Differentiation

P1 | Study notes, worked example and practice

What to understand

The derivative gives the gradient of a curve. Differentiate each term and substitute the x-coordinate to find a gradient.

A tangent has the same gradient as the curve. A normal is perpendicular to the tangent.

Key formulae

$$\frac{d}{dx}(x^n) = nx^{n-1}$$

$$\text{tangent}: \quad y - y_1 = m(x - x_1)$$

Worked example

$$y = x^2 \quad \Longrightarrow \quad \frac{dy}{dx} = 2x$$

At x = 2 the gradient is 4. The point is (2, 4), so the tangent is y = 4x − 4.

Practice questions

Show your working. Try these without looking at the answers.

1. Differentiate $y = 3x^3 - 4x + 7$.

2. Find the gradient of $y = x^2 + 3x$ at $x = 2$.

3. Find the tangent to $y = x^2$ at $x = 2$.

Answers

Use these to check the method as well as the final answer.

1. $dy/dx = 9x^2 - 4$.

2. 7.

3. $y = 4x - 4$.