

Marked example

Paper 1 style · No calculator

2 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)

$$\text{gradient at } P = f'(3) = -2$$

A1

Total 2 marks

MARKSCHEME (b)

$$\text{gradient of the normal} = \frac{1}{2}$$

(A1)

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

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 $x = -9, y = 0$.