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TUTGATHER PRACTICE PAPER

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2027

MATHEMATICS Extended Part Module M2
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: Differentiation

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

2. Differentiate $y = (2x^3 - 5x + 1)^4$ with respect to x. **(3 marks)**

3. Find $\frac{dy}{dx}$ for $y = e^{2x} \sin 3x$. **(4 marks)**

Answers written in the margins will not be marked.

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

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

(b) Hence find the equation of the tangent to the curve $y = f(x)$ at $x = 3$.

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SECTION A(2) (24 marks)

5. Let $y = \frac{x^2 + 1}{x - 1}$. **(7 marks)**

(a) Find $\frac{dy}{dx}$.

(b) Find the equations of the tangents to the curve at the points where $x = 2$ and $x = 0$.

(c) Determine whether these two tangents are perpendicular.

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6. Let $f(x) = \ln(\sin x)$ for $0 < x < \pi$. **(8 marks)**

(a) Find $f'(x)$.

(b) Find $f''(x)$ and simplify your answer.

(c) Hence show that $f''(x) + (f'(x))^2 + 1 = 0$.

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7. Let $f(x) = \frac{1}{x}$ for $x \neq 0$. **(9 marks)**

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

(b) Using the result in (a), find the derivative of $g(x) = \frac{1}{2x+1}$ from first principles.

(Hint: consider $g(x) = f(2x + 1)$.)

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SECTION B (10 marks)

8. Let $y = x^x$ for $x > 0$. **(10 marks)**

(a) By taking natural logarithms, show that $\frac{dy}{dx} = x^x(1 + \ln x)$.

(b) Find the coordinates of the stationary point of the curve $y = x^x$ and determine its nature.

(c) Find the equation of the tangent to the curve at $x = 1$.

END OF PAPER

Answers written in the margins will not be marked.

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