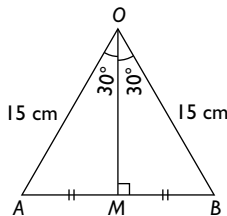
$$OM = \sqrt{12^2 - 6.778^2} = 9.902 \text{ cm}$$

$$\begin{aligned} \text{Luas tembereng berlorek} \\ &= \frac{1}{2}(12^2)(1.2) - \frac{1}{2}(13.556)(9.902) \\ &= 19.28 \text{ cm}^2 \end{aligned}$$

3. (a) $\angle AOB = 2 \times 30^\circ$
 $= 60^\circ$

$$\begin{aligned} \text{Luas sektor } OAB \\ &= \frac{1}{2}(15^2)\left(60^\circ \times \frac{\pi}{180^\circ}\right) \\ &= 117.8 \text{ cm}^2 \end{aligned}$$

(b)



Dalam $\triangle OAB$,

$$AM = 15 \sin 30^\circ$$

$$AB = 2 \times 15 \sin 30^\circ = 15 \text{ cm}$$

$$OM = 15 \cos 30^\circ = 12.99 \text{ cm}$$

$$\begin{aligned} \text{Luas tembereng berlorek} \\ &= 117.8 - \frac{1}{2}(15)(12.99) \\ &= 20.38 \text{ cm}^2 \end{aligned}$$

Praktis Formatif: Kertas 1

1. (a) $\angle POQ = 150^\circ \times \frac{\pi}{180^\circ}$
 $= \frac{5}{6} \pi \text{ rad}$

(b) Perimeter sektor $OPQ = 9 + 9 + 9\left(\frac{5}{6}\pi\right)$
 $= 41.57 \text{ cm}$

2. $OB = r \text{ cm}$, $OA = 3OB = 3r \text{ cm}$, $AB = 2r \text{ cm}$
Panjang lengkok $BC = r(4\alpha) = 4r\alpha \text{ cm}$
Panjang lengkok major $AD = 3r(6\alpha) = 18r\alpha \text{ cm}$
Perimeter seluruh rajah = 400 cm
Maka, $4r\alpha + 18r\alpha + 2r + 2r = 400$
 $22r\alpha + 4r = 400$
 $2r(11\alpha + 2) = 400$
 $r(11\alpha + 2) = 200$
 $r = \frac{200}{11\alpha + 2}$

3. (a) Panjang lengkok $KL = 8 \times 1.62$
 $= 12.96 \text{ cm}$

(b) Luas kawasan berlorek
 $= \text{Luas sektor } KOL - \text{Luas } \triangle OJM$
 $= \frac{1}{2}(8^2)(1.62) - \frac{1}{2}(4^2) \sin 1.62 \text{ rad}$
 $= 43.85 \text{ cm}^2$

4. Luas kawasan berlorek
 $= \text{Luas sektor } OAB - \text{Luas sektor } PQR$
 $= \frac{1}{2}(12^2)(1.6) - \frac{1}{2}(8^2)(0.45)$
 $= 100.8 \text{ cm}^2$

5. (a) $OP : PQ = 3 : 2$
 $OQ = \frac{5}{3} \times 6 \text{ cm} = 10 \text{ cm}$

(b) Luas kawasan berlorek
 $= \text{Luas sektor } OQR - \text{Luas sektor } OPS$
 $43.64 = \frac{1}{2}(10^2)\theta - \frac{1}{2}(6^2)\theta$
 $43.64 = 50\theta - 18\theta$
 $32\theta = 43.64$
 $\theta = 1.364 \text{ rad}$

6. Luas segi empat sama $PQRS = 8 \times 8$
 $= 64 \text{ m}^2$

$$\begin{aligned} \text{Luas sektor } PQT &= \frac{1}{2} \times 8 \times 8 \times \frac{\pi}{3} \\ &= 33.5 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{Luas tembereng } TQ &= 33.5 - \text{Luas } \triangle PTQ \\ &= 33.5 - \frac{1}{2} \times 8 \times 8 \times \sin 60^\circ \\ &= 5.80 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{Luas kawasan yang perlu dicat semula} \\ &= 64 - 33.5 - 5.80 \\ &= 24.69 \text{ m}^2 \end{aligned}$$

7. (a) OAB ialah \triangle sama kaki.
 $\theta = 180^\circ - 50^\circ - 50^\circ$
 $= 80^\circ$

$$\begin{aligned} &= \frac{80}{180} \times 3.142 \\ &= 1.396 \text{ rad} \end{aligned}$$

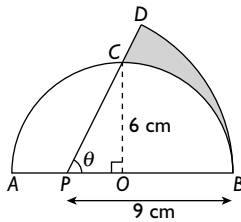
(b) Luas kawasan berlorek
 $= \text{Luas sektor } OAB - \text{Luas } \triangle OAB$
 $= \frac{1}{2}(10^2)(1.396) - \frac{1}{2}(10)(10) \sin 80^\circ$
 $= 20.56 \text{ cm}^2$

8. (a) $12\theta = 20$
 $\theta = \frac{20}{12} = 1.667 \text{ rad}$

(b) Luas sektor major OAB
 $= \frac{1}{2} \times 12^2 \times (2\pi - 1.667)$
 $= 332.4 \text{ cm}^2$ (4 a.b.)

Praktis Formatif: Kertas 2

1.



$$(a) \quad OP = PB - OB = 9 - 6 = 3 \text{ cm}$$

$$OC = 6 \text{ cm}$$

$$\tan \theta = \frac{OC}{OP}$$

$$= \frac{6}{3}$$

$$= 2$$

$$\theta = 1.107 \text{ rad}$$

$$(b) \quad \text{Panjang lengkok } BC = 6 \times \frac{\pi}{2}$$

$$= 9.426 \text{ cm}$$

$$\text{Panjang lengkok } BD = 9 \times 1.107$$

$$= 9.963 \text{ cm}$$

$$\text{Dalam } \triangle OPC, PC = \sqrt{6^2 + 3^2}$$

$$= 6.708 \text{ cm}$$

$$CD = PD - PC$$

$$= 9 - 6.708$$

$$= 2.292 \text{ cm}$$

$$\text{Perimeter rantau berlorek}$$

$$= \text{Lengkok } BC + \text{Lengkok } BD + CD$$

$$= 9.426 + 9.963 + 2.292$$

$$= 21.681 \text{ cm}$$

$$(c) \quad \text{Luas rantau berlorek}$$

$$= \text{Luas sektor } BPD - \text{Luas sukuan bulatan } OBC$$

$$- \text{Luas } \triangle OPC$$

$$= \frac{1}{2}(9^2)(1.107) - \frac{1}{2}(6^2)\left(\frac{\pi}{2}\right) - \frac{1}{2}(3)(6)$$

$$= 7.556 \text{ cm}^2$$

$$2. (a) \quad \text{Panjang lengkok } PQ = 2 \text{ cm} \rightarrow r\theta = 2$$

$$\text{Panjang lengkok } RS = 6 \text{ cm} \rightarrow (10 + r)\theta = 6$$

$$\text{Maka, } (10 + r)\theta = 6$$

$$10\theta + r\theta = 6$$

$$10\theta + 2 = 6$$

$$10\theta = 4$$

$$\theta = 0.4 \text{ rad}$$

$$\text{dan } r(0.4) = 2$$

$$r = \frac{2}{0.4} = 5$$

$$(b) \quad \text{Luas sektor } OPQ = \frac{1}{2} \times 5^2 \times 0.4$$

$$= 5 \text{ cm}^2$$

$$\text{Luas segi tiga } ORS = \frac{1}{2} \times 15^2 \times \sin 0.4 \text{ rad}$$

$$= 43.81 \text{ cm}^2$$

$$\text{Luas kawasan berlorek} = 43.81 - 5$$

$$= 38.81 \text{ cm}^2$$

$$3. (a) \quad \angle EOC = \sin^{-1}\left(\frac{3}{6}\right)$$

$$= 30^\circ$$

$$= \frac{\pi}{6} \text{ rad}$$

$$\theta = \pi - \frac{\pi}{6} = 2.618 \text{ rad}$$

$$(b) \quad \text{Panjang } OC = 6 \cos 30^\circ$$

$$= 5.196 \text{ cm}$$

$$\text{Perimeter seluruh rajah}$$

$$= \text{Lengkok } BE + \text{Lengkok } DE + CD + OC + OB$$

$$= 6(2.618) + \frac{1}{4}(2)(3.142)(3) + 3 + 5.196 + 6$$

$$= 34.62 \text{ cm}$$

$$(c) \quad \text{Luas tembereng } EAC$$

$$= \text{Luas sektor } OAE - \text{Luas segi tiga } OCE$$

$$= \frac{1}{2}(6^2)\left(\frac{\pi}{6}\right) - \frac{1}{2}(5.196)(3)$$

$$= 1.632 \text{ cm}^2$$

$$\text{Luas kawasan berlorek}$$

$$= \text{Luas sukuan bulatan } DCE$$

$$- \text{Luas tembereng } EAC$$

$$= \frac{1}{4}(3.142)(3^2) - 1.632$$

$$= 5.438 \text{ cm}^2$$

$$4. (a) \quad \text{Dalam } \triangle TOR,$$

$$\cos \angle TOR = \frac{5}{10} = \frac{1}{2}$$

$$\angle TOR = 60^\circ$$

$$= 60 \times \frac{3.142}{180}$$

$$= 1.047 \text{ rad}$$

$$(b) \quad TOS \text{ ialah segi tiga sama kaki dan}$$

$$\angle TOS = 120^\circ.$$

$$\text{Maka, } \angle TSO = 30^\circ$$

$$= 0.5237 \text{ rad}$$

$$\text{Panjang lengkok } TQ = 10 \times 0.5237$$

$$= 5.237 \text{ cm}$$

$$(c) \quad \text{Luas kawasan berlorek}$$

$$= \text{Luas sektor } QST - \text{Luas } \triangle TRS$$

$$\text{Dalam } \triangle TOR, TR^2 = 10^2 - 5^2$$

$$= 75$$

$$TR = 8.660 \text{ cm}$$

$$\text{Luas } \triangle TRS = \frac{1}{2} \times 8.660 \times 15$$

$$= 64.95 \text{ cm}^2$$

$$\text{Dalam } \triangle TOS, TS^2 = 75 + 15^2$$

$$= 300$$

$$\text{Luas sektor } QST = \frac{1}{2} \times TS^2 \times 0.5237$$

$$= \frac{1}{2} \times 300 \times 0.5237$$

$$= 78.56 \text{ cm}^2$$

$$\text{Luas kawasan berlorek} = 78.56 - 64.95$$

$$= 13.61 \text{ cm}^2$$

5. (a) Panjang lengkok AB
 = Lilitan tapak kon
 = $2\pi j$
 = $2\pi \left(\frac{18.8}{2}\right)$
 = 59.07 cm

Panjang sendeng kon
 = $\sqrt{26^2 + 9.4^2}$
 = 27.65 cm

Maka, $OA = 27.65$ cm

Panjang lengkok $AB = j\theta$

Maka, $27.65\theta = 59.07$
 $\theta = 2.136$ rad

$\angle BOC = \pi - 2.136$
 = 1.006 rad
 = 57.63°

$\cos 57.63^\circ = \frac{OC}{27.65}$
 $OC = 14.80$ cm

Maka, panjang minimum kad
 = 27.65 + 14.80
 = 42 cm [kepada integer terdekat]

Lebar minimum kad = 28 cm
 [kepada integer terdekat]

(b) Luas kad yang tidak digunakan
 = $(42 \times 28) - \text{Luas sektor } OAB$
 = $1176 - \frac{1}{2}(27.65^2)(2.136)$
 = 359.5 cm²

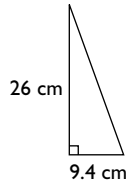
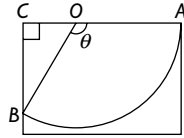
6. (a) $\triangle AOB$ ialah segi tiga sama kaki dengan
 $OA = OB$.

$\frac{1}{2}AB = 18 \sin 20^\circ$
 $AB = 2 \times 18 \sin 20^\circ$
 = 12.313 cm
 = 12.3 cm

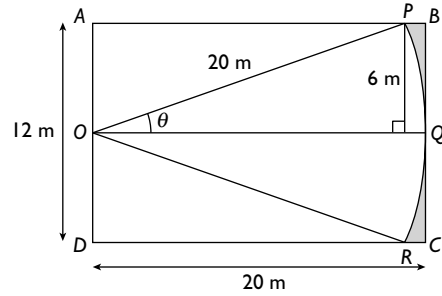
(b) $\angle ABC = (180^\circ - 40^\circ) \div 2$
 = 70°
 = 1.222 radian

Perimeter sektor ABC
 = $AB + BC + \text{Lengkok } AC$
 = $12.3 + 12.3 + 12.3 \times 1.222$
 = 39.63 cm

(c) Luas rantau berlorek
 = Luas sektor ABC + Luas tembereng yang dibatasi oleh lengkok AB dan perentas AB
 = $\frac{1}{2}(12.3^2)(1.222) + (\text{Luas sektor } AOB - \text{Luas segi tiga } AOB)$
 = $92.44 + \left[\frac{1}{2}(18^2) \left(40^\circ \times \frac{\pi}{180^\circ} \right) - \frac{1}{2}(12.3)(18 \cos 20^\circ) \right]$
 = 92.44 + (113.11 - 104.02)
 = 101.5 cm²



FOKUS KBAT



(a) $OP = OQ = 20$ m

$\tan \theta = \frac{6}{20}$
 $\theta = 0.2915$ rad

$AP = \sqrt{20^2 - 6^2} = 19.079$ m

Luas kawasan berlorek
 = $2(\text{Luas } ABQO - \text{Luas } \triangle OAP - \text{Luas sektor } OPQ)$
 = $2 \left[20(6) - \frac{1}{2}(6)(19.079) - \frac{1}{2}(20^2)(0.2915) \right]$
 = 8.926 m²

(b) $\angle POR = 2(0.2915) = 0.583$ rad

$PB = RC = 20 - 19.079 = 0.921$ m

Perimeter kawasan berlorek
 = $20(0.583) + 2(0.921) + 12$
 = 25.502 m

Jumlah kos pagar = $25.502 \times \text{RM}50$
 = RM1 275.10

JAWAPAN

BAB 9: PEMBEZAAN

9.1

A

- $$\begin{aligned} \lim_{x \rightarrow 2} \left(\frac{2}{x+6} \right) &= \frac{2}{2+6} \\ &= \frac{2}{8} \\ &= \frac{1}{4} \end{aligned}$$
- $$\begin{aligned} \lim_{x \rightarrow 0} \left(\frac{3x+2x^2}{x} \right) &= \lim_{x \rightarrow 0} \left(\frac{3x}{x} + \frac{2x^2}{x} \right) \\ &= \lim_{x \rightarrow 0} (3+2x) \\ &= 3 \end{aligned}$$
- $$\begin{aligned} \lim_{x \rightarrow 4} (x^2 + 2x + 1) &= 16 + 8 + 1 \\ &= 25 \end{aligned}$$
- $$\begin{aligned} \lim_{x \rightarrow 3} \left(\frac{x^2 - x - 6}{x - 3} \right) &= \lim_{x \rightarrow 3} \frac{(x-3)(x+2)}{x-3} \\ &= \lim_{x \rightarrow 3} (x+2) \\ &= 3 + 2 \\ &= 5 \end{aligned}$$

B

- $$\begin{aligned} 1. \quad y &= 5x \quad \dots\dots \textcircled{1} \\ y + \delta y &= 5(x + \delta x) \\ &= 5x + 5\delta x \quad \dots\dots \textcircled{2} \\ \textcircled{2} - \textcircled{1}: \quad \delta y &= 5\delta x \\ \frac{\delta y}{\delta x} &= 5 \\ \frac{dy}{dx} &= \lim_{\delta x \rightarrow 0} \frac{\delta y}{\delta x} \\ &= \lim_{\delta x \rightarrow 0} 5 \\ &= 5 \end{aligned}$$
- $$\begin{aligned} 2. \quad y &= 4x^2 + x \quad \dots\dots \textcircled{1} \\ y + \delta y &= 4(x + \delta x)^2 + (x + \delta x) \\ &= 4x^2 + 8x\delta x + 4(\delta x)^2 + x + \delta x \quad \dots\dots \textcircled{2} \\ \textcircled{2} - \textcircled{1}: \quad \delta y &= 8x\delta x + 4(\delta x)^2 + \delta x \\ \frac{\delta y}{\delta x} &= 8x + 4\delta x + 1 \\ \frac{dy}{dx} &= \lim_{\delta x \rightarrow 0} \frac{\delta y}{\delta x} \\ &= \lim_{\delta x \rightarrow 0} (8x + 4\delta x + 1) \\ &= 8x + 1 \end{aligned}$$

- $$\begin{aligned} 3. \quad y &= 5 - 4x^2 \quad \dots\dots \textcircled{1} \\ y + \delta y &= 5 - 4(x + \delta x)^2 \\ &= 5 - 4[x^2 + 2x\delta x + (\delta x)^2] \\ &= 5 - 4x^2 - 8x\delta x - 4(\delta x)^2 \quad \dots\dots \textcircled{2} \\ \textcircled{2} - \textcircled{1}: \quad \delta y &= -8x\delta x - 4(\delta x)^2 \\ \frac{\delta y}{\delta x} &= -8x - 4\delta x \\ \frac{dy}{dx} &= \lim_{\delta x \rightarrow 0} (-8x - 4\delta x) \\ &= -8x \end{aligned}$$

9.2

A

- $$\begin{aligned} 1. \quad y &= 15x \\ \frac{dy}{dx} &= 15x^{1-1} \\ &= 15x^0 \\ &= 15 \end{aligned}$$
- $$\begin{aligned} 2. \quad y &= -4x^2 \\ \frac{dy}{dx} &= 2(-4x^{2-1}) \\ &= 2(-4x) \\ &= -8x \end{aligned}$$
- $$\begin{aligned} 3. \quad y &= -16x^3 \\ \frac{dy}{dx} &= 3(-16x^{3-1}) \\ &= 3(-16x^2) \\ &= -48x^2 \end{aligned}$$
- $$\begin{aligned} 4. \quad f(x) &= 18 \\ f'(x) &= 0 \end{aligned}$$
- $$\begin{aligned} 5. \quad f(x) &= \frac{5}{x^2} = 5x^{-2} \\ f'(x) &= -2(5x^{-2-1}) \\ &= -10x^{-3} \\ &= -\frac{10}{x^3} \end{aligned}$$
- $$\begin{aligned} 6. \quad f(x) &= \frac{2}{5x^3} = \frac{2}{5}x^{-3} \\ f'(x) &= -3\left(\frac{2}{5}x^{-3-1}\right) \\ &= -\frac{6}{5}x^{-4} \\ &= -\frac{6}{5x^4} \end{aligned}$$

B

$$1. \frac{dy}{dx} = 2(3x^3 - 1) = 6x^2$$

Apabila $x = 2$,

$$\frac{dy}{dx} = 6(2)^2 = 24$$

$$2. \frac{dy}{dx} = -3(2x^2 - 1) = -6x$$

Apabila $x = 5$,

$$\frac{dy}{dx} = -6(5) = -30$$

$$3. f'(x) = -3x^3 - 1 = -3x^2$$

$$f'(6) = -3(6)^2 = -108$$

$$4. f(x) = \frac{8}{x^2} = 8x^{-2}$$

$$f'(x) = -16x^{-3} = -\frac{16}{x^3}$$

$$f'(-2) = -\frac{16}{(-2)^3} = 2$$

$$5. f(x) = \frac{2}{3x^3} = \frac{2}{3}x^{-3}$$

$$f'(x) = \frac{2}{3}(-3x^{-4}) = -\frac{2}{x^4}$$

$$f'(1) = -\frac{2}{1^4} = -2$$

C

$$1. f'(x) = -8x$$

$$f'(3) = -8(3) = -24$$

$$2. f'(x) = 15x^2$$

$$f'(-2) = 15(-2)^2 = 60$$

$$3. f'(x) = \frac{2}{3}(3x^3 - 1) = 2x^2$$

$$f'(4) = 2(4)^2 = 32$$

$$4. f(x) = \frac{4}{x^4} = 4x^{-4}$$

$$f'(x) = -16x^{-5} = -\frac{16}{x^5}$$

$$f'(2) = -\frac{16}{2^5} = -\frac{1}{2}$$

$$5. f(x) = \frac{3}{4x^2} = \frac{3}{4}x^{-2}$$

$$f'(x) = -\frac{3}{2}x^{-3} = -\frac{3}{2x^3}$$

$$f'(1) = -\frac{3}{2(1)^3} = -\frac{3}{2}$$

D

$$1. \frac{d}{dx} \left(-2x^3 + \frac{2}{x^2} + 6x \right)$$

$$= \frac{d}{dx} (-2x^3 + 2x^{-2} + 6x)$$

$$= -6x^2 - \frac{4}{x^3} + 6$$

$$2. \frac{d}{dx} \left(\frac{x^3 - 2x + 1}{x^2} \right) = \frac{d}{dx} \left(x - \frac{2}{x} + \frac{1}{x^2} \right)$$

$$= \frac{d}{dx} (x - 2x^{-1} + x^{-2})$$

$$= 1 + \frac{2}{x^2} - \frac{2}{x^3}$$

$$3. \frac{d}{dx} \left(\frac{3}{x^3} - 4x \right) = \frac{d}{dx} (3x^{-3} - 4x)$$

$$= -\frac{9}{x^4} - 4$$

E

$$1. y = x^2(5x + 3)$$

$$= 5x^3 + 3x^2$$

$$\frac{dy}{dx} = 15x^2 + 6x$$

$$2. y = (x + 3)^2$$

$$= x^2 + 6x + 9$$

$$\frac{dy}{dx} = 2x + 6$$

$$3. y = (x - 3)(5 - 2x)$$

$$= 11x - 2x^2 - 15$$

$$\frac{dy}{dx} = 11 - 4x$$

$$4. y = \left(2x + \frac{3}{x} \right)^2$$

$$= 4x^2 + 12 + \frac{9}{x^2}$$

$$\frac{dy}{dx} = 8x - \frac{18}{x^3}$$

$$5. y = x^3 \left(6x - \frac{1}{x} \right)$$

$$= 6x^4 - x^2$$

$$\frac{dy}{dx} = 24x^3 - 2x$$

F

1. $y = (1 - 2x^3)(x + 2)$

$$u = 1 - 2x^3 \quad \text{dan} \quad v = x + 2$$

$$\frac{du}{dx} = -6x^2 \quad \frac{dv}{dx} = 1$$

$$\begin{aligned} \frac{dy}{dx} &= (1 - 2x^3)(1) + (x + 2)(-6x^2) \\ &= 1 - 2x^3 - 6x^3 - 12x^2 \\ &= -8x^3 - 12x^2 + 1 \end{aligned}$$

2. $y = (x^2 - x)(3x^2 + 2x)$

$$u = x^2 - x \quad \text{dan} \quad v = 3x^2 + 2x$$

$$\frac{du}{dx} = 2x - 1 \quad \frac{dv}{dx} = 6x + 2$$

$$\begin{aligned} \frac{dy}{dx} &= (x^2 - x)(6x + 2) + (3x^2 + 2x)(2x - 1) \\ &= 6x^3 - 6x^2 + 2x^2 - 2x + 6x^3 + 4x^2 - 3x^2 - 2x \\ &= 12x^3 - 3x^2 - 4x \end{aligned}$$

G

1. $f(x) = \frac{3x - 1}{2x + 6}$

$$u = 3x - 1 \quad \text{dan} \quad v = 2x + 6$$

$$\frac{du}{dx} = 3 \quad \frac{dv}{dx} = 2$$

$$\begin{aligned} f'(x) &= \frac{(2x + 6)(3) - (3x - 1)(2)}{(2x + 6)^2} \\ &= \frac{6x + 18 - 6x + 2}{(2x + 6)^2} \\ &= \frac{20}{(2x + 6)^2} \end{aligned}$$

2. $f(x) = \frac{x^2 + 3}{x - 1}$

$$u = x^2 + 3 \quad \text{dan} \quad v = x - 1$$

$$\frac{du}{dx} = 2x \quad \frac{dv}{dx} = 1$$

$$\begin{aligned} f'(x) &= \frac{(x - 1)(2x) - (x^2 + 3)(1)}{(x - 1)^2} \\ &= \frac{x^2 - 2x - 3}{(x - 1)^2} \\ &= \frac{(x - 3)(x + 1)}{(x - 1)^2} \end{aligned}$$

3. $f(x) = \frac{3x}{2x^2 + 2}$

$$u = 3x \quad \text{dan} \quad v = 2x^2 + 2$$

$$\frac{du}{dx} = 3 \quad \frac{dv}{dx} = 4x$$

$$\begin{aligned} f'(x) &= \frac{(2x^2 + 2)(3) - 3x(4x)}{(2x^2 + 2)^2} \\ &= \frac{6x^2 + 6 - 12x^2}{(2x^2 + 2)^2} \\ &= \frac{6 - 6x^2}{(2x^2 + 2)^2} \\ &= \frac{6(1 - x^2)}{4(x^2 + 1)^2} \\ &= \frac{3(1 - x^2)}{2(x^2 + 1)^2} \end{aligned}$$

4. $f(x) = \frac{3x - 4}{5 - 2x}$

$$u = 3x - 4 \quad \text{dan} \quad v = 5 - 2x$$

$$\frac{du}{dx} = 3 \quad \frac{dv}{dx} = -2$$

$$\begin{aligned} f'(x) &= \frac{(5 - 2x)(3) - (3x - 4)(-2)}{(5 - 2x)^2} \\ &= \frac{15 - 6x + 6x - 8}{(5 - 2x)^2} \\ &= \frac{7}{(5 - 2x)^2} \end{aligned}$$

5. $f(x) = \frac{x^3}{x^2 + 1}$

$$u = x^3 \quad \text{dan} \quad v = x^2 + 1$$

$$\frac{du}{dx} = 3x^2 \quad \frac{dv}{dx} = 2x$$

$$\begin{aligned} f'(x) &= \frac{(x^2 + 1)(3x^2) - x^3(2x)}{(x^2 + 1)^2} \\ &= \frac{3x^4 + 3x^2 - 2x^4}{(x^2 + 1)^2} \\ &= \frac{x^4 + 3x^2}{(x^2 + 1)^2} \end{aligned}$$

6. $f(x) = \frac{4x}{x^3 + x} = \frac{4}{x^2 + 1}$

$$u = 4 \quad \text{dan} \quad v = x^2 + 1$$

$$\frac{du}{dx} = 0 \quad \frac{dv}{dx} = 2x$$

$$\begin{aligned} f'(x) &= \frac{(x^2 + 1)(0) - 4(2x)}{(x^2 + 1)^2} \\ &= -\frac{8x}{(x^2 + 1)^2} \end{aligned}$$

H

1. $\frac{dy}{dx} = 3(4x - 5)^2(4)$
 $= 12(4x - 5)^2$
2. $\frac{dy}{dx} = 3(2x + 3)^2(2)$
 $= 6(2x + 3)^2$
3. $\frac{dy}{dx} = 4(3x + x^2)^3(3 + 2x)$
 $= 4(3 + 2x)(3x + x^2)^3$
4. $\frac{dy}{dx} = 5(x^3 - 3x + 2)^4(3x^2 - 3)$
 $= 5(3x^2 - 3)(x^3 - 3x + 2)^4$

5. $\frac{dy}{dx} = 3(4x^3 - 3x)^2(12x^2 - 3)$
 $= 9x^2(4x^2 - 3)^2(4x^2 - 1)$
6. $\frac{dy}{dx} = 4(x^3 - x)^3(3x^2 - 1)$
 $= 4(3x^2 - 1)(x^3 - x)^3$
7. $\frac{dy}{dx} = 3(x^2 - 2x + 4)^2(2x - 2)$
 $= 3(x^2 - 2x + 4)^2(2)(x - 1)$
 $= 6(x - 1)(x^2 - 2x + 4)^2$
8. $\frac{dy}{dx} = 2(x^2 + 3x + 1)(2x + 3)$

I

Kecerunan tangen (m_1) dan normal (m_2)	Persamaan tangen	Persamaan normal
<p>1. $y = (4x - x^2)^2 ; (3, 9)$</p> $\frac{dy}{dx} = 2(4x - x^2)(4 - 2x)$ <p>Pada $x = 3$, $\frac{dy}{dx} = 2[4(3) - 3^2][4 - 2(3)]$ $= -12$</p> <p>Maka, $m_1 = -12$ dan $m_2 = \frac{1}{12}$.</p>	$y - 9 = -12(x - 3)$ $y - 9 = -12x + 36$ $y = -12x + 45$	$y - 9 = \frac{1}{12}(x - 3)$ $y - 9 = \frac{1}{12}x - \frac{1}{4}$ $y = \frac{1}{12}x + \frac{35}{4}$
<p>2. $y = \frac{3}{(x^2 + x)^2} ; (1, \frac{3}{4})$</p> $\frac{dy}{dx} = -6(x^2 + x)^{-3}(2x + 1) = \frac{-6(2x + 1)}{(x^2 + x)^3}$ <p>Pada $x = 1$, $\frac{dy}{dx} = \frac{-6[2(1) + 1]}{(1^2 + 1)^3} = -\frac{9}{4}$</p> <p>Maka, $m_1 = -\frac{9}{4}$ dan $m_2 = \frac{4}{9}$.</p>	$y - \frac{3}{4} = -\frac{9}{4}(x - 1)$ $y - \frac{3}{4} = -\frac{9}{4}x + \frac{9}{4}$ $y = -\frac{9}{4}x + 3$	$y - \frac{3}{4} = \frac{4}{9}(x - 1)$ $y - \frac{3}{4} = \frac{4}{9}x - \frac{4}{9}$ $y = \frac{4}{9}x + \frac{11}{36}$
<p>3. $y = (x^2 + 1)(3x - 4) ; (2, 10)$</p> $\frac{dy}{dx} = (x^2 + 1)(3) + (3x - 4)(2x)$ <p>Pada $x = 2$, $\frac{dy}{dx} = (2^2 + 1)(3) + [3(2) - 4][2(2)]$ $= 23$</p> <p>Maka, $m_1 = 23$ and $m_2 = -\frac{1}{23}$.</p>	$y - 10 = 23(x - 2)$ $y - 10 = 23x - 46$ $y = 23x - 36$	$y - 10 = -\frac{1}{23}(x - 2)$ $y - 10 = -\frac{1}{23}x + \frac{2}{23}$ $y = -\frac{1}{23}x + \frac{232}{23}$
<p>4. $y = \frac{x}{x^2 + 1} ; (3, \frac{3}{10})$</p> $\frac{dy}{dx} = \frac{(x^2 + 1)(1) - x(2x)}{(x^2 + 1)^2}$ <p>Pada $x = 3$, $\frac{dy}{dx} = \frac{(3^2 + 1) - 3[2(3)]}{(3^2 + 1)^2} = -\frac{8}{100}$ $= -\frac{2}{25}$</p> <p>Maka, $m_1 = -\frac{2}{25}$ dan $m_2 = \frac{25}{2}$.</p>	$y - \frac{3}{10} = -\frac{2}{25}(x - 3)$ $y - \frac{3}{10} = -\frac{2}{25}x + \frac{6}{25}$ $y = -\frac{2}{25}x + \frac{27}{50}$	$y - \frac{3}{10} = \frac{25}{2}(x - 3)$ $y - \frac{3}{10} = \frac{25}{2}x - \frac{75}{2}$ $y = \frac{25}{2}x - \frac{186}{5}$

J

1. $y = 3x^2 + 6x + 4$

$$\frac{dy}{dx} = 6x + 6$$

Kecerunan tangen ialah 12 apabila $x = p$.

$$\begin{aligned} 6p + 6 &= 12 \\ 6p &= 6 \\ p &= 1 \end{aligned}$$

2. $y = 3x^2 - 5x + 2$

$$\frac{dy}{dx} = 6x - 5$$

Apabila $x = 2$, $\frac{dy}{dx} = 6(2) - 5 = 7$

Persamaan tangen ialah

$$\begin{aligned} y - 4 &= 7(x - 2) \\ y - 4 &= 7x - 14 \\ y &= 7x - 10 \end{aligned}$$

Maka, $m = 7$ dan $n = -10$.

3. (a) $y = (x^2 - 4)^2$

$$\frac{dy}{dx} = 2(x^2 - 4)(2x) = 4x(x^2 - 4)$$

Bandingkan $mx(x^2 - 4)$ dengan $4x(x^2 - 4)$.

Maka, $m = 4$

(b) Apabila $x = 1$, $\frac{dy}{dx} = 4(1)(1^2 - 4) = -12$

dan $y = (1^2 - 4)^2 = 9$

Persamaan tangen ialah

$$\begin{aligned} y - 9 &= -12(x - 1) \\ y - 9 &= -12x + 12 \\ y &= -12x + 21 \end{aligned}$$

9.3

1. $y = 2x^2 + 8x + 3$

$$\frac{dy}{dx} = 4x + 8$$

Pada titik pusingan, $\frac{dy}{dx} = 0$.

Maka, $4x + 8 = 0$
 $x = -2$

Apabila $x = -2$, $y = 2(-2)^2 + 8(-2) + 3 = -5$

Maka, titik pusingan ialah $(-2, -5)$.

Nilai x	-3	-2	-1
Nilai $\frac{dy}{dx}$	-4	0	4
Lakaran tangen	\	—	/

Maka, $(-2, -5)$ ialah titik minimum.

2. $y = 8x - x^2$

$$\frac{dy}{dx} = 8 - 2x$$

Pada titik pusingan, $\frac{dy}{dx} = 0$.

Maka, $8 - 2x = 0$
 $x = 4$

Apabila $x = 4$, $y = 8(4) - 4^2 = 16$

Maka, titik pusingan ialah $(4, 16)$.

Nilai x	3	4	5
Nilai $\frac{dy}{dx}$	2	0	-2
Lakaran tangen	/	—	\

Maka, $(4, 16)$ ialah titik maksimum.

3. $y = \frac{1}{3}x^3 - x^2 - 3x$

$$\frac{dy}{dx} = x^2 - 2x - 3$$

Pada titik pusingan, $\frac{dy}{dx} = 0$.

Maka, $x^2 - 2x - 3 = 0$
 $(x + 1)(x - 3) = 0$
 $x = -1$ atau 3

Apabila $x = -1$, $y = \frac{1}{3}(-1)^3 - (-1)^2 - 3(-1) = \frac{5}{3}$

Apabila $x = 3$, $y = \frac{1}{3}(3)^3 - 3^2 - 3(3) = -9$

Maka, titik pusingan ialah $(-1, \frac{5}{3})$ dan $(3, -9)$.

Nilai x	-2	-1	0	2	3	4
Nilai $\frac{dy}{dx}$	5	0	-3	-3	0	5
Lakaran tangen	/	—	\	\	—	/

Maka, $(-1, \frac{5}{3})$ ialah titik maksimum dan $(3, -9)$ ialah titik minimum.

9.4

1. $\frac{dv}{dt} = 324 \text{ cm}^3 \text{ s}^{-1}$

$$v = \pi r^2 h = \pi r^2(2r) = 2\pi r^3$$

$$\frac{dv}{dr} = 6\pi r^2$$

$$\frac{dv}{dt} = \frac{dv}{dr} \times \frac{dr}{dt}$$

Apabila $r = 6$, $324 = 6\pi(6)^2 \times \frac{dr}{dt}$

$$\begin{aligned} \frac{dr}{dt} &= \frac{324}{216\pi} \\ &= \frac{3}{2\pi} \text{ cm s}^{-1} \end{aligned}$$

$$2. \frac{dA}{dt} = \frac{dA}{dj} \times \frac{dj}{dt}$$

$$A = \pi j^2$$

$$25\pi = \pi j^2$$

$$j^2 = 25$$

$$j = 5$$

$$\frac{dA}{dj} = 2\pi j$$

$$\text{Apabila } j = 5, \frac{dA}{dj} = 2\pi(5) = 10\pi$$

$$\text{Diberi } \frac{dj}{dt} = 0.5$$

$$\text{Maka, } \frac{dA}{dt} = 10\pi \times 0.5 = 5\pi \text{ cm}^2 \text{ s}^{-1}$$

$$3. \text{ Isi padu kuboid, } V = y \times y \times 2y = 2y^3$$

$$\text{Maka, } 2y^3 = 432$$

$$y^3 = 216$$

$$y = 6$$

$$\frac{dV}{dy} = 6y^2 \Rightarrow \frac{dy}{dV} = \frac{1}{6y^2}$$

$$\frac{dy}{dt} = \frac{dV}{dt} \times \frac{dy}{dV} = 3.6 \times \frac{1}{6y^2}$$

$$\begin{aligned} \text{Apabila } y = 6, \frac{dy}{dt} &= 3.6 \times \frac{1}{6(6^2)} \\ &= \frac{1}{60} \text{ s}^{-1} \end{aligned}$$

9.5

$$1. y = 4x^2 + 5x - 4$$

$$\frac{dy}{dx} = 8x + 5$$

$$\delta x = 3.1 - 3 = 0.1$$

$$\begin{aligned} \text{Apabila } x = 3, \delta y &\approx \frac{dy}{dx} \times \delta x \\ &= (8x + 5)(0.1) \\ &= (8 \times 3 + 5)(0.1) \\ &= 2.9 \end{aligned}$$

$$\begin{aligned} \text{Nilai hampir bagi } y &= y + \delta y \\ &= 4(3^2) + 5(3) - 4 + 2.9 \\ &= 49.9 \end{aligned}$$

$$2. y = x^3$$

$$\frac{dy}{dx} = 3x^2$$

$$\begin{aligned} \text{Andaikan } x \text{ berubah daripada } 2 \text{ kepada } 2.1. \\ \delta x = 2.1 - 2 = 0.1 \end{aligned}$$

$$\begin{aligned} \text{Apabila } x = 2, \delta y &\approx \frac{dy}{dx} \times \delta x \\ &= 3x^2 \times \delta x \\ &= 3(2)^2 \times 0.1 \\ &= 1.2 \end{aligned}$$

$$\begin{aligned} \text{Maka, } 2.1^3 &= y + \delta y \\ &= 2^3 + 1.2 \\ &= 9.2 \end{aligned}$$

$$3. L = \pi j^2$$

$$\frac{dL}{dj} = 2\pi j$$

$$\delta j = 4.02 - 4 = 0.02$$

$$\delta L \approx \frac{dL}{dj} \times \delta j$$

$$\delta L = 2\pi j \times 0.02$$

$$\begin{aligned} \text{Apabila } j = 4, \delta L &= 2\pi(4) \times 0.02 \\ &= 0.16\pi \text{ cm}^2 \end{aligned}$$

$$4. \delta r = 3.2 - 3 = 0.2$$

$$p = 2\pi r$$

$$\frac{dp}{dr} = 2\pi$$

$$\delta p \approx \frac{dp}{dr} \times \delta r$$

$$= 2\pi \times 0.2$$

$$= 0.4\pi \text{ cm}$$

$$5. \text{ Katakan panjang setiap tepi kubus itu ialah } x \text{ cm.}$$

$$V = x^3$$

$$\frac{dV}{dx} = 3x^2$$

$$\delta V = 64.5 - 64 = 0.5$$

$$\begin{aligned} \text{Apabila } x^3 &= 64 \\ x &= \sqrt[3]{64} = 4 \end{aligned}$$

$$\frac{\delta V}{\delta x} \approx \frac{dV}{dx} \Rightarrow \frac{0.5}{\delta x} \approx 3x^2$$

$$\delta x = \frac{0.5}{3x^2}$$

$$\text{Apabila } x = 4, \delta x = \frac{0.5}{3 \times 4^2} = 0.01 \text{ cm}$$

9.6

A

$$1. \frac{dy}{dx} = 9x^2 - 4x$$

$$\frac{d^2y}{dx^2} = 18x - 4$$

$$2. \frac{dy}{dx} = 3(3x - 5)^2(3) = 9(3x - 5)^2$$

$$\begin{aligned} \frac{d^2y}{dx^2} &= 18(3x - 5)(3) \\ &= 54(3x - 5) \end{aligned}$$

$$3. f'(x) = 4(3x + 5)^3(3) = 12(3x + 5)^3$$

$$\begin{aligned} f''(x) &= 36(3x + 5)^2(3) \\ &= 108(3x + 5)^2 \end{aligned}$$

$$4. f'(x) = x^4 - 12x^2 + x$$

$$f''(x) = 4x^3 - 24x + 1$$

$$5. f(x) = x + \frac{5}{x}$$

$$f'(x) = 1 - \frac{5}{x^2}$$

$$f''(x) = \frac{10}{x^3}$$

$$6. \frac{dy}{dx} = 3x^2 - \frac{1}{x^2}$$

$$\frac{d^2y}{dx^2} = 6x - \left(-\frac{2}{x^3}\right) = 6x + \frac{2}{x^3}$$

B

$$1. \frac{dy}{dx} = 18x^2 - 12x$$

Pada titik pusingan, $\frac{dy}{dx} = 0$.

$$18x^2 - 12x = 0$$

$$6x(3x - 2) = 0$$

$$x = 0 \text{ atau } \frac{2}{3}$$

$$\text{Apabila } x = 0, \quad y = 6(0)^3 - 6(0)^2 + 8 = 8$$

$$\text{Apabila } x = \frac{2}{3}, \quad y = 6\left(\frac{2}{3}\right)^3 - 6\left(\frac{2}{3}\right)^2 + 8 = 7\frac{1}{9}$$

Maka, $(0, 8)$ dan $\left(\frac{2}{3}, 7\frac{1}{9}\right)$ ialah titik pusingan.

$$\frac{d^2y}{dx^2} = 36x - 12$$

$$\text{Apabila } x = 0, \frac{d^2y}{dx^2} = 36(0) - 12 = -12 < 0$$

$(0, 8)$ ialah titik maksimum.

$$\text{Apabila } x = \frac{2}{3}, \frac{d^2y}{dx^2} = 36\left(\frac{2}{3}\right) - 12 = 12 > 0$$

$\left(\frac{2}{3}, 7\frac{1}{9}\right)$ ialah titik minimum.

$$2. \frac{dy}{dx} = x^2 - 4x$$

Pada titik pusingan, $\frac{dy}{dx} = 0$.

$$x^2 - 4x = 0$$

$$x(x - 4) = 0$$

$$x = 0 \text{ atau } 4$$

Apabila $x = 0, y = 0$.

$$\text{Apabila } x = 4, y = \frac{1}{3}(4)^3 - 2(4)^2 = -10\frac{2}{3}$$

Maka, $(0, 0)$ dan $\left(4, -10\frac{2}{3}\right)$ ialah titik pusingan.

$$\frac{d^2y}{dx^2} = 2x - 4$$

$$\text{Apabila } x = 0, \frac{d^2y}{dx^2} = 2(0) - 4 = -4 < 0$$

$(0, 0)$ ialah titik maksimum.

$$\text{Apabila } x = 4, \frac{d^2y}{dx^2} = 2(4) - 4 = 4 > 0$$

$\left(4, -10\frac{2}{3}\right)$ ialah titik minimum.

Praktis Formatif: Kertas 1

$$1. \quad y = x^2(3 + px) \\ = 3x^2 + px^3$$

$$\frac{dy}{dx} = 6x + 3px^2$$

$$\text{Apabila } x = -1, \frac{dy}{dx} = -3.$$

$$\begin{aligned} \text{Maka, } 6(-1) + 3p(-1)^2 &= -3 \\ -6 + 3p &= -3 \\ 3p &= 3 \\ p &= 1 \end{aligned}$$

$$2. (a) \quad y = 2x^2 - 7x$$

$$\frac{dy}{dx} = 4x - 7$$

$$\text{Pada } (1, -5): \quad \frac{dy}{dx} = 4(1) - 7 = -3$$

$$(b) \text{ Kecerunan normal pada titik } P = \frac{1}{3}$$

Persamaan normal pada titik P ialah

$$y - (-5) = \frac{1}{3}(x - 1)$$

$$y + 5 = \frac{1}{3}x - \frac{1}{3}$$

$$y = \frac{1}{3}x - \frac{16}{3}$$

$$\text{atau } 3y - x + 16 = 0$$

$$3. \text{ Pada titik } P, y = 0.$$

$$\text{Maka, } \frac{2x + 6}{x - 2} = 0$$

$$2x + 6 = 0$$

$$2x = -6$$

$$x = -3$$

$$y = \frac{2x + 6}{x - 2}$$

$$\frac{dy}{dx} = \frac{2(x - 2) - (2x + 6)}{(x - 2)^2}$$

$$= \frac{2x - 4 - 2x - 6}{(x - 2)^2}$$

$$= -\frac{10}{(x - 2)^2}$$

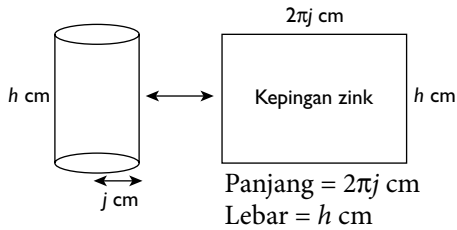
$$\text{Apabila } x = -3, \frac{dy}{dx} = -\frac{10}{(-3 - 2)^2} = -\frac{2}{5}$$

Pintasan- $y = 3$

Maka, persamaan garis lurus itu ialah

$$y = -\frac{2}{5}x + 3.$$

4. Silinder yang dibina:



Perimeter = 28 cm

$$2\pi j \times 2 + h \times 2 = 28$$

$$4\pi j + 2h = 28$$

$$2\pi j + h = 14$$

$$h = 14 - 2\pi j$$

Isi padu kon, $V = \pi j^2 h$

$$= \pi j^2 (14 - 2\pi j)$$

$$= 14\pi j^2 - 2\pi^2 j^3$$

$$\frac{dV}{dj} = 28\pi j - 6\pi^2 j^2$$

$$= 2\pi j(14 - 3\pi j)$$

$\frac{dV}{dj} = 0$ untuk V maksimum.

Maka, $2\pi j(14 - 3\pi j) = 0$

$$14 - 3\pi j = 0$$

$$3\pi j = 14$$

$$j = \frac{14}{3\pi}$$

Panjang = $2\pi j$

$$= 2\pi \left(\frac{14}{3\pi} \right)$$

$$= \frac{28}{3}$$

$$= 9 \frac{1}{3} \text{ cm}$$

Lebar = $14 - 2\pi j$

$$= 14 - \frac{28}{3}$$

$$= 4 \frac{2}{3} \text{ cm}$$

5. Luas kawasan, $L = 12x(4 - x)$

$$= 48x - 12x^2$$

$$\frac{dL}{dx} = 48 - 24x$$

Apabila L maksimum, $\frac{dL}{dx} = 0$.

$$48 - 24x = 0$$

$$24x = 48$$

$$x = 2$$

Panjang pagar yang perlu dibeli

$$= 2 \times [12(2) + (4 - 2)]$$

$$= 2 \times 26$$

$$= 52 \text{ m}$$

6. (a) $x = t^2 - 3$

$$\frac{dx}{dt} = 2t$$

(b) $\frac{dy}{dx} = \frac{dy}{dt} \times \frac{dt}{dx}$

$$= 12t^3 \times \frac{1}{2t}$$

$$= 6t^2$$

$$= 6(x + 3)$$

7. Isi padu kotak = 160 cm^3

$$10x^2 = 160$$

$$x^2 = 16$$

$$x = 4$$

Luas permukaan, $L = 2x^2 + 4(10x)$

$$= 2x^2 + 40x$$

$$\frac{dL}{dx} = 4x + 40$$

Diberi $\frac{dx}{dt} = 0.2 \text{ cm s}^{-1}$.

Apabila $x = 4$ dan $\frac{dx}{dt} = 0.2$,

$$\frac{dL}{dt} = \frac{dL}{dx} \times \frac{dx}{dt}$$

$$= (4x + 40) \times 0.2$$

$$= (4 \times 4 + 40) \times 0.2$$

$$= 11.2 \text{ cm}^2 \text{ s}^{-1}$$

8. (a) $y = 3x^2 - 2x + 3$

$$\frac{dy}{dx} = 6x - 2$$

Apabila $x = 2$,

$$\frac{dy}{dx} = 6(2) - 2 = 10$$

(b) Apabila x berubah daripada 2 kepada $2 + m$,
 $x = 2$ dan $\delta x = m$.

$$\delta y \approx \frac{dy}{dx} \times \delta x$$

$$= 10 \times m$$

$$= 10m$$

9. $y = 5 - \frac{10}{x} = 5 - 10x^{-1}$

$$\frac{dy}{dx} = 10x^{-2} = \frac{10}{x^2}$$

Apabila $y = 3$, $3 = 5 - \frac{10}{x}$ dan $\frac{dy}{dx} = \frac{10}{x^2}$

$$\frac{10}{x} = 2$$

$$x = 5$$

$$= \frac{10}{5^2}$$

$$= \frac{2}{5}$$

Apabila nilai y berubah daripada 3 kepada $3 + p$,

$$\delta y = (3 + p) - 3 = p$$

$$\frac{\delta y}{\delta x} \approx \frac{dy}{dx} = \frac{2}{5}$$

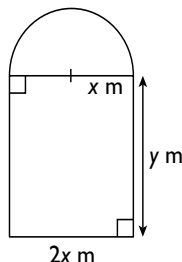
$$\frac{p}{\delta x} = \frac{2}{5}$$

$$\delta x = \frac{5p}{2}$$

10. (a) Titik A dan titik C
 (b) Titik D dan titik E
 (c) Titik B
 (d) Titik C

Praktis Formatif: Kertas 2

1.



- (a) Diberi perimeter pintu = 8 m
 $\pi x + 2x + y + y = 8$
 $2y = 8 - \pi x - 2x \dots\dots \textcircled{1}$

Katakan luas permukaan hadapan pintu = $L \text{ m}^2$

$$L = \frac{1}{2} \pi x^2 + 2xy \dots\dots \textcircled{2}$$

Gantikan $\textcircled{1}$ ke dalam $\textcircled{2}$.

$$\begin{aligned} L &= \frac{1}{2} \pi x^2 + x(8 - \pi x - 2x) \\ &= \frac{1}{2} \pi x^2 + 8x - \pi x^2 - 2x^2 \\ &= 8x - \frac{1}{2} \pi x^2 - 2x^2 \end{aligned}$$

- (b) $\frac{dL}{dx} = 8 - \pi x - 4x$

Apabila luas permukaan hadapan pintu itu maksimum, $\frac{dL}{dx} = 0$.

$$\begin{aligned} \text{Maka, } 8 - \pi x - 4x &= 0 \\ x(\pi + 4) &= 8 \end{aligned}$$

$$\begin{aligned} x &= \frac{8}{\pi + 4} \\ &= \frac{8}{3.142 + 4} \\ &= 1.120 \text{ m} \end{aligned}$$

Luas maksimum permukaan hadapan pintu

$$\begin{aligned} &= 8(1.120) - \frac{1}{2} \pi (1.120)^2 - 2(1.120)^2 \\ &= 4.481 \text{ m}^2 \end{aligned}$$

2. (a) $y = 3x(1 - 2x)^4$
 $\frac{dy}{dx} = 3x(4)(1 - 2x)^3(-2) + 3(1 - 2x)^4$
 $= -24x(1 - 2x)^3 + 3(1 - 2x)^4$

Pada $P(1, 3)$, $x = 1$.

$$\begin{aligned} \frac{dy}{dx} &= -24(1)(1 - 2)^3 + 3(1 - 2)^4 \\ &= 24 + 3 \\ &= 27 \end{aligned}$$

Maka, kecerunan lengkung pada titik P ialah 27.

- (b) Kecerunan garis normal pada titik P ialah $-\frac{1}{27}$.

Persamaan garis normal pada titik P ialah

$$\begin{aligned} y - 3 &= -\frac{1}{27}(x - 1) \\ 27y - 81 &= -x + 1 \\ x + 27y &= 82 \end{aligned}$$

3. (a) $y = x^2(x - 3) + \frac{3}{2}$
 $= x^3 - 3x^2 + \frac{3}{2}$
 $\frac{dy}{dx} = 3x^2 - 6x$

- (b) Pada titik pusingan, $\frac{dy}{dx} = 0$.

$$\begin{aligned} 3x^2 - 6x &= 0 \\ 3x(x - 2) &= 0 \\ x &= 0 \text{ atau } 2 \end{aligned}$$

Apabila $x = 0$, $y = \frac{3}{2}$

Apabila $x = 2$, $y = 2^2(2 - 3) + \frac{3}{2} = -\frac{5}{2}$

Maka, titik pusingan ialah $(0, 1\frac{1}{2})$

dan $(2, -2\frac{1}{2})$.

- (c) $\frac{d^2y}{dx^2} = 6x - 6$

Pada titik $(0, 1\frac{1}{2})$: $\frac{d^2y}{dx^2} = 6(0) - 6 = -6$

$(0, 1\frac{1}{2})$ ialah titik maksimum.

Pada titik $(2, -2\frac{1}{2})$: $\frac{d^2y}{dx^2} = 6(2) - 6 = 6$

$(2, -2\frac{1}{2})$ ialah titik minimum.

4. (a) $y = -\frac{5}{x^2} = -5x^{-2}$

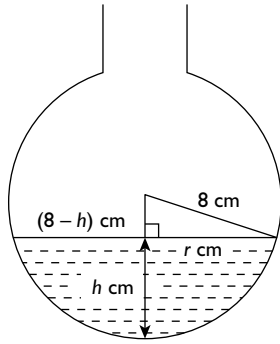
$$\begin{aligned} \frac{dy}{dx} &= -5(-2)x^{-2-1} \\ &= 10x^{-3} \\ &= \frac{10}{x^3} \end{aligned}$$

Apabila $x = 2$, $\frac{dy}{dx} = \frac{10}{2^3} = 1.25$

- (b) $\delta x = 2 - 1.98 = 0.02$

Nilai hampir bagi $-\frac{5}{1.98^2}$

$$\begin{aligned} &= y + \delta y \\ &= y + \left(\frac{dy}{dx} \times \delta x\right) \\ &= -\frac{5}{2^2} + (1.25 \times 0.02) \\ &= -1.225 \end{aligned}$$

FOKUS KBAT

- (a) Katakan jejari permukaan cecair = r cm

$$\begin{aligned} r^2 &= 8^2 - (8-h)^2 \\ &= 64 - 64 + 16h - h^2 \\ &= 16h - h^2 \end{aligned}$$

$$\begin{aligned} \text{Luas permukaan cecair, } A &= \pi r^2 \\ &= \pi(16h - h^2) \\ &= 16\pi h - \pi h^2 \end{aligned}$$

$$\frac{dA}{dh} = 16\pi - 2\pi h$$

$$\text{Diberi } \frac{dh}{dt} = 0.5 \text{ cm s}^{-1}$$

$$\begin{aligned} \text{Apabila } h = 6, \quad \frac{dA}{dt} &= \frac{dA}{dh} \times \frac{dh}{dt} \\ &= [16\pi - 2\pi(6)] \times 0.5 \\ &= 2\pi \text{ cm}^2 \text{ s}^{-1} \end{aligned}$$

- (b) $\delta h = 6.2 - 6 = 0.2$ cm

$$\begin{aligned} \delta A &\approx \frac{dA}{dh} \times \delta h \\ &= [16\pi - 2\pi(6)] \times 0.2 \\ &= 0.8\pi \text{ cm}^2 \end{aligned}$$

JAWAPAN

BAB 10: PENYELESAIAN SEGI TIGA

10.1

A

- $$\frac{a}{\sin 30^\circ} = \frac{7}{\sin 45^\circ}$$

$$a = \frac{7 \sin 30^\circ}{\sin 45^\circ}$$

$$= 4.950 \text{ cm}$$

$$\angle B = 180^\circ - 30^\circ - 45^\circ$$

$$= 105^\circ$$

$$\frac{b}{\sin 105^\circ} = \frac{7}{\sin 45^\circ}$$

$$b = \frac{7 \sin 105^\circ}{\sin 45^\circ}$$

$$= 9.562 \text{ cm}$$
- $$\angle R = 180^\circ - 100^\circ - 42^\circ$$

$$= 38^\circ$$

$$\frac{r}{\sin 38^\circ} = \frac{13}{\sin 100^\circ}$$

$$r = \frac{13 \sin 38^\circ}{\sin 100^\circ}$$

$$= 8.127 \text{ cm}$$

$$\frac{q}{\sin 42^\circ} = \frac{13}{\sin 100^\circ}$$

$$q = \frac{13 \sin 42^\circ}{\sin 100^\circ}$$

$$= 8.833 \text{ cm}$$
- $$\frac{\sin q}{8} = \frac{\sin 100^\circ}{12}$$

$$\sin q = \frac{8 \sin 100^\circ}{12}$$

$$q = 41^\circ 2'$$

$$\angle R = 180^\circ - 100^\circ - 41^\circ 2'$$

$$= 38^\circ 58'$$

$$\frac{r}{\sin 38^\circ 58'} = \frac{12}{\sin 100^\circ}$$

$$r = \frac{12 \sin 38^\circ 58'}{\sin 100^\circ}$$

$$= 7.663 \text{ cm}$$
- $$\frac{\sin r}{27.2} = \frac{\sin 105^\circ}{34.3}$$

$$\sin r = \frac{27.2 \sin 105^\circ}{34.3}$$

$$r = 50^\circ$$

$$\angle P = 180^\circ - 105^\circ - 50^\circ$$

$$= 25^\circ$$

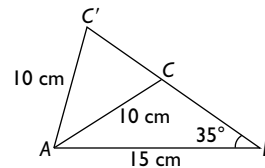
$$\frac{p}{\sin 25^\circ} = \frac{34.3}{\sin 105^\circ}$$

$$p = \frac{34.3 \sin 25^\circ}{\sin 105^\circ}$$

$$= 15.01 \text{ cm}$$

B

1.



Kes berambiguiti berlaku.

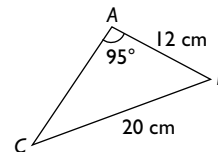
$$\frac{\sin \angle ACB}{15} = \frac{\sin 35^\circ}{10}$$

$$\sin \angle ACB = \frac{15 \sin 35^\circ}{10} = 0.8604$$

$$\angle ACB = 59^\circ 21' \text{ atau } 180^\circ - 59^\circ 21'$$

$$= 59^\circ 21' \text{ atau } 120^\circ 39'$$

2.



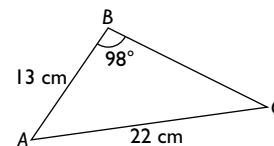
Kes berambiguiti tidak berlaku kerana $\angle A$ bukan sudut tirus dan sudut ini tidak bertentangan dengan sisi yang lebih pendek.

$$\frac{\sin \angle ACB}{12} = \frac{\sin 95^\circ}{20}$$

$$\sin \angle ACB = \frac{12 \sin 95^\circ}{20} = 0.5977$$

$$\angle ACB = 36^\circ 42'$$

3.



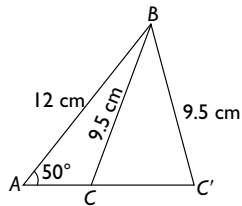
Kes berambiguiti tidak berlaku kerana $\angle B$ bukan sudut tirus dan sudut ini tidak bertentangan dengan sisi yang lebih pendek.

$$\frac{\sin \angle ACB}{13} = \frac{\sin 98^\circ}{22}$$

$$\sin \angle ACB = \frac{13 \sin 98^\circ}{22} = 0.5852$$

$$\angle ACB = 35^\circ 49'$$

4.



Kes berambiguiti berlaku.

$$\frac{\sin \angle ACB}{12} = \frac{\sin 50^\circ}{9.5}$$

$$\sin \angle ACB = \frac{12 \sin 50^\circ}{9.5} = 0.9676$$

$$\begin{aligned} \angle ACB &= 75^\circ 23' \text{ atau } 180^\circ - 75^\circ 23' \\ &= 75^\circ 23' \text{ atau } 104^\circ 37' \end{aligned}$$

C

1. (a) ABD ialah segi tiga sama kaki.

$$\angle ABD = \angle ADB$$

$$\angle ABD = \frac{180^\circ - 70^\circ}{2} = 55^\circ$$

$$\frac{AD}{\sin 55^\circ} = \frac{7.5}{\sin 70^\circ}$$

$$AD = \frac{7.5 \sin 55^\circ}{\sin 70^\circ} = 6.538 \text{ cm}$$

$$CD = AD = 6.538 \text{ cm}$$

(b) $\angle BDC = 180^\circ - 55^\circ = 125^\circ$

$$\frac{\sin \angle CBD}{6.538} = \frac{\sin \angle BDC}{12.5}$$

$$\sin \angle CBD = \frac{6.538 \sin 125^\circ}{12.5} = 0.4284$$

$$\angle CBD = 25^\circ 22'$$

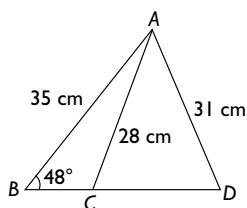
2. (a) $\frac{\sin \angle ACB}{35} = \frac{\sin 48^\circ}{28}$

$$\sin \angle ACB = \frac{35 \sin 48^\circ}{28}$$

$$= 0.9289$$

$$\begin{aligned} \angle ACB &= 180^\circ - 68^\circ 16' \\ &= 111^\circ 44' \end{aligned}$$

(b) $\angle ACD = 68^\circ 16'$



$$\frac{\sin \angle ADB}{28} = \frac{\sin 68^\circ 16'}{31}$$

$$\sin \angle ADB = \frac{28 \sin 68^\circ 16'}{31}$$

$$= 0.8390$$

$$\angle ADB = 57^\circ 2'$$

3. (a) $\frac{BD}{\sin 35^\circ} = \frac{19.2}{\sin 125^\circ}$

$$\begin{aligned} BD &= \frac{19.2 \sin 35^\circ}{\sin 125^\circ} \\ &= 13.44 \text{ cm} \end{aligned}$$

(b) $\angle BDC = 180^\circ - 125^\circ = 55^\circ$

$$\angle BCD = 180^\circ - 80^\circ - 55^\circ = 45^\circ$$

$$\frac{CD}{\sin 80^\circ} = \frac{BD}{\sin 45^\circ}$$

$$\begin{aligned} CD &= \frac{13.44 \sin 80^\circ}{\sin 45^\circ} \\ &= 18.72 \text{ cm} \end{aligned}$$

(c) $\frac{BC}{\sin 55^\circ} = \frac{BD}{\sin 45^\circ}$

$$\begin{aligned} BC &= \frac{13.44 \sin 55^\circ}{\sin 45^\circ} \\ &= 15.57 \text{ cm} \end{aligned}$$

4. (a) $AD^2 = AB^2 + BD^2$

$$= 5^2 + 13^2$$

$$= 194$$

$$AD = 13.93 \text{ cm}$$

$$\begin{aligned} \angle ACD &= 180^\circ - 35^\circ - 42^\circ \\ &= 103^\circ \end{aligned}$$

$$\frac{CD}{\sin 35^\circ} = \frac{AD}{\sin 103^\circ}$$

$$\begin{aligned} CD &= \frac{13.93 \sin 35^\circ}{\sin 103^\circ} \\ &= 8.2 \text{ cm} \end{aligned}$$

(b) Dalam $\triangle ABD$,

$$\tan \angle BAD = \frac{13}{5}$$

$$\angle BAD = 68^\circ 58'$$

10.2

A

$$1. \quad x^2 = 12^2 + 15^2 - 2(12)(15) \cos 110^\circ$$

$$= 492.1$$

$$x = \sqrt{492.1}$$

$$= 22.18$$

$$2. \quad x^2 = 8^2 + 10^2 - 2(8)(10) \cos 38.6^\circ$$

$$= 38.96$$

$$x = \sqrt{38.96}$$

$$= 6.242$$

B

$$1. \quad 6.2^2 = 4^2 + 5^2 - 2(4)(5) \cos x$$

$$2(4)(5) \cos x = 4^2 + 5^2 - 6.2^2$$

$$\cos x = \frac{4^2 + 5^2 - 6.2^2}{2(4)(5)}$$

$$= 0.064$$

$$x = 86^\circ 20'$$

$$\begin{aligned}
 2. \quad 10.2^2 &= 5.4^2 + 7.5^2 - 2(5.4)(7.5) \cos x \\
 2(5.4)(7.5) \cos x &= 5.4^2 + 7.5^2 - 10.2^2 \\
 \cos x &= \frac{5.4^2 + 7.5^2 - 10.2^2}{2(5.4)(7.5)} \\
 &= -0.23 \\
 x &= 103^\circ 18'
 \end{aligned}$$

$$\begin{aligned}
 3. \quad 13^2 &= 6^2 + 8^2 - 2(6)(8) \cos x \\
 2(6)(8) \cos x &= 6^2 + 8^2 - 13^2 \\
 \cos x &= \frac{6^2 + 8^2 - 13^2}{2(6)(8)} \\
 &= -0.7188 \\
 x &= 135^\circ 57'
 \end{aligned}$$

C

$$\begin{aligned}
 1. \quad (a) \text{ Dalam } \triangle ACD, \\
 \angle ACD &= 180^\circ - 70^\circ \\
 &= 110^\circ \\
 AD^2 &= 13^2 + 5^2 - 2(13)(5) \cos 110^\circ \\
 &= 238.46 \\
 AD &= 15.44 \text{ cm}
 \end{aligned}$$

$$\begin{aligned}
 (b) \text{ Dalam } \triangle ABC, \\
 AB^2 &= 13^2 + 20^2 - 2(13)(20) \cos 70^\circ \\
 &= 391.15 \\
 AB &= 19.78 \text{ cm}
 \end{aligned}$$

$$\begin{aligned}
 \frac{\sin \angle ABC}{13} &= \frac{\sin 70^\circ}{19.78} \\
 \sin \angle ABC &= \frac{13 \sin 70^\circ}{19.78} \\
 &= 0.61759 \\
 \angle ABC &= 38^\circ 8'
 \end{aligned}$$

$$\begin{aligned}
 2. \quad (a) \text{ Dalam } \triangle ABD, \\
 11^2 &= 5^2 + 10^2 - 2(5)(10) \cos \angle DBA \\
 \cos \angle DBA &= \frac{5^2 + 10^2 - 11^2}{2(5)(10)} \\
 &= 0.04 \\
 \angle DBA &= 87^\circ 42'
 \end{aligned}$$

$$\begin{aligned}
 (b) \sin \angle BCD &= 0.75 \\
 \angle BCD &= 48^\circ 35' \\
 \angle BDC &= 180^\circ - \angle BCD - \angle DBC \\
 &= 180^\circ - 48^\circ 35' - (180^\circ - 87^\circ 42') \\
 &= 39^\circ 7'
 \end{aligned}$$

$$\begin{aligned}
 \frac{BC}{\sin \angle BDC} &= \frac{10}{\sin \angle BCD} \\
 BC &= \frac{10 \sin 39^\circ 7'}{0.75} \\
 &= 8.412 \text{ cm}
 \end{aligned}$$

$$\begin{aligned}
 3. \quad (a) \text{ Dalam } \triangle ACE, \\
 20^2 &= 15^2 + 13^2 - 2(15)(13) \cos \angle ACE \\
 \cos \angle ACE &= \frac{15^2 + 13^2 - 20^2}{2(15)(13)} \\
 &= -0.0154 \\
 \angle ACE &= 90^\circ 53'
 \end{aligned}$$

$$\begin{aligned}
 (b) \angle CBD &= 180^\circ - 150^\circ = 30^\circ \\
 \frac{BD}{\sin 90^\circ 53'} &= \frac{5}{\sin 30^\circ} \\
 BD &= \frac{5 \sin 90^\circ 53'}{\sin 30^\circ} \\
 &= 9.999 \text{ cm}
 \end{aligned}$$

$$\begin{aligned}
 4. \quad (a) \text{ Dalam } \triangle ABC, \\
 AC^2 &= 6.5^2 + 4.3^2 - 2(6.5)(4.3) \cos 83^\circ \\
 &= 53.93 \\
 AC &= 7.344 \text{ cm}
 \end{aligned}$$

$$\begin{aligned}
 (b) \text{ Dalam } \triangle ADC, \\
 7.344^2 &= 8^2 + 10.4^2 - 2(8)(10.4) \cos \angle ADC \\
 \cos \angle ADC &= \frac{8^2 + 10.4^2 - 7.344^2}{2(8)(10.4)} \\
 \angle ADC &= 44^\circ 44'
 \end{aligned}$$

$$\begin{aligned}
 \text{Dalam } \triangle ADC, \\
 \frac{\sin \angle ACD}{8} &= \frac{\sin \angle ADC}{7.344} \\
 \sin \angle ACD &= \frac{8 \sin 44^\circ 44'}{7.344} \\
 \angle ACD &= 50^\circ 3'
 \end{aligned}$$

10.3

A

$$\begin{aligned}
 1. \text{ Luas } \triangle PQR &= \frac{1}{2}(6)(7) \sin 55^\circ \\
 &= 17.20 \text{ cm}^2 \\
 2. \text{ Luas } \triangle PQR &= \frac{1}{2}(13)(9.3) \sin 108^\circ 10' \\
 &= 57.44 \text{ cm}^2 \\
 3. \text{ Luas } \triangle ABC &= \frac{1}{2}(14)(6) \sin 35^\circ 21' \\
 &= 24.30 \text{ cm}^2 \\
 4. \text{ Luas } \triangle LMN &= \frac{1}{2}(9.5)(8) \sin 88^\circ \\
 &= 37.98 \text{ cm}^2
 \end{aligned}$$

B

$$1. \angle ABC = 180^\circ - 60^\circ - 35^\circ = 85^\circ$$

Gunakan petua sinus:

$$\begin{aligned}
 \frac{AC}{\sin 85^\circ} &= \frac{10}{\sin 35^\circ} \\
 AC &= \frac{10 \sin 85^\circ}{\sin 35^\circ} \\
 &= 17.368 \text{ cm}
 \end{aligned}$$

$$\begin{aligned}
 \text{Luas } \triangle ABC &= \frac{1}{2}(10)(17.368) \sin 60^\circ \\
 &= 75.21 \text{ cm}^2
 \end{aligned}$$

2. Gunakan petua sinus:

$$\frac{\sin \angle LNM}{9} = \frac{\sin 60^\circ}{12}$$

$$\sin \angle LNM = \frac{9 \sin 60^\circ}{12}$$

$$= 0.6495$$

$$\angle LNM = 40^\circ 30'$$

$$\angle MLN = 180^\circ - 60^\circ - 40^\circ 30'$$

$$= 79^\circ 30'$$

$$\text{Luas } \triangle LMN = \frac{1}{2}(9)(12) \sin 79^\circ 30'$$

$$= 53.10 \text{ cm}^2$$

C

1. Luas $\triangle ABC = 16.09 \text{ cm}^2$

$$\frac{1}{2}(6)(AB) \sin 50^\circ = 16.09$$

$$AB = \frac{16.09}{3 \sin 50^\circ}$$

$$= 7.001 \text{ cm}$$

2. Luas $\triangle PQR = 49.24 \text{ cm}^2$

$$\frac{1}{2}(10^2) \sin \angle QPR = 49.24$$

$$\sin \angle QPR = \frac{49.24}{50}$$

$$\angle QPR = 80^\circ$$

$$\text{Maka, } \angle PQR = \frac{180^\circ - 80^\circ}{2} = 50^\circ$$

Praktis Formatif: Kertas 2

1. (a) $\frac{\sin \angle DBC}{24.2} = \frac{\sin 65^\circ}{22.6}$

$$\sin \angle DBC = \frac{24.2 \sin 65^\circ}{22.6}$$

$$= 0.97047$$

$$\angle DBC = \sin^{-1} 0.97047$$

$$= 76.04^\circ$$

(b) $\angle BCD = 180^\circ - 65^\circ - 76.04^\circ$

$$= 38.96^\circ$$

$$BD^2 = 22.6^2 + 24.2^2 - 2(22.6)(24.2) \cos 38.96^\circ$$

$$= 245.846$$

$$BD = \sqrt{245.846} = 15.68 \text{ m}$$

(c) $VB^2 = 6^2 + 9^2 = 117$

$$VD^2 = 6^2 + 8^2 = 100$$

$$VD = 10 \text{ m}$$

$$VB^2 = VD^2 + BD^2 - 2(VD)(BD) \cos \angle VDB$$

$$117 = 100 + 245.86 - 2(10)(15.68) \cos \angle VDB$$

$$\cos \angle VDB = 0.729783$$

$$\angle VDB = \cos^{-1} 0.729783$$

$$= 43.13^\circ$$

$$\text{Luas satah } VBD = \frac{1}{2}(15.68)(10) \sin 43.13^\circ$$

$$= 53.60 \text{ m}^2$$

2. (a) (i) Dalam $\triangle PQR$,

$$\frac{\sin \angle PRQ}{12} = \frac{\sin 86.42^\circ}{14}$$

$$\sin \angle PRQ = \frac{12 \sin 86.42^\circ}{14}$$

$$\angle PRQ = 58.81^\circ$$

(ii) Dalam $\triangle TQR$,

$$\angle TQR = 180^\circ - 2(58.81^\circ)$$

$$= 62.38^\circ$$

$$\frac{TR}{\sin 62.38^\circ} = \frac{8}{\sin 58.81^\circ}$$

$$TR = \frac{8 \sin 62.38^\circ}{\sin 58.81^\circ}$$

$$= 8.286 \text{ cm}$$

(iii) Dalam $\triangle PQT$,

$$\angle PQT = 86.42^\circ - 62.38^\circ$$

$$= 24.04^\circ$$

$$\text{Luas } \triangle PQT = \frac{1}{2}(12)(8) \sin 24.04^\circ$$

$$= 19.55 \text{ cm}^2$$

(b) $\angle RQS = \angle TQR = 62.38^\circ$

$$\angle PQS = 84.62^\circ + 62.38^\circ = 147^\circ$$

$$PS^2 = 12^2 + 8^2 - 2(12)(8) \cos 147^\circ$$

$$= 369.02$$

$$PS = 19.21 \text{ cm}$$

3. (a) (i) Luas $\triangle PQR = 34.41 \text{ cm}^2$

$$\frac{1}{2}(QR)(10) \sin 35^\circ = 34.41$$

$$QR = \frac{2 \times 34.41}{10 \sin 35^\circ}$$

$$= 12 \text{ cm}$$

(ii) $PR^2 = 12^2 + 10^2 - 2(12)(10) \cos 35^\circ$

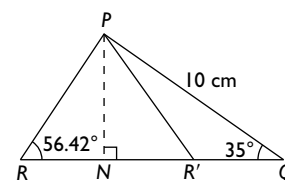
$$PR = 6.885 \text{ cm}$$

(iii) $\frac{\sin \angle PRQ}{10} = \frac{\sin 35^\circ}{6.885}$

$$\sin \angle PRQ = \frac{10 \sin 35^\circ}{6.885}$$

$$\angle PRQ = 56.42^\circ$$

(b) (i)



(ii) Lukis garis lurus PN yang berserenjang dengan RQ .

$$\angle PR'Q = 180^\circ - 56.42^\circ$$

$$= 123.58^\circ$$

$$\angle QPR' = 180^\circ - 35^\circ - 123.58^\circ$$

$$= 21.42^\circ$$

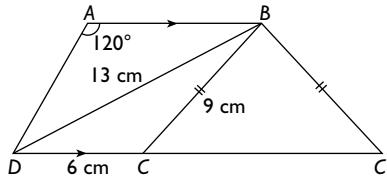
$$\text{Luas } \triangle PQR' = \frac{1}{2}(10)(6.885) \sin 21.42^\circ$$

$$= 12.57 \text{ cm}^2$$

4. (a) (i) $9^2 = 6^2 + 13^2 - 2(6)(13) \cos \angle BDC$
 $\cos \angle BDC = \frac{6^2 + 13^2 - 9^2}{2(6)(13)}$
 $\angle BDC = 37.36^\circ$

(ii) $\angle ABD = \angle BDC = 37.36^\circ$
 $\frac{AD}{\sin 37.36^\circ} = \frac{13}{\sin 120^\circ}$
 $AD = \frac{13 \sin 37.36^\circ}{\sin 120^\circ}$
 $= 9.107 \text{ cm}$

(b) (i)



(ii) $\frac{\sin \angle BCD}{13} = \frac{\sin \angle BDC}{9}$
 $\sin \angle BCD = \frac{13 \sin 37.36^\circ}{9} = 0.8765$
 $\angle BCD = 180^\circ - \sin^{-1}(0.8765)$
 $= 118.77^\circ$

Maka,

$$\angle BCC' = 180^\circ - 118.77^\circ = 61.23^\circ$$

$$\angle BC'C = \angle BCC' = 61.23^\circ$$

$$\angle CBC' = 180^\circ - 61.23^\circ - 61.23^\circ = 57.54^\circ$$

$$\text{Luas } \triangle BCC' = \frac{1}{2}(9^2) \sin 57.54^\circ = 34.17 \text{ cm}^2$$

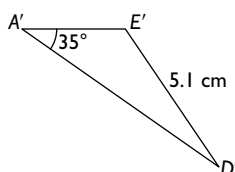
5. (a) (i) $\frac{AE}{\sin 100^\circ} = \frac{5.1}{\sin 35^\circ}$
 $AE = \frac{5.1 \sin 100^\circ}{\sin 35^\circ} = 8.756 \text{ cm}$

(ii) $AC^2 = 8^2 + 4.5^2 - 2(8)(4.5) \cos 130^\circ$
 $= 130.53$
 $AC = 11.425 \text{ cm}$

$$EC = AC - AE = 11.425 - 8.756 = 2.669 \text{ cm}$$

(iii) Luas $\triangle ADE$
 $= \frac{1}{2} \times AE \times DE \times \sin \angle AED$
 $= \frac{1}{2} (8.756)(5.1) \sin (180^\circ - 100^\circ - 35^\circ)$
 $= 15.79 \text{ cm}^2$

(b) (i)



(ii) $\angle A'E'D' = 180^\circ - 45^\circ = 135^\circ$
 $\angle A'D'E' = 180^\circ - 135^\circ - 35^\circ = 10^\circ$

6. (a) (i) $\angle BAD = 180^\circ - 72^\circ - 30^\circ = 78^\circ$

Dalam $\triangle ABD$,

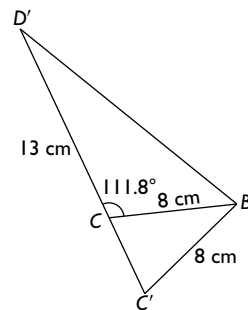
$$\frac{BD}{\sin 78^\circ} = \frac{9}{\sin 30^\circ}$$

$$BD = \frac{9 \sin 78^\circ}{\sin 30^\circ} = 17.61 \text{ cm}$$

(ii) Dalam $\triangle BCD$,
 $BD^2 = 13^2 + 8^2 - 2(13)(8) \cos \angle BCD$
 $\cos \angle BCD = \frac{13^2 + 8^2 - 17.61^2}{2(13)(8)}$
 $\angle BCD = 111.76^\circ$

(iii) Luas sisi empat ABCD
 $= \text{Luas } \triangle BCD + \text{Luas } \triangle ABD$
 $= \frac{1}{2}(13)(8) \sin 111.76^\circ + \frac{1}{2}(9)(17.61) \sin 72^\circ$
 $= 123.7 \text{ cm}^2$

(b) (i)



(ii) $\angle B'C'D' = 180^\circ - 111.76^\circ = 68.24^\circ$

7. (a) (i) Dalam $\triangle ABD$,
 $BD^2 = 8.5^2 + 6.7^2 - 2(8.5)(6.7) \cos 82^\circ$
 $= 101.29$
 $BD = 10.06 \text{ cm}$

(ii) $\angle BCD = 180^\circ - 82^\circ = 98^\circ$

Dalam $\triangle BCD$,

$$\frac{\sin \angle CBD}{5} = \frac{\sin 98^\circ}{10.06}$$

$$\sin \angle CBD = \frac{5 \sin 98^\circ}{10.06}$$

 $\angle CBD = 29.5^\circ$

(b) (i) Luas segi tiga BCD

$$= \frac{1}{2}(5)(7.8) \sin 98^\circ = 19.31 \text{ cm}^2$$

(ii) $\frac{1}{2} \times BD \times \text{Jarak terdekat} = 19.31$

$$\frac{1}{2} \times 10.06 \times \text{Jarak terdekat} = 19.31$$

$$\text{Jarak terdekat} = \frac{19.31 \times 2}{10.06} = 3.839 \text{ cm}$$

FOKUS KBAT

$$(a) \angle QPR = \frac{\angle QOR}{2} = \frac{80^\circ}{2} = 40^\circ$$

$$\angle ORQ = \frac{180^\circ - 80^\circ}{2} = 50^\circ$$

$$\angle PQR = 180^\circ - 15^\circ - 50^\circ - 40^\circ = 75^\circ$$

Dalam ΔOQR ,

$$QR^2 = 6^2 + 6^2 - 2(6)(6) \cos 80^\circ$$
$$= 59.4973$$

$$QR = 7.7134 \text{ cm}$$

Dalam ΔPQR ,

$$\frac{PR}{\sin 75^\circ} = \frac{7.7134}{\sin 40^\circ}$$

$$PR = \frac{7.7134 \times \sin 75^\circ}{\sin 40^\circ}$$
$$= 11.591 \text{ cm}$$

$$(b) \angle PSR = 180^\circ - \angle PQR$$
$$= 180^\circ - 75^\circ$$
$$= 105^\circ$$

Dalam ΔPRS ,

$$\frac{SR}{\sin 42^\circ} = \frac{11.591}{\sin 105^\circ}$$

$$SR = \frac{11.591 \times \sin 42^\circ}{\sin 105^\circ}$$
$$= 8.0295 \text{ cm}$$

Luas kawasan berlorek

$$= \text{Luas bulatan} - \text{Luas } \Delta PRS - \text{Luas } \Delta PQR$$

$$= \pi(6^2) - \frac{1}{2}(8.0295)(11.591) \sin 33^\circ$$

$$- \frac{1}{2}(11.591)(7.7134) \sin 65^\circ$$

$$= 36(3.142) - 25.345 - 40.515$$

$$= 47.252 \text{ cm}^2$$

JAWAPAN

BAB 11: NOMBOR INDEKS

11.1

A

1. Q_{15} = Bilangan pekerja pada tahun 2015

Q_{17} = Bilangan pekerja pada tahun 2017

$$\begin{aligned}\text{Nombor indeks} &= \frac{Q_{17}}{Q_{15}} \times 100 \\ &= \frac{442}{520} \times 100 \\ &= 85\end{aligned}$$

2. Q_{10} = Bilangan beg yang dijual pada tahun 2010

Q_{13} = Bilangan beg yang dijual pada tahun 2013

$$\begin{aligned}\text{Nombor indeks} &= \frac{Q_{13}}{Q_{10}} \times 100 \\ &= \frac{8\,840}{6\,500} \times 100 \\ &= 136\end{aligned}$$

B

1. Q_{08} = RM1.20

Q_{11} = RM1.35

$$\begin{aligned}I_{11/08} &= \frac{Q_{11}}{Q_{08}} \times 100 \\ &= \frac{1.35}{1.20} \times 100 \\ &= 112.5\end{aligned}$$

2. Q_{05} = RM12

Q_{11} = RM15

$$\begin{aligned}I_{11/05} &= \frac{Q_{11}}{Q_{05}} \times 100 \\ &= \frac{15}{12} \times 100 \\ &= 125\end{aligned}$$

3. Q_{07} = RM10.00

Q_{11} = RM14.50

$$\begin{aligned}I_{11/07} &= \frac{Q_{11}}{Q_{07}} \times 100 \\ &= \frac{14.50}{10.00} \times 100 \\ &= 145\end{aligned}$$

C

1. $I_{12/09} = 80$

$$\frac{Q_{12}}{Q_{09}} \times 100 = 80$$

$$\frac{Q_{12}}{\text{RM}750} \times 100 = 80$$

$$\begin{aligned}Q_{12} &= \frac{80 \times \text{RM}750}{100} \\ &= \text{RM}600\end{aligned}$$

2. $I_{10/06} = 120$

$$\frac{Q_{10}}{Q_{06}} \times 100 = 120$$

$$\frac{Q_{10}}{\text{RM}350} \times 100 = 120$$

$$\begin{aligned}Q_{10} &= \frac{120 \times \text{RM}350}{100} \\ &= \text{RM}420\end{aligned}$$

3. $I_{13/10} = 130$

$$\frac{Q_{13}}{Q_{10}} \times 100 = 130$$

$$\frac{Q_{13}}{\text{RM}30\,000} \times 100 = 130$$

$$\begin{aligned}Q_{13} &= \frac{130 \times \text{RM}30\,000}{100} \\ &= \text{RM}39\,000\end{aligned}$$

D

1. $I_{09/07} = \frac{Q_{09}}{Q_{07}} \times 100 = 80$

$$\frac{Q_{09}}{Q_{07}} = \frac{80}{100}$$

$$I_{12/07} = \frac{Q_{12}}{Q_{07}} \times 100 = 120$$

$$\frac{Q_{12}}{Q_{07}} = \frac{120}{100}$$

$$\begin{aligned}I_{12/09} &= \frac{Q_{12}}{Q_{09}} \times 100 \\ &= \left(\frac{Q_{12}}{Q_{07}} \times \frac{Q_{07}}{Q_{09}} \right) \times 100 \\ &= \left(\frac{120}{100} \times \frac{100}{80} \right) \times 100 \\ &= 150\end{aligned}$$

atau

$$\begin{aligned}I_{12/09} &= \frac{I_{12/07}}{I_{09/07}} \times 100 \\ &= \frac{120}{80} \times 100 \\ &= 150\end{aligned}$$

$$2. I_{08/06} = \frac{Q_{08}}{Q_{06}} \times 100$$

$$= 105$$

$$I_{10/06} = \frac{Q_{10}}{Q_{06}} \times 100$$

$$= 125$$

$$I_{10/08} = \frac{I_{10/06}}{I_{08/06}} \times 100$$

$$= \frac{125}{105} \times 100$$

$$= 119$$

$$\frac{Q_{10}}{Q_{08}} \times 100 = 119$$

$$\frac{\text{RM}5.00}{Q_{08}} \times 100 = 119$$

$$Q_{08} = \frac{\text{RM}5.00 \times 100}{119}$$

$$= \text{RM}4.20$$

11.2

A

1.	Nombor indeks, I_i	120	105	130	145
	Pemberat, W_i	5	4	6	5
	$I_i W_i$	600	420	780	725

$$\bar{I} = \frac{600 + 420 + 780 + 725}{5 + 4 + 6 + 5}$$

$$= \frac{2\,525}{20}$$

$$= 126.25$$

2.	Nombor indeks, I_i	90	110	105	85
	Pemberat, W_i	3	4	5	4
	$I_i W_i$	270	440	525	340

$$\bar{I} = \frac{270 + 440 + 525 + 340}{3 + 4 + 5 + 4}$$

$$= \frac{1\,575}{16}$$

$$= 98.44$$

B

$$1. 114.5 = \frac{115b + 180(4) + 85(7) + 105(6)}{b + 4 + 7 + 6}$$

$$114.5 = \frac{115b + 1\,945}{b + 17}$$

$$114.5b + 1\,946.5 = 115b + 1\,945$$

$$115b - 114.5b = 1\,946.5 - 1\,945$$

$$0.5b = 1.5$$

$$b = 3$$

$$2. 122 = \frac{90(2) + 200(3) + 110c + 100(5)}{2 + 3 + c + 5}$$

$$122 = \frac{1\,280 + 110c}{10 + c}$$

$$1\,220 + 122c = 1\,280 + 110c$$

$$122c - 110c = 1\,280 - 1\,220$$

$$12c = 60$$

$$c = 5$$

$$3. 129 = \frac{120(3) + 4d + 200(1) + 95(2)}{3 + 4 + 1 + 2}$$

$$129 = \frac{360 + 4d + 200 + 190}{10}$$

$$1\,290 = 750 + 4d$$

$$4d = 540$$

$$d = 135$$

C

$$1. (a) \text{ Diberi } \bar{I} = 130.$$

$$130(4) + 120a + 125(2)$$

$$130 = \frac{+ 150(1) + 140(2)}{4 + a + 2 + 1 + 2}$$

$$130 = \frac{1\,200 + 120a}{a + 9}$$

$$130a + 1\,170 = 1\,200 + 120a$$

$$130a - 120a = 1\,200 - 1\,170$$

$$10a = 30$$

$$a = 3$$

$$(b) \quad \bar{I} = 130$$

$$\frac{Q_{18}}{Q_{15}} \times 100 = 130$$

$$\frac{Q_{18}}{\text{RM}45} \times 100 = 130$$

$$Q_{18} = \frac{130}{100} \times \text{RM}45$$

$$= \text{RM}58.50$$

2. (a) $\frac{a}{5\,600} \times 100 = 150$
 $a = \frac{150 \times 5\,600}{100}$
 $= 8\,400$

$b = \frac{12\,000}{9\,600} \times 100 = 125$

$\frac{4\,400}{c} \times 100 = 110$
 $c = \frac{4\,400 \times 100}{110}$
 $= 4\,000$

(b) $\bar{I}_{12/11} = \frac{150(3) + 125(2) + 110(10)}{3 + 2 + 10}$
 $= 120$

(c) (i) $\bar{I}_{13/11} = 120 \times \frac{115}{100} = 138$

(ii) $\bar{I}_{13/11} = 138$

$\frac{\text{Sewa pada tahun 2013}}{\text{Sewa pada tahun 2011}} \times 100 = 138$

$\frac{\text{Sewa pada tahun 2013}}{\text{RM76\,000}} = \frac{138}{100}$

Sewa pada tahun 2013
 $= \frac{138}{100} \times \text{RM76\,000}$
 $= \text{RM104\,880}$

Praktis Formatif: Kertas 2

1. (a) (i) $I_{13/10} = \frac{Q_{13}}{Q_{10}} \times 100 = 110$
 $\frac{\text{RM5.50}}{Q_{10}} \times 100 = 110$
 $Q_{10} = \frac{\text{RM5.50} \times 100}{110}$
 $= \text{RM5.00}$

(ii) $I_{13/10} = \frac{Q_{13}}{Q_{10}} \times 100 = 140$
 $\frac{Q_{13}}{\text{RM3.50}} \times 100 = 140$
 $Q_{13} = \frac{140 \times \text{RM3.50}}{100}$
 $= \text{RM4.90}$

(b) $\bar{I}_{13/10} = 115.5$
 $\frac{110(2) + 120(4) + 3x + 140(1)}{2 + 4 + 3 + 1} = 115.5$
 $\frac{840 + 3x}{10} = 115.5$
 $840 + 3x = 1\,155$
 $3x = 315$
 $x = 105$

(c) Indeks harga bahan pada tahun 2015 berasarkan tahun 2010:

Bahan A : $I_A = 110 \times 1.1 = 121$

Bahan B : $I_B = 120$

Bahan C : $I_C = 105 \times 0.95 = 99.75$

Bahan D : $I_D = 140$

$$\bar{I}_{15/10} = \frac{121(2) + 120(4) + 99.75(3) + 140(1)}{2 + 4 + 3 + 1}$$

$$= 116.1$$

(d) $\bar{I}_{15/10} = 116.1$

$$\frac{Q_{15}}{Q_{10}} \times 100 = 116.1$$

$$\frac{Q_{15}}{\text{RM15}} \times 100 = 116.1$$

$$Q_{15} = \frac{116.1 \times \text{RM15}}{100}$$

$$= \text{RM17.42}$$

2. (a) $\frac{\text{Harga bahan P pada tahun 2014}}{\text{RM30}} \times 100$

$$= 120$$

Harga bahan P pada tahun 2014

$$= \frac{120}{100} \times \text{RM30}$$

$$= \text{RM36}$$

(b) $\frac{120(2) + 110(1) + 95(4) + 3m}{2 + 1 + 4 + 3} = 103$

$$\frac{730 + 3m}{10} = 103$$

$$730 + 3m = 1\,030$$

$$3m = 300$$

$$m = 100$$

Indeks harga = 100 bermaksud tiada perubahan harga bagi bahan S dari tahun 2012 ke tahun 2014.

(c) (i) Indeks gubahan = 103×1.15
 $= 118.45$

(ii) $\frac{\text{Harga kek pada tahun 2015}}{\text{RM85}} \times 100$
 $= 118.45$

Harga kek pada tahun 2015

$$= \frac{118.45}{100} \times \text{RM85}$$

$$= \text{RM100.68}$$

$$3. (a) (i) \quad m = \frac{Q_{15}}{Q_{11}} \times 100$$

$$= \frac{RM15.40}{RM14.00} \times 100$$

$$= 110$$

$$(ii) \quad \frac{Q_{13}}{Q_{11}} \times 100 = 105$$

$$\frac{Q_{13}}{RM14.00} \times 100 = 105$$

$$Q_{13} = \frac{105 \times RM14.00}{100}$$

$$= RM14.70$$

$$(b) (i) \quad \bar{I} = 106.2$$

$$\frac{108(3) + 106h + 105(4)}{3 + h + 4} = 106.2$$

$$\frac{744 + 106h}{7 + h} = 106.2$$

$$744 + 106h = 743.4 + 106.2h$$

$$106.2h - 106h = 744 - 743.4$$

$$0.2h = 0.6$$

$$h = 3$$

$$(ii) \quad \frac{Q_{13}}{Q_{11}} \times 100 = 106.2$$

$$\frac{RM60.50}{Q_{11}} \times 100 = 106.2$$

$$Q_{11} = \frac{RM60.50 \times 100}{106.2}$$

$$= RM56.97$$

$$(c) \quad I_{15/13} = \frac{Q_{15}}{Q_{13}} \times 100$$

$$= \frac{Q_{15}}{Q_{11}} \times \frac{Q_{11}}{Q_{13}} \times 100$$

$$= \frac{125}{100} \times \frac{100}{106.2} \times 100$$

$$= 117.7$$

$$4. (a) \quad \frac{R}{60} \times 100 = 120$$

$$R = \frac{120 \times 60}{100} = 72$$

$$\frac{98}{S} \times 100 = 140$$

$$S = \frac{98 \times 100}{140} = 70$$

$$\frac{T}{50} \times 100 = 110$$

$$T = \frac{110 \times 50}{100} = 55$$

(b) Indeks harga bahan mentah pada tahun 2017 berasaskan tahun 2012:

$$\text{Bahan A : } 120 \times 110\% = 120 \times \frac{110}{100}$$

$$= 132$$

$$\text{Bahan B : } 140 \times 105\% = 140 \times \frac{105}{100}$$

$$= 147$$

Bahan C : 110

$$\text{Bahan D : } 150 \times 90\% = 150 \times \frac{90}{100}$$

$$= 135$$

(c) (i) Indeks gubahan pada tahun 2017 berasaskan tahun 2012

$$\frac{132(20) + 147(25) + 110(30) + 135(15)}{20 + 25 + 30 + 15}$$

$$= 129.3$$

$$(ii) \quad \bar{I}_{17/12} = 129.3$$

$$\frac{RM274.50}{\text{Harga kos pada tahun 2012}} \times 100 = 129.3$$

Harga kos pada tahun 2012

$$= \frac{RM274.50 \times 100}{129.3}$$

$$= RM212.30$$

$$5. (a) (i) \quad x = 100 + 15 = 115$$

$$(ii) \quad \frac{RM3.00}{y} \times 100 = 115$$

$$y = \frac{RM3.00 \times 100}{115}$$

$$= RM2.61$$

(b) Indeks gubahan, \bar{I}

$$= \frac{130(50) + 115(20) + 200(1)}{50 + 20 + 1}$$

$$= \frac{9\,000}{71}$$

$$= 126.8$$

$$(c) (i) \quad \frac{Q_{2018}}{Q_{2014}} \times 100 = 145$$

$$\frac{Q_{2018}}{Q_{2014}} = 1.45$$

Indeks gubahan pada tahun 2016 berasaskan tahun 2014

$$= \frac{Q_{2016}}{Q_{2014}} \times 100$$

$$= \frac{Q_{2016}}{Q_{2018}} \times \frac{Q_{2018}}{Q_{2014}} \times 100$$

$$= \frac{1}{1.268} \times 1.45 \times 100$$

$$= 114.4$$

$$(ii) \quad \frac{Q_{2018}}{Q_{2014}} \times 100 = 145$$

$$\frac{Q_{2018}}{22 \text{ sen}} \times 100 = 145$$

$$Q_{2018} = \frac{22 \text{ sen} \times 145}{100}$$

$$= 31.90 \text{ sen}$$

Bilangan aiskrim yang dapat dihasilkan

$$= \frac{RM150}{31.90 \text{ sen}}$$

$$= \frac{150 \times 100 \text{ sen}}{31.90 \text{ sen}}$$

$$= 470.22 \text{ batang}$$

Bilangan maksimum aiskrim yang dapat dihasilkan pada tahun 2018 ialah 470 batang.

FOKUS KBAT

$$\begin{aligned} \text{(a) Harga beg} &= \text{RM}90 \times \frac{110}{100} \\ &= \text{RM}99.00 \end{aligned}$$

$$\begin{aligned} \text{(b) } \bar{I}_{18} &= 136.95 \\ \bar{I}_{17} \times \frac{110}{100} &= 136.95 \\ \bar{I}_{17} &= \frac{136.95 \times 100}{110} = 124.5 \\ I_{\text{Kasut}} &= \frac{54}{40} \times 100 = 135 \\ I_{\text{Beg}} &= \frac{90}{75} \times 100 = 120 \end{aligned}$$

$$\frac{135(120) + 120(180) + I_{\text{Payung}}(60)}{360} = 124.5$$

$$\frac{60 I_{\text{Payung}} + 37\,800}{360} = 124.5$$

$$60 I_{\text{Payung}} + 37\,800 = 44\,820$$

$$60 I_{\text{Payung}} = 7\,020$$

$$I_{\text{Payung}} = 117$$

$$I_{\text{Payung}} = \frac{x}{\text{RM}30} \times 100 = 117$$

$$\begin{aligned} x &= \frac{117 \times \text{RM}30}{100} \\ &= \text{RM}35.10 \end{aligned}$$

Harga payung pada tahun 2017 ialah RM35.10.

$$\begin{aligned} \text{(c) } I_{16/17} \times \frac{125}{100} &= 135 \\ I_{16/17} &= \frac{135 \times 100}{125} \\ &= 108 \end{aligned}$$

JAWAPAN

PENILAIAN AKHIR TAHUN

KERTAS 1

1. $f(m) = 2g(m)$

$$3m + 6 = 2\left(\frac{m+2}{4}\right)$$

$$6m + 12 = m + 2$$

$$5m = -10$$

$$m = -2$$

2. (a) $\{(2, r), (4, p), (6, p), (8, s)\}$

(b) Hubungan banyak kepada satu

(c) Julat = $\{p, r, s\}$

3. (a) $f(x) = x^2 - 6x + m$
 $= x^2 - 6x + 3^2 - 3^2 + m$
 $= (x - 3)^2 - 3^2 + m$
 $= (x - 3)^2 - 9 + m$

(b) Titik minimum ialah $(a, 6)$.

Maka, $(a, 6) = (3, -9 + m)$

Jadi, $a = 3$ dan $-9 + m = 6$

$$m = 6 + 9$$

$$= 15$$

4. (a) Katakan punca-punca persamaan ialah m dan $2m$.

HTP : $m + 2m = p + 6$

$$3m = p + 6$$

$$p = 3m - 6$$

HDP : $m \times 2m = 2p^2$

$$2m^2 = 2p^2$$

$$m = p$$

Iaitu, $m = 3m - 6$

$$2m = 6$$

$$m = 3$$

Nilai hasil tambah punca = $3m$

$$= 3 \times 3$$

$$= 9$$

(b) Bagi dua punca yang sama, $b^2 - 4ac = 0$.

Maka, $(-3n)^2 - 4(m)(9m) = 0$

$$9n^2 - 36m^2 = 0$$

$$9n^2 = 36m^2$$

$$\frac{m^2}{n^2} = \frac{9}{36}$$

$$\frac{m}{n} = \frac{3}{6}$$

$$\frac{m}{n} = \frac{1}{2}$$

Maka, $m : n = 1 : 2$.

5. (a) Dari $f(x) = -2(x + k)^2 + 4$,
titik maksimum = $(-k, 4)$.

Maka, $(-k, 4) = (3, h)$

$$-k = 3 \quad \text{dan} \quad h = 4$$

$$k = -3$$

(b) Paksi simetri melalui titik $(3, 4)$ dan selari dengan paksi-y.

Persamaan paksi simetri ialah $x = 3$.

6. (a) Katakan $f^{-1}(x) = y$.

$$f[f^{-1}(x)] = f(y)$$

$$x = 2y + 10$$

$$2y = x - 10$$

$$y = \frac{x - 10}{2}$$

Maka, $f^{-1}(x) = \frac{x - 10}{2}$

(b) $f^2(x) = f(2x + 10)$

$$= 2(2x + 10) + 10$$

$$= 4x + 20 + 10$$

$$= 4x + 30$$

$$f^2\left(\frac{5}{2}p\right) = 50$$

$$4\left(\frac{5}{2}p\right) + 30 = 50$$

$$10p = 20$$

$$p = 2$$

7. $y = 2x^2 - 8x + 1$ ①

$y = 2x - 7$ ②

Samakan ① dan ②.

$$2x^2 - 8x + 1 = 2x - 7$$

$$2x^2 - 10x + 8 = 0$$

$$x^2 - 5x + 4 = 0$$

$$(x - 1)(x - 4) = 0$$

$$x = 1 \text{ atau } 4$$

Apabila $x = 1$, $y = 2(1) - 7 = -5$

Apabila $x = 4$, $y = 2(4) - 7 = 1$

Koordinat bagi titik A dan titik B masing-masing ialah $(1, -5)$ dan $(4, 1)$.

8. $3^{x+3} - 3^x = \frac{26}{3}$

$$3^x(3^3) - 3^x = \frac{26}{3}$$

$$3^x(3^3 - 1) = \frac{26}{3}$$

$$3^x(27 - 1) = \frac{26}{3}$$

$$26(3^x) = \frac{26}{3}$$

$$3^x = \frac{1}{3} = 3^{-1}$$

$$x = -1$$

$$\begin{aligned}
 9. \quad & (x+3)(x+2-m) = 0 \\
 & x^2 + (2-m)x + 3x + 6 - 3m = 0 \\
 & x^2 + (2-m+3)x + 6 - 3m = 0 \\
 & x^2 + (5-m)x + 6 - 3m = 0 \\
 & \text{Bandingkan dengan } x^2 - (n+1)x + 15 = 0. \\
 & \text{Maka, } 6 - 3m = 15 \quad \text{dan} \quad 5 - m = -(n+1) \\
 & \quad -3m = 9 \quad \quad \quad 5 - (-3) = -n - 1 \\
 & \quad \quad m = -3 \quad \quad \quad 8 = -n - 1 \\
 & \quad \quad \quad \quad \quad \quad 9 = -n \\
 & \quad \quad \quad \quad \quad \quad n = -9
 \end{aligned}$$

$$\begin{aligned}
 10. \quad & y = (x-4)^2 + 2 \quad \dots\dots \textcircled{1} \\
 & \text{Gantikan } y = 6 \text{ ke dalam } \textcircled{1} \text{ untuk mencari} \\
 & \text{koordinat titik } A \text{ dan titik } B. \\
 & \quad 6 = (x-4)^2 + 2 \\
 & \quad (x-4)^2 = 4 \\
 & \quad x-4 = \pm 2 \\
 & \quad x-4 = 2 \quad \text{atau} \quad x-4 = -2 \\
 & \quad \quad x = 6 \quad \quad \quad \quad x = 2
 \end{aligned}$$

Maka, koordinat titik A dan titik B masing-masing ialah (2, 6) dan (6, 6).

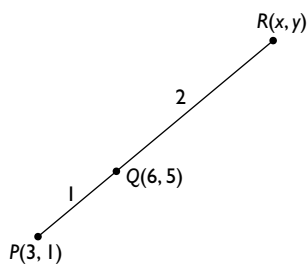
$$\begin{aligned}
 \text{Panjang } AB &= 6 - 2 \\
 &= 4 \text{ unit}
 \end{aligned}$$

Koordinat titik C ialah (4, 2).

$$\begin{aligned}
 \text{Tinggi segi tiga } ABC &= 6 - 2 \\
 &= 4 \text{ unit}
 \end{aligned}$$

$$\begin{aligned}
 \text{Luas segi tiga } ABC &= \frac{1}{2} \times 4 \times 4 \\
 &= 8 \text{ unit}^2
 \end{aligned}$$

11. Katakan koordinat titik R ialah (x, y).



$$\text{Maka, } \left(\frac{x+2(3)}{1+2}, \frac{y+2(1)}{1+2} \right) = (6, 5)$$

$$\begin{aligned}
 \frac{x+6}{3} = 6 \quad \text{dan} \quad \frac{y+2}{3} = 5 \\
 x+6 = 18 \quad \quad \quad y+2 = 15 \\
 x = 18 - 6 \quad \quad \quad y = 15 - 2 \\
 x = 12 \quad \quad \quad y = 13
 \end{aligned}$$

Koordinat titik R ialah (12, 13).

$$12. \text{ Dalam } \Delta AMO, AM = \frac{20 \text{ cm}}{2} = 10 \text{ cm}$$

$$\tan \angle AOM = \frac{10}{50} = 0.2$$

$$\angle AOM = \tan^{-1} 0.2 = 11.31^\circ$$

$$\begin{aligned}
 \angle AOB &= 2 \times \angle AOM \\
 &= 2 \times 11.31^\circ \\
 &= 22.62^\circ \\
 &= 0.3948 \text{ rad}
 \end{aligned}$$

$$\begin{aligned}
 AO^2 &= AM^2 + MO^2 \\
 &= 10^2 + 50^2 \\
 &= 2600
 \end{aligned}$$

$$\begin{aligned}
 AO &= \sqrt{2600} \\
 &= 50.99 \text{ cm}
 \end{aligned}$$

$$\begin{aligned}
 \text{Luas sektor } AOB &= \frac{1}{2} \times 50.99^2 \times 0.3948 \\
 &= 513.3 \text{ cm}^2
 \end{aligned}$$

13. Katakan titik A(x, y) ialah suatu titik pada garis lurus yang dilukis oleh Nasir.

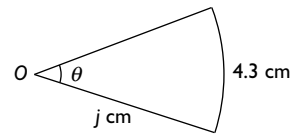
$$\begin{aligned}
 \text{Maka, } AP &= AQ \\
 (x-6)^2 + (y-0)^2 &= (x-3)^2 + (y-2)^2 \\
 x^2 - 12x + 36 + y^2 &= x^2 - 6x + 9 + y^2 - 4y + 4 \\
 -12x + 36 &= -6x - 4y + 13 \\
 4y &= 6x - 23 \\
 y &= \frac{3}{2}x - \frac{23}{4}
 \end{aligned}$$

Pernyataan Nasir adalah tidak betul

Kecerunan garis lurus itu ialah $\frac{3}{2}$.

14. Katakan j dan θ masing-masing ialah jejari dan sudut bagi sektor asal.

$$\text{(a) Bagi sektor asal: } j\theta = 4.3$$



Bagi sektor yang diperbesarkan:

$$\frac{1}{2} \times (2j)^2 \times \theta = 86$$

$$2j \times j\theta = 86$$

$$2j \times 4.3 = 86$$

$$j = 10 \text{ cm}$$

$$\text{(b) } j\theta = 4.3$$

$$10 \times \theta = 4.3$$

$$\theta = 0.43 \text{ radian}$$

$$15. \log_m \left(\frac{48m}{9} \right) = \log_m 48m - \log_m 9$$

$$= \log_m 48 + \log_m m - \log_m 3^2$$

$$= \log_m (4 \times 4 \times 3) + 1 - 2 \log_m 3$$

$$= \log_m 4 + \log_m 4 + \log_m 3 + 1 - 2p$$

$$= r + r + p + 1 - 2p$$

$$= 2r - p + 1$$

16. (a) $\theta + 5\theta = 2\pi$

$$6\theta = 2\pi$$

$$\theta = \frac{\pi}{3} \text{ rad}$$

(b) Katakan jejari $OA = j$ cm.

$$\text{Lengkok } AB + \text{Lengkok } DC = 5\pi$$

$$j\left(\frac{\pi}{3}\right) + 2j\left(\frac{\pi}{3}\right) = 5\pi$$

$$3j\left(\frac{\pi}{3}\right) = 5\pi$$

$$j = 5 \text{ cm}$$

$$OD = 2 \times 5 \text{ cm} = 10 \text{ cm}$$

17. (a) $\sum x = 38 + 43 + 49 + 52 + 53 + 54 + 55$

$$+ 55 + h$$

$$= 399 + h$$

$$N = 9$$

Diberi min = 51.

$$\text{Maka, } \frac{399 + h}{9} = 51$$

$$399 + h = 459$$

$$h = 60$$

(b) $\sum x^2 = 38^2 + 43^2 + 49^2 + 52^2 + 53^2 + 54^2$

$$+ 55^2 + 55^2 + 60^2$$

$$= 23\,773$$

$$\text{Varians} = \frac{\sum x^2}{N} - \bar{x}^2$$

$$= \frac{23\,773}{9} - 51^2$$

$$= 40.44$$

18. Bagi L_1 : $3x - 4y + 6 = 0$

$$4y = 3x + 6$$

$$y = \frac{3}{4}x + \frac{3}{2}$$

$$\text{Kecerunan} = \frac{3}{4}$$

$$\text{Pintasan-}y = \frac{3}{2}$$

Bagi L_2 : $my - x + b = 0$

$$my = x - b$$

$$y = \frac{1}{m}x - \frac{b}{m}$$

$$\text{Kecerunan} = \frac{1}{m}$$

$$\text{Pintasan-}y = -\frac{b}{m}$$

Maka, $\frac{3}{4}\left(\frac{1}{m}\right) = -1$

$$m = -\frac{3}{4}$$

dan $-\frac{b}{m} = \frac{3}{2}$

$$b = -\frac{3}{2}m$$

$$= -\frac{3}{2} \times \left(-\frac{3}{4}\right)$$

$$= \frac{9}{8}$$

19. Katakan koordinat titik P ialah (a, b) .

$$OP = 5k \text{ unit}$$

$$\text{Maka, } a^2 + b^2 = (5k)^2$$

$$a^2 + b^2 = 25k^2 \quad \dots\dots \textcircled{1}$$

$$\text{Bagi } 8y - 6x = 0:$$

$$\text{Kecerunan} = \frac{6}{8} = \frac{3}{4}$$

$$\text{Maka, } \frac{b}{a} = \frac{3}{4}$$

$$b = \frac{3}{4}a$$

Gantikan $b = \frac{3}{4}a$ ke dalam $\textcircled{1}$.

$$a^2 + \left(\frac{3}{4}a\right)^2 = 25k^2$$

$$a^2 + \frac{9}{16}a^2 = 25k^2$$

$$\frac{25}{16}a^2 = 25k^2$$

$$a^2 = 16k^2$$

$$a = 4k$$

$$\text{dan } b = \frac{3}{4} \times 4k = 3k$$

Koordinat titik P ialah $(4k, 3k)$.

20. $6 - \log_2 x = 2 \log_4 x$

$$6 - \log_2 x = 2\left(\frac{\log_2 x}{\log_2 4}\right)$$

$$6 - \log_2 x = 2\left(\frac{\log_2 x}{2}\right)$$

$$6 - \log_2 x = \log_2 x$$

$$6 = 2 \log_2 x$$

$$\log_2 x = 3$$

$$x = 2^3$$

$$= 8$$

21. (a) (i) Bahagian AB dan CD

(ii) Bahagian BC

(b) (i) Titik C

(ii) Titik B

22. $y = 3x^2 - 2x + 3$

$$\frac{dy}{dx} = 6x - 2$$

$$\text{Diberi } \frac{dx}{dt} = 4.$$

$$\frac{dy}{dt} = \frac{dy}{dx} \times \frac{dx}{dt}$$

$$= (6x - 2) \times 4$$

$$\text{Apabila } x = 2, \frac{dy}{dt} = [6(2) - 2] \times 4$$

$$= 10 \times 4$$

$$= 40 \text{ unit s}^{-1}$$

23. $8^{x+4} = 32^{4x-1}$

$$(2^3)^{x+4} = (2^5)^{4x-1}$$

$$2^{3(x+4)} = 2^{5(4x-1)}$$

$$3x + 12 = 20x - 5$$

$$17x = 17$$

$$x = 1$$

24. Muthu adalah betul.

Perhatikan set data di atas, nombor 18 ialah nilai ekstrem yang menyebabkan nilai min terpesong dan menjadi terlalu besar. Maka, min adalah sukatan yang tidak sesuai. Median adalah sukatan yang lebih sesuai kerana nilai median tidak akan dipengaruhi oleh nilai ekstrem 18.

25. Jumlah markah bagi 6 ujian yang lepas
 $= 6 \times 70$
 $= 420$

Katakan markah bagi ujian terakhir ialah x .

$$\begin{aligned} \text{Maka, } \frac{420 + x}{7} &= 75 \\ 420 + x &= 525 \\ x &= 525 - 420 \\ &= 105 \end{aligned}$$

Oleh kerana markah maksimum bagi setiap ujian ialah 100, maka Hamidy tidak mungkin mendapat gred B walaupun dia mencapai 100 markah dalam ujian terakhir.

KERTAS 2

1. $2x + y + 1 = 0$ ①
 $2x^2 + y^2 + xy = 8$ ②

Dari ①: $y = -1 - 2x$ ③

Gantikan ③ ke dalam ②.

$$\begin{aligned} 2x^2 + (-1 - 2x)^2 + x(-1 - 2x) &= 8 \\ 2x^2 + 1 + 4x + 4x^2 - x - 2x^2 &= 8 \\ 4x^2 + 3x - 7 &= 0 \\ (4x + 7)(x - 1) &= 0 \end{aligned}$$

$$\begin{aligned} 4x + 7 = 0 & \quad \text{atau} \quad x - 1 = 0 \\ x = -\frac{7}{4} & \quad \quad \quad x = 1 \end{aligned}$$

Apabila $x = -\frac{7}{4}$, $y = -1 - 2\left(-\frac{7}{4}\right) = 2\frac{1}{2}$

Apabila $x = 1$, $y = -1 - 2(1) = -3$

Penyelesaian ialah $x = -1\frac{3}{4}$, $y = 2\frac{1}{2}$
 dan $x = 1$, $y = -3$.

2. (a) Katakan $f^{-1}(x) = y$
 $x = f(y)$
 $x = 2 - 3y$
 $3y = 2 - x$
 $y = \frac{2 - x}{3}$

Maka, $f^{-1}(x) = \frac{2 - x}{3}$

(b) $f^{-1}g(x) = f^{-1}\left(\frac{x}{4} - 1\right)$
 $= \frac{2 - \left(\frac{x}{4} - 1\right)}{3}$
 $= \frac{1}{3}\left(3 - \frac{x}{4}\right)$
 $= 1 - \frac{x}{12}$

(c) $hg(x) = x - 2$

$$h\left(\frac{x}{4} - 1\right) = x - 2$$

Katakan $u = \frac{x}{4} - 1$, maka $x = 4u + 4$.

Seterusnya, $h(u) = 4u + 4 - 2$
 $= 4u + 2$

Maka, $h(x) = 4x + 2$

3. (a) Saiz selang kelas = $(9 - 0) + 1$
 $= 10$

(b)

	Skor	Kekerapan	Kekerapan longgokan
	0 - 9	3	3
	10 - 19	4	7
	20 - 29	9	16
Kelas median →	30 - 39	13	29
	40 - 49	p	$29 + p$
	50 - 59	3	$32 + p$

Skor median ialah skor ke- $\left(\frac{32 + p}{2}\right)$ dan kelas median ialah 30 - 39.

$$\text{Maka, } 29.5 + \left(\frac{\frac{32 + p}{2} - 16}{13}\right)(10) = 30.27$$

$$\left(\frac{\frac{32 + p}{2} - 16}{13}\right)(10) = 0.77$$

$$\frac{32 + p}{2} - 16 = 1.001$$

$$\frac{32 + p}{2} = 17.001$$

$$32 + p = 34.002$$

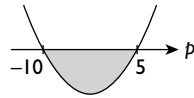
$$p = 2.002$$

p ialah integer. Maka, $p = 2$.

(c) Skor min = $\frac{3(4.5) + 4(14.5) + 9(24.5) + 13(34.5) + 2(44.5) + 3(54.5)}{32 + 2}$
 $= \frac{993}{34}$
 $= 29.2$

(d) Kelas mod ialah 30 - 39.

$$\begin{aligned}
 4. (a) \quad & 3p(p+5) \leq 150 \\
 & p(p+5) \leq 50 \\
 & p^2 + 5p - 50 \leq 0 \\
 & (p+10)(p-5) \leq 0
 \end{aligned}$$



Maka, $-10 \leq p \leq 5$.

Tetapi p mestilah integer positif.
Maka, julat nilai p ialah $1 \leq p \leq 5$.

Pilih $p = 4$.

$$\begin{aligned}
 \text{Luas segi empat tepat} &= 3(4) \times (4 + 5) \\
 &= 12 \times 9 \\
 &= 108 \text{ cm}^2
 \end{aligned}$$

(Mana-mana integer p dalam julat $1 \leq p \leq 5$ boleh dipilih untuk menentusahkan jawapan.)

(b) Bagi $y = 2(x+3)^2 + 5$,
paksi simetri ialah $x = -3$.

Bagi $y = x^2 + mx + 10$:

$$y = \left(x + \frac{m}{2}\right)^2 - \left(\frac{m}{2}\right)^2 + 10$$

Paksi simetri ialah $x = -\frac{m}{2}$.

$$\begin{aligned}
 \text{Maka, } -\frac{m}{2} &= -3 \\
 m &= 6
 \end{aligned}$$

$$5. (a) (i) \quad 2 \log_2(x+4) - \log_2 x = 4$$

$$\log_2(x+4)^2 - \log_2 x = 4$$

$$\log_2 \frac{(x+4)^2}{x} = 4$$

$$\frac{(x+4)^2}{x} = 2^4$$

$$(x+4)^2 = 16x$$

$$x^2 + 8x + 16 = 16x$$

$$x^2 - 8x + 16 = 0$$

$$(ii) \quad x^2 - 8x + 16 = 0$$

$$(x-4)(x-4) = 0$$

$$x = 4$$

$$(b) \quad 3^x = 0.5$$

$$\log_{10} 3^x = \log_{10} 0.5$$

$$x \log_{10} 3 = \log_{10} 0.5$$

$$x = \frac{\log_{10} 0.5}{\log_{10} 3}$$

$$= -0.631 \text{ (3 t.p.)}$$

$$6. (a) \text{ Bagi } y = (3x-4)^2 + 2$$

$$\begin{aligned}
 \frac{dy}{dx} &= 2(3x-4)(3) \\
 &= 18x - 24
 \end{aligned}$$

Garis lurus $y = 12x + m$ ialah tangen kepada lengkung itu pada titik A.

Maka, kecerunan = 12.

$$18x - 24 = 12$$

$$18x = 36$$

$$x = 2$$

$$\text{dan } y = [3(2) - 4]^2 + 2$$

$$= 4 + 2$$

$$= 6$$

Koordinat titik A ialah (2, 6).

Gantikan (2, 6) ke dalam $y = 12x + m$.

$$6 = 12(2) + m$$

$$6 = 24 + m$$

$$m = -18$$

(b) Kecerunan garis tangen pada titik A = 12

Maka, kecerunan garis normal pada titik A

$$= -\frac{1}{12}$$

Persamaan garis normal pada titik A ialah

$$y - 6 = -\frac{1}{12}(x - 2)$$

$$12y - 72 = -x + 2$$

$$x + 12y - 74 = 0$$

7. (a) Dalam $\triangle OAB$,

$$\tan 30^\circ = \frac{OB}{AB}$$

$$AB = \frac{OB}{\tan 30^\circ}$$

$$= \frac{20}{\tan 30^\circ}$$

$$= 34.64 \text{ cm}$$

Panjang garis $ABC = 2 \times AB$

$$= 2 \times 34.64 \text{ cm}$$

$$= 69.28 \text{ cm}$$

$$(b) \text{ Luas } \triangle OAC = \frac{1}{2} \times 69.28 \times 20$$

$$= 692.8 \text{ cm}^2$$

$$\angle AOC = 180^\circ - 30^\circ - 30^\circ$$

$$= 120^\circ$$

$$= 2.0947 \text{ radian}$$

$$\text{Luas sektor } OMN = \frac{1}{2} \times 20^2 \times 2.0947$$

$$= 418.94 \text{ cm}^2$$

Luas kawasan berlorek = $692.8 - 418.94$

$$= 273.86 \text{ cm}^2$$

(c) Panjang lengkok $MBN = 20 \times 2.0947$
 $= 41.894 \text{ cm}$

$$OA = \sqrt{34.64^2 + 20^2}$$

$$= \sqrt{1599.9}$$

$$= 40 \text{ cm}$$

$$AM = 40 \text{ cm} - 20 \text{ cm}$$

$$= 20 \text{ cm}$$

Perimeter kawasan berlorek
 $= AM + CN + ABC + \text{Lengkok } MBN$
 $= 20 + 20 + 68.28 + 41.894$
 $= 150.174 \text{ cm}$
 $= 150.2 \text{ cm}$

8. (a) $y = x^3 - 6x^2 + 9x + 6$

$$\frac{dy}{dx} = 3x^2 - 12x + 9$$

$$= 3(x^2 - 4x + 3)$$

$$= 3(x - 3)(x - 1)$$

Apabila tangen selari dengan paksi-x, $\frac{dy}{dx} = 0$.

Maka, $3(x - 3)(x - 1) = 0$
 $x = 3$ atau 1

Apabila $x = 3$, $y = 3^3 - 6(3)^2 + 9(3) + 6$
 $= 6$

Apabila $x = 1$, $y = 1^3 - 6(1)^2 + 9(1) + 6$
 $= 10$

Titik-titik di mana tangennya selari dengan paksi-x ialah (3, 6) dan (1, 10).

(b) $x = t - 4$
 $t = x + 4$

Gantikan $t = x + 4$ ke dalam $y = 2t^2$.

$$y = 2(x + 4)^2$$

$$= 2(x^2 + 8x + 16)$$

$$= 2x^2 + 16x + 32$$

$$\frac{dy}{dx} = 4x + 16$$

Apabila $t = 3$, $x = 3 - 4 = -1$

$$y = 2(3)^2 = 18$$

$$\frac{dy}{dx} = 4(-1) + 16 = 12$$

Maka, persamaan garis tangen ialah

$$y - 18 = 12(x + 1)$$

$$y - 18 = 12x + 12$$

$$y = 12x + 30$$

9. (a) $x^2 + px + 4 = 0$

Katakan punca-punca persamaan kuadratik ialah α dan 4α .

HTP : $\alpha + 4\alpha = -p$
 $5\alpha = -p$

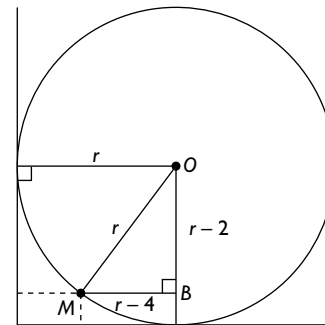
HDP : $\alpha(4\alpha) = 4$
 $4\alpha^2 = 4$
 $\alpha^2 = 1$

$$\alpha = 1 \quad (\alpha \text{ bernilai positif})$$

Apabila $\alpha = 1$, $-p = 5(1)$
 $p = -5$

(b) $OB = (r - 2)$ cm sebab titik B adalah 2 cm dari lantai.

$MB = (r - 4)$ cm sebab titik M adalah 4 cm dari dinding.



Dalam $\triangle OMB$,

$$OB^2 + MB^2 = OM^2$$

$$(r - 2)^2 + (r - 4)^2 = r^2$$

$$r^2 - 4r + 4 + r^2 - 8r + 16 = r^2$$

$$r^2 - 12r + 20 = 0$$

$$(r - 2)(r - 10) = 0$$

$$r = 2 \text{ atau } 10$$

Jejari bekas silinder sama dengan 2 cm adalah tidak mungkin.

Maka, $r = 2$ diabaikan dan $r = 10$.

Apabila $r = 10$, diameter bekas silinder

$$= 2r \text{ cm}$$

$$= 20 \text{ cm}$$

Ini bermaksud dimensi bekas silinder adalah lebih besar daripada dimensi kotak.

Jadi, bekas silinder itu tidak boleh dimasukkan ke dalam kotak itu.

10. (a) (i) $\text{Min} = \frac{196}{35} = 5.6$

$$\text{Sisihan piawai} = \sqrt{\frac{1\ 172}{35} - 5.6^2} = 1.460$$

(ii) $\text{Min baharu} = (3.6 + 4) \times 3 = 22.8$

$$\text{Sisihan piawai baharu} = 1.460 \times 3 = 4.380$$

(b) Bagi set 5 nombor:

$$\frac{\Sigma x}{5} = 4.68$$

$$\Sigma x = 5 \times 4.68 = 23.4$$

$$\frac{\Sigma x^2}{5} - 4.68^2 = 1.47^2$$

$$\Sigma x^2 = (1.47^2 + 4.68^2) \times 5 = 120.32$$

Bagi set 8 nombor:

$$\frac{\Sigma y}{8} = 7$$

$$\Sigma y = 7 \times 8 = 56$$

$$\frac{\Sigma y^2}{8} - 7^2 = 2.5^2$$

$$\Sigma y^2 = (2.5^2 + 7^2) \times 8 = 442$$

(i) Bagi set nombor baharu:

$$\Sigma x + \Sigma y = 23.4 + 56 = 79.4$$

$$\text{Min} = \frac{79.4}{5 + 8} = 6.108$$

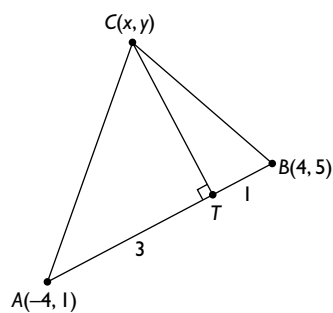
(ii) Bagi set nombor baharu:

$$\Sigma x^2 + \Sigma y^2 = 120.32 + 442 = 562.32$$

$$\text{Varians} = \frac{562.32}{13} - 6.108^2 = 5.9477$$

$$\text{Sisihan piawai} = \sqrt{5.9477} = 2.44$$

11.



(a) Koordinat titik T

$$= \left(\frac{3(4) + 1(-4)}{3 + 1}, \frac{3(5) + 1(1)}{3 + 1} \right)$$

$$= \left(\frac{8}{4}, \frac{16}{4} \right)$$

$$= (2, 4)$$

$$\text{Kecerunan } AB = \frac{5 - 1}{4 - (-4)} = \frac{4}{8} = \frac{1}{2}$$

Maka, kecerunan $CT = -2$

Persamaan garis lurus CT ialah

$$y - 4 = -2(x - 2)$$

$$y - 4 = -2x + 4$$

$$y = -2x + 8$$

Selesaikan persamaan garis CT dan persamaan $y = 3x + 13$ secara serentak untuk mendapatkan koordinat titik C.

$$y = -2x + 8$$

$$y = 3x + 13$$

Maka, $-2x + 8 = 3x + 13$

$$5x = -5$$

$$x = -1$$

dan $y = -2(-1) + 8 = 10$

Koordinat titik C ialah $(-1, 10)$.

(b) Luas segi tiga ABC

$$= \frac{1}{2} \begin{vmatrix} 4 & -1 & -4 & 4 \\ 5 & 10 & 1 & 5 \end{vmatrix}$$

$$= \frac{1}{2} [40 + (-1) + (-20)] - [(-5) + (-40) + 4]$$

$$= \frac{1}{2} |19 - (-41)|$$

$$= \frac{1}{2} (60)$$

$$= 30 \text{ unit}^2$$

12. (a) $AC^2 = 25^2 + 20^2 - 2(25)(20) \cos 60^\circ = 525$

$$AC = 22.91 \text{ cm}$$

(b) (i) $\frac{\sin \angle ADC}{22.91} = \frac{\sin 40^\circ}{15}$

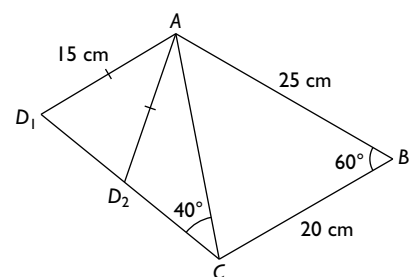
$$\sin \angle ADC = \frac{22.91 \sin 40^\circ}{15}$$

$$= 0.981751$$

Maka, $\angle AD_1C = 79.04^\circ$

dan $\angle AD_2C = 180^\circ - 79.04^\circ = 100.96^\circ$

(ii)



$$\angle CAD_1 = 180^\circ - 40^\circ - 79.04^\circ = 60.94^\circ$$

$$\frac{CD_1}{\sin 60.94^\circ} = \frac{22.91}{\sin 79.04^\circ}$$

$$CD_1 = \frac{22.91 \sin 60.94^\circ}{\sin 79.04^\circ}$$

$$= 20.40 \text{ cm}$$

$$\begin{aligned} \text{(c) Jarak serenjang dari titik } A \text{ ke garis lurus } CD &= 22.91 \times \sin 40^\circ \\ &= 14.73 \text{ cm} \end{aligned}$$

$$13. \text{ (a) Luas segi tiga } BCD = 71.62 \text{ cm}^2$$

$$\frac{1}{2} \times 17 \times BD \times \sin 33^\circ = 71.62$$

$$\begin{aligned} BD &= \frac{71.62 \times 2}{17 \sin 33^\circ} \\ &= 15.47 \text{ cm} \end{aligned}$$

$$\text{(b) } \frac{AD}{\sin 33^\circ} = \frac{15.47}{\sin 50^\circ}$$

$$\begin{aligned} AD &= \frac{15.47 \sin 33^\circ}{\sin 50^\circ} \\ &= 11.0 \text{ cm} \end{aligned}$$

$$\angle ABD = \angle BDC = 33^\circ \quad (\text{Sudut selang seli})$$

$$\begin{aligned} \angle ADB &= 180^\circ - 33^\circ - 50^\circ \\ &= 97^\circ \end{aligned}$$

$$\frac{AB}{\sin 97^\circ} = \frac{15.47}{\sin 50^\circ}$$

$$\begin{aligned} AB &= \frac{15.47 \sin 97^\circ}{\sin 50^\circ} \\ &= 20.04 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{(c) } BC^2 &= 15.47^2 + 17^2 - 2(15.47)(17) \cos 33^\circ \\ &= 87.19695 \end{aligned}$$

$$\begin{aligned} BC &= \sqrt{87.19695} \\ &= 9.338 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Panjang lengkok } BEC &= \pi \times 9.338 \\ &= 3.142 \times 9.338 \\ &= 29.34 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Perimeter seluruh rajah} &= 20.04 + 11 + 17 + 29.34 \\ &= 77.38 \text{ cm} \end{aligned}$$

$$14. \text{ (a) } x = \frac{11}{10} \times 100 = 110$$

$$\frac{y}{12} \times 100 = 140$$

$$y = \frac{140 \times 12}{100} = 16.80$$

$$\frac{8}{z} \times 100 = 100$$

$$z = \frac{8 \times 100}{100} = 8.00$$

$$\text{(b) (i) Indeks gubahan}$$

$$= \frac{110(3) + 140(2) + 100(1) + 115(4)}{3 + 2 + 1 + 4}$$

$$= \frac{1170}{10}$$

$$= 117$$

(ii) Katakan kos penghasilan pada tahun 2017 ialah Q_{17} .

$$\bar{I}_{17/15} = 117$$

$$\text{Maka, } \frac{Q_{17}}{\text{RM15}} \times 100 = 117$$

$$\begin{aligned} Q_{17} &= \frac{117 \times \text{RM15}}{100} \\ &= \text{RM17.55} \end{aligned}$$

$$\begin{aligned} \text{(c) } \bar{I}_{18/15} &= 117 + 117 \times \frac{20}{100} \\ &= 140.4 \end{aligned}$$

15. (a) Jumlah peratus perbelanjaan = 100%

$$20 + 15 + 25 + X + 5 + 5 = 100$$

$$70 + X = 100$$

$$X = 30$$

Indeks gubahan = 128

$$\begin{aligned} 120(20) + 135(15) + 110(25) \\ + Y(30) + 180(5) + 105(5) &= 128 \end{aligned}$$

$$\frac{8\ 600 + 30Y}{100} = 128$$

$$8\ 600 + 30Y = 12\ 800$$

$$30Y = 4\ 200$$

$$Y = 140$$

$$\begin{aligned} \text{(b) (i) } \frac{\text{Harga ayam pada tahun 2017}}{\text{RM5.50}} \times 100 \\ &= 110 \end{aligned}$$

Harga ayam pada tahun 2017

$$= \frac{110 \times \text{RM5.50}}{100}$$

$$= \text{RM6.05}$$

$$\begin{aligned} \text{(ii) } \frac{\text{RM15}}{\text{Harga daging pada tahun 2015}} \times 100 \\ &= 120 \end{aligned}$$

Harga daging pada tahun 2015

$$= \frac{\text{RM15} \times 100}{120}$$

$$= \text{RM12.50}$$

$$\text{(c) } \frac{Q_{17}}{\text{RM800}} \times 100 = 128$$

$$Q_{17} = \frac{128 \times \text{RM800}}{100}$$

$$= \text{RM1 024}$$

Perbelanjaan bulanan keluarga Danny pada tahun 2017 ialah RM1 024.

$$\text{RM1 024} - \text{RM800} = \text{RM224}$$

Maka, perbelanjaan bulanan keluarga Danny bertambah sebanyak RM224 pada tahun 2017.