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TUTGATHER PRACTICE PAPER

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2027

MATHEMATICS Extended Part Module M1
PAPER

Question-Answer Book

Candidate Number

TUTGATHER
PRACTICE PAPER · NOT AN OFFICIAL HKEAA PAPER

1 hour 5 minutes

This paper must be answered in English

Topic practice: Derivative of a Function

INSTRUCTIONS

(1) This paper consists of THREE sections, A(1), A(2) and B.

(2) Attempt ALL questions in this paper. Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins.

(3) Unless otherwise specified, all working must be clearly shown.

(4) Unless otherwise specified, numerical answers should be either exact or correct to 3 significant figures.

(5) The diagrams in this paper are not necessarily drawn to scale.

(6) Calculators and mathematical drawing instruments may be used.

(7) The marks for each question are shown in brackets.

(8) No extra time will be given after the 'Time is up' announcement.

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SECTION A(1) (16 marks)

1. Evaluate $\lim_{x \to 3} \frac{x^2 - 9}{x - 3}$. **(3 marks)**

2. Evaluate $\lim_{x \to 0} \frac{e^{2x} - 1}{x}$. **(3 marks)**

3. Find the derivative of $f(x) = x^2 + 3x$ from first principles. **(4 marks)**

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4. **(6 marks)**

The function f is defined by $f(x) = \begin{cases} x^2 + 1 & \text{if } x < 2, \\ 3x - 1 & \text{if } x \geq 2. \end{cases}$

(a) Find $\lim_{x \to 2^-} f(x)$ and $\lim_{x \to 2^+} f(x)$.

(b) Determine whether $\lim_{x \to 2} f(x)$ exists. Justify your answer.

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SECTION A(2) (24 marks)

5. Evaluate the following limits. **(7 marks)**

(a) $\lim_{x \to 0} \frac{\ln(1 + 5x)}{x}$

(b) $\lim_{x \to \infty} \frac{3e^{2x} + 2e^{-x}}{e^{2x} - 5}$

6. Let $f(x) = \sqrt{2x + 1}$. **(8 marks)**

(a) Find $f'(x)$ from first principles.

(b) Hence find the equation of the tangent to the curve $y = f(x)$ at $x = 4$.

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7. Let $f(x) = \frac{x^2 - 4}{x - 2}$ for $x \neq 2$. **(9 marks)**

(a) Simplify $f(x)$ for $x \neq 2$.

(b) Find $\lim_{x \to 2} f(x)$.

(c) Can f be defined at $x = 2$ so that f becomes continuous at $x = 2$? If so, state the value of $f(2)$.

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SECTION B (10 marks)

8. Let $f(x) = \frac{e^{3x} - 1}{e^x - 1}$ for $x \neq 0$. **(10 marks)**

(a) Simplify $f(x)$ by using the identity $e^{3x} - 1 = (e^x - 1)(e^{2x} + e^x + 1)$.

(b) Hence evaluate $\lim_{x \to 0} f(x)$.

(c) Find $\lim_{x \to 0} \frac{f(x) - 3}{x}$.

END OF PAPER

Answers written in the margins will not be marked.

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