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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: Definite Integration

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 $\int_1^4 (3\sqrt{x} - \frac{2}{x^2})\,dx$. **(3 marks)**

2. It is given that $\int_0^5 f(x)\,dx = 12$ and $\int_0^2 f(x)\,dx = 5$. Evaluate **(3 marks)**

   (a) $\int_2^5 f(x)\,dx$;

   (b) $\int_0^5 (3f(x) + 2)\,dx$.

3. Using the substitution $u = x^2 + 3$, evaluate $\int_0^1 x(x^2 + 3)^5\,dx$. **(4 marks)**

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4. The curve $y = x^2 - 2x$ cuts the x-axis at $O(0, 0)$ and $A(2, 0)$. **(6 marks)**

(a) Find the area of the region bounded by the curve and the x-axis between O and A.

(b) Find the area of the region bounded by the curve, the x-axis and the line $x = 3$.

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SECTION A(2) (24 marks)

5. Let $I = \int_0^{\pi/4} \frac{\sec^2 x}{1 + \tan x}\, dx$. **(7 marks)**

(a) Using the substitution $u = 1 + \tan x$, show that $I = \ln 2$.

(b) Hence, or otherwise, evaluate $\int_0^{\pi/4} \frac{\sec^2 x}{(1 + \tan x)^2}\, dx$.

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6. Let f be a continuous function such that $\int_0^2 f(x)\,dx = 6$ and $\int_0^2 x\,f(x)\,dx = 10$. **(8 marks)**

(a) Evaluate $\int_0^2 (x + 3)f(x)\,dx$.

(b) Using the substitution $x = 2 - t$, show that $\int_0^2 f(2 - x)\,dx = \int_0^2 f(x)\,dx$.

(c) Evaluate $\int_0^2 (f(x) + f(2 - x))\,dx$ and hence find $\int_0^2 f(2 - x)\,dx$.

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7. The curve $y = \frac{\ln x}{x^2}$ for $x > 0$ has a maximum point at $x = e$. **(9 marks)**

(a) Using the substitution $u = \ln x$, find $\int \frac{\ln x}{x^2}\, dx$.

(b) Find the area of the region bounded by the curve, the x-axis and the lines $x = 1$ and $x = e$.

(c) Find the area of the region bounded by the curve, the x-axis and the line $x = e^2$.

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SECTION B (10 marks)

8. Let $f(x) = x^3 - 3x^2 + 2x$. **(10 marks)**

(a) Factorise $f(x)$ completely and write down the x-intercepts of the curve $y = f(x)$.

(b) Find the coordinates of the local maximum and local minimum points of the curve $y = f(x)$.

(c) Find the total area of the regions bounded by the curve $y = f(x)$ and the x-axis.

(d) The line $y = kx$ meets the curve at three distinct points. Using a definite integral, find the value of k for which the two regions enclosed between the line and the curve have equal areas.

END OF PAPER

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