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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: Indefinite Integration and its Applications

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 $\int (6x^2 - \frac{4}{x^3} + 5)\, dx$. **(3 marks)**

2. Using the substitution $u = x^2 + 1$, find $\int 2x\,(x^2 + 1)^5\, dx$. **(3 marks)**

3. Find $\int (3e^{2x} - \frac{1}{2x + 7})\, dx$, where $2x + 7 > 0$. **(4 marks)**

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4. A curve Γ passes through the point $(1, 4)$ and its slope at any point (x, y) on Γ is given by $\frac{dy}{dx} = 3x^2 - 8x + 2$. **(6 marks)**

(a) Find the equation of Γ.

(b) Find the y-coordinate of the point on Γ where $x = 2$.

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SECTION A(2) (24 marks)

5. Let $I = \int x\sqrt{x+3}\,dx$. **(7 marks)**

(a) Using the substitution $u = x + 3$, show that $I = \int (u^{3/2} - 3u^{1/2})du$.

(b) Hence find I in terms of x.

(c) Verify your answer in (b) by differentiating.

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6. The rate of change of the temperature T (in $^\circ$C) of a metal bar after t hours of cooling is modelled by **(8 marks)**

$$\frac{dT}{dt} = -6e^{-t/2} + \frac{4}{t+1} \quad (t \geq 0).$$

Initially ($t = 0$) the temperature is 80°C.

(a) Find T as a function of t.

(b) Find the temperature of the bar after 2 hours, correct to 3 significant figures.

(c) Describe the long-term behaviour of the temperature as $t \to \infty$.

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7. A curve Γ has $\frac{dy}{dx} = 6x^2 - 6x - 12$ and passes through the point $(0, 5)$. **(9 marks)**

(a) Find the equation of Γ.

(b) Find the coordinates of the stationary points of Γ and determine the nature of each.

(c) Find the equation of the tangent to Γ at the point where $x = 3$.

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SECTION B (10 marks)

8. Let $I = \int \frac{x}{\sqrt{2x+1}}\,dx$ for $x > -\frac{1}{2}$. **(10 marks)**

(a) Using the substitution $u = \sqrt{2x+1}$, show that $I = \int (u^2 - 1)\,du$.

(b) Hence find I in terms of x.

(c) A curve Γ passes through $(4, 10)$ and satisfies $\frac{dy}{dx} = \frac{x}{\sqrt{2x+1}}$. Find the equation of Γ and the x-intercept of Γ.

END OF PAPER

Answers written in the margins will not be marked.

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