Marked example 1

Paper 1 style · No calculator

1 6 marks SL 5.4 ●●○ Typical

Let $f(x) = 3 + 4x - x^2$. The point $P(3, 6)$ 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 x-axis at the point Q.

(c) Find the coordinates of Q. **[1]**

MARKSCHEME (a)

$f'(x) = 4 - 2x$ **(A1)**

gradient at $P = f'(3) = -2$ **A1**

Total 2 marks

MARKSCHEME (b)

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

$y - 6 = \frac{1}{2}(x - 3)$ OR $6 = \frac{1}{2}(3) + c$ **M1**

$y = \frac{1}{2}x + \frac{9}{2}$ **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)

$Q(-9, 0)$ **A1**

Total 1 mark

Note FT from their equation in (b). Accept $x = -9$, $y = 0$.

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. © 2026 Hence