



QUESTION WORKBOOK

The derivative from first principles

Differentiation · Year 12–13

6 questions · 20 marks

NAVY SCREEN EDITION

SECTION A · Warm-up

- A1** Write down the first-principles definition of the derivative $f'(x)$, and explain in one sentence what the limit as $h \rightarrow 0$ achieves. [2]

- A2** For $f(x) = x^2$, calculate the chord gradient from $x = 3$ with $h = 0.1$, and again with $h = 0.01$. What do the answers suggest about the gradient at $x = 3$? [3]

SECTION B · Standard

- B1** Prove from first principles that the derivative of $f(x) = x^2$ is $2x$. [4]

B2 Prove from first principles that the derivative of $f(x) = 3x^2 + 2x$ is $6x + 2$. [4]

B3 From first principles, find the gradient of $y = x^3$ at the point $(2, 8)$. [3]

SECTION C · Stretch

C1 For $f(x) = x^3 - 6x^2$, find $f'(x)$ and $f''(x)$, and find the value of x at which $f''(x) = 0$. What does f'' measure? [4]