CHAPTER 3: QUADRATIC FUNCTIONS

Paper 1

Solution to Question 25

(a) Given the roots are -4 and p.
Sum of roots: $-4 + p = p - 4$
Product of roots: $-4p$
The quadratic equation is $x^2 - (p - 4)x - 4p = 0$.

Thus, $f(x) = x^2 - (p - 4)x - 4p$.

(b) $y = kf(x)$
$= k[x^2 - (p - 4)x - 4p]$
When $p = 3$, $y = k[x^2 - (3 - 4)x - 4(3)]$
$= kx^2 + kx - 12k$

(i) The curve $y = kx^2 + kx - 12k$ intersects the y-axis at $(0, -36)$.
Substitute $x = 0$ and $y = -36$ into the equation.
$-36 = k(0)^2 + k(0) - 12k$
$-36 = -12k$
$k = 3$

(ii)
$$\begin{aligned} y &= 3x^2 + 3x - 36 \\ &= 3(x^2 + x) - 36 \\ &= 3\left[x^2 + x + \left(\frac{1}{2}\right)^2 - \left(\frac{1}{2}\right)^2\right] - 36 \\ &= 3\left[\left(x + \frac{1}{2}\right)^2 - \frac{1}{4}\right] - 36 \\ &= 3\left(x + \frac{1}{2}\right)^2 - \frac{3}{4} - 36 \\ &= 3\left(x + \frac{1}{2}\right)^2 - 36\frac{3}{4} \end{aligned}$$

Thus, the coordinates of the minimum point are $\left(-\frac{1}{2},\ -36\frac{3}{4}\right)$.