AQA, Edexcel, OCR

A Level

A Level Mathematics

C1 Differentiation

Name:

MME
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Total Marks: /65

$$\boxed{\begin{array}{c} \text{C1 - Differentiation} \\ \text{OCR, AQA, Edexcel} \end{array}}$$

1. For each of the following functions calculate $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$:

    (a) $y = x$.   [2]

    (b) $y = x^{\frac{1}{3}}$.   [2]

    (c) $y = \frac{4}{3}x^3$.   [2]

    (d) $y = 5x^4 + 3x + 20$.   [3]

    (e) $y = x(x - 1)$.   [3]

    (f) $3x^2 + 2y = 108$.   [3]

    (g) $y = 2x(x - 3)(x - 5)$.   [3]

    (h) $y = \frac{x^2 + 3x + 2}{x}$.   [3]

    (i) $y = \frac{3x^3 + 6\sqrt{x} + 3}{3x^{\frac{1}{4}}}$.   [3]

    (j) $xy - 2y - 2x^3 + 4x^2 = 0$ (for $x \neq 2$).   [4]

2. Find the gradients of the following functions at the speficied points:

    (a) $y = 2x^2$ at $x = 3$.   [2]

    (b) $y = 3x^2 - \frac{2}{3}x + 1$ at $x = 0$.   [3]

    (c) $xy - y - 2x^2 + 2x = 0$ at $x = 2$.   [4]

3. Consider the function $f(x) = x^2 - 2x + 4$:

    (a) By finding $f'(x)$ show that $f(x)$ has a stationary point at $(1, 3)$.   [5]

    (b) Determine the nature of the stationary point.   [2]

    (c) By writing $f(x)$ in the form $f(x) = (x + a)^2 + b$, verify that $f(x)$ has a stationary point at $(1, 3)$.   [2]

    (d) Calculate the gradient of $f(x)$ at $x = 4$.   [2]

    (e) Hence, or otherwise show that the equation of the tangent line to $f(x)$ at $x = 4$ is $g(x) = 6(x - 2)$, where $g(x)$ denotes the function of the tangent line.   [5]

4. Consider the function $f(x) = \frac{2}{3}x^3 + bx^2 + 2x + 3$, where b is some undetermined coefficient:

(a) Find $f'(x)$ and $f''(x)$. [4]

(b) You are given that $f(x)$ has a stationary point at $x = 2$. Use this information to find b. [3]

(c) Find the *coordinates* of the other stationary point. [2]

(d) Determine the nature of both stationary points. [3]