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TUTGATHER PRACTICE PAPER

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2027

MATHEMATICS Compulsory Part
PAPER 1

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: Further 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. A sum of \$20 000 is deposited in a bank that pays interest at 4% per annum, compounded quarterly. Find the amount in the account after 3 years, correct to the nearest dollar. **(3 marks)**

2. In a survey of 250 students, 160 said they use public transport daily. (a) Find the sample proportion $\hat{p}$ of students who use public transport daily. (b) Estimate the standard error of $\hat{p}$, correct to 3 significant figures. **(3 marks)**

3. In the figure, $ABCD$ is a cyclic quadrilateral with $\angle BAD = 105^\circ$. The side AB is produced to a point E so that $\angle CBE = 70^\circ$. Find $\angle BCD$ and $\angle ADC$, giving reasons. **(4 marks)**

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4. A rectangular sheet of cardboard measures 40 cm by 30 cm. Squares of side x cm are cut from each corner and the remaining sheet is folded to form an open box of height x cm. (a) Write down expressions for the length and width of the base of the box. (b) Show that the volume V cm^3 of the box is $V = 4x^3 - 140x^2 + 1200x$. (c) State the restriction on x. **(6 marks)**

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SECTION A(2) (24 marks)

5. Mary borrows \$300 000 from a bank at an annual interest rate of 3.6%, compounded monthly, and repays it by equal monthly instalments over 10 years, the first instalment being paid one month after the loan is taken. (a) Find the monthly interest rate. (b) If the monthly instalment is R, show that the amount owed after n months is $300\,000(1.003)^n - R \cdot \dfrac{(1.003)^n - 1}{0.003}$. (c) Hence find the monthly instalment R, correct to the nearest dollar. **(7 marks)**

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6. A survey is conducted to estimate the proportion p of voters in a city who support a proposal. A random sample of 400 voters is taken and 232 of them support the proposal. (a) Find the sample proportion $\hat{p}$. (b) Construct a 95% confidence interval for p, using the approximation $\hat{p} \pm 1.96\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$. (c) A newspaper claims that "more than half of the voters support the proposal". Using your interval, comment on this claim. (d) Find the minimum sample size needed so that the margin of error of a 95% confidence interval is at most 0.03, assuming $\hat{p} = 0.58$ is used as an estimate. **(8 marks)**

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7. In the figure, ABC is a triangle with AB = 13 cm, BC = 14 cm and CA = 15 cm. The point D lies on BC such that $AD \perp BC$. (a) Find the length of BD. (b) Find the area of $\triangle ABC$. (c) The incircle of $\triangle ABC$ touches BC at P. Find BP. (d) Hence find the radius of the incircle. **(9 marks)**

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SECTION B (10 marks)

8. A small factory produces and sells x units of a product each week. The weekly cost \$$C$ and the weekly revenue \$$R$ (both in dollars) are modelled by **(10 marks)**

$$C(x) = 0.02x^2 + 40x + 18\,000, \qquad R(x) = 90x - 0.01x^2,$$

where $0 \le x \le 3000$. (a) Write down the profit function $P(x) = R(x) - C(x)$. (b) Find the number of units that maximises the weekly profit, and the maximum weekly profit. (c) The factory must sell at least enough units to break even. Find the range of x for which the factory makes a non-negative profit, correct to the nearest integer. (d) The factory owner wants the weekly profit to be at least \$20 000. Using your answer to (b), determine whether this is possible, and if so, find the corresponding range of x correct to the nearest integer.

END OF PAPER

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