Exercise 1

Paper 1 style · No calculator

1 8 marks SL 5.4 ●●○ Typical

Let $f(x) = x^2 - 6x + 10$. The point $P(4, 2)$ lies on the graph of f.

(a) Find the gradient of the tangent to the graph of f at P. **[2]**

(b) Find the equation of the normal to the graph of f at P. Give your answer in the form $y = mx + c$. **[3]**

The normal meets the graph of f again at the point Q.

(c) Find the coordinates of Q. **[3]**

The markscheme is on the next page: try the question first. Written and verified by a practising IB mathematics teacher, produced with AI assistance; solved twice and recomputed by software. Not affiliated with or endorsed by the International Baccalaureate Organization.
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MARKSCHEME (a)

$f'(x) = 2x - 6$ **(A1)**

gradient at $P = f'(4) = 2$ **A1**

Total 2 marks

MARKSCHEME (b)

gradient of the normal $= -\frac{1}{2}$ **(A1)**

$y - 2 = -\frac{1}{2}(x - 4)$ OR $2 = -\frac{1}{2}(4) + c$ **M1**

$y = -\frac{1}{2}x + 4$ **A1**

Total 3 marks

Note Award M1 for substituting the coordinates of P with *their* normal gradient. Award M0 if the tangent gradient 2 is used. FT from their answer to (a).

MARKSCHEME (c)

equating: $x^2 - 6x + 10 = -\frac{1}{2}x + 4$ **M1**

$2x^2 - 11x + 12 = 0 \Rightarrow (2x - 3)(x - 4) = 0$ **(A1)**

$x = 4$ is P, so $Q\left(\frac{3}{2}, \frac{13}{4}\right)$ **A1**

Total 3 marks

Note Accept (1.5, 3.25). FT from their normal in (b). A candidate who gives (4, 2) as Q earns M1(A1)A0.