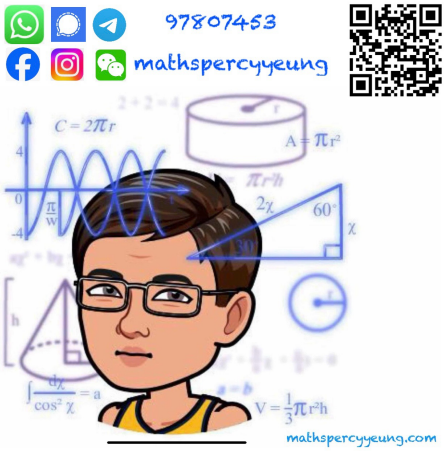
2023-2024 First/Second Term Examination (Revision)

F. 3 Mathematics

Paper 1



Time allowed : 1 hour 30 minutes

Full mark : 80

This question-answer book consists of 15 printed pages.

Instructions to candidates:

1. This paper must be answered in English with a blue / black ball pen, unless otherwise specified.
2. Write your name, class and class number in the space provided on this cover.
3. This paper consists of TWO sections, A and B.
   Section A carries 40 marks and Section B carries 40 marks.
4. Answer ALL questions in this paper. Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins. Answers written in the margins will not be marked.
5. All diagrams / graphs / charts as part of the answers must be clearly drawn with an HB pencil.
6. Graph paper and supplementary answer sheets will be supplied on request. Write your name, class and class number on each sheet, and fasten them INSIDE this book.
7. Unless otherwise specified, all working must be clearly shown.
8. The diagrams in this paper are not necessarily drawn to scale.
9. Unless otherwise specified, numerical answers must be exact or correct to 3 significant figures.
10. Calculator pad printed with the “HKEA Approved” / “HKEAA Approved” label is allowed.
    Remove the calculator cover / jacket.

2023-24 E1

1. Factorize the following expressions.

   (a) $x^2 - 3xy - 10y^2$

   (b) $2x^2y^2 - 6xy^3 - 20y^4$

   (c) $(a+2)^2 - 3(a+2)(b+3) - 10(b+3)^2$

(5 marks)

2. Simplify $\dfrac{(a^3b^{-4})^3}{(-2b^4)^2}$ and express your answer with positive indices. (3 marks)

Answers written in the margins will not be marked.

3. (a) Solve the inequality $\frac{2(x+8)}{-5} < 6 - x$.

(b) Write down the greatest integer satisfying the inequality in (a).

(3 marks)

4. A sum of \$20 000 is deposited in a bank at a simple interest rate of 2% p.a.

(a) Find the time required for the amount to reach \$22 400.

(b) Find the amount received if the interest is compounded quarterly for the same period of time in (a). (Give the answer correct to the nearest dollar.)

(5 marks)

Answers written in the margins will not be marked.

5. The profit made by a company increased at a constant rate each year between 2009 and 2019.

The company made a profit of $\$1.28 \times 10^{10}$ and $\$1.312 \times 10^{10}$ in 2018 and 2019 respectively.

(a) Find the increasing rate of the profit made by the company each year between 2009 and 2019.

(b) Find the difference in the profits made by the company in 2009 and in 2019 in scientific notation. (Give your answer correct to 3 significant figures.)

(6 marks)

Answers written in the margins will not be marked.

9. It is given that the sum S of the first n positive integers can be expressed by $S = \frac{n(n+1)}{2}$.

(a) (i) Express $20 \times 20^2 \times 20^3 \times ... \times 20^{10}$ in the form of 20^M, where M is an integer.

(ii) Express $2 \times 4 \times 8 \times ... \times 512 \times 1024$ in the form of 2^N, where N is an integer.

(b) Without using a calculator, express $\frac{20 \times 20^2 \times 20^3 \times ... \times 20^{10}}{2 \times 4 \times 8 \times ... \times 512 \times 1024}$ in scientific notation.

(5 marks)

Answers written in the margins will not be marked.

10. The value of a flat was $\$P$ at the end of 2010. At the end of 2011, its value was decreased by 5%. Its value was then increased at a constant rate of 10% each year until the end of 2014. The increase in its value over these four years is \$528 900.

(a) (i) Find the overall percentage change of the flat in these four years. (3 marks)

(ii) Find the value of P. (2 marks)

(b) The value of the flat grew at a constant rate of t % each year from the end of 2014 to the end of 2017. If the value of the flat at the end of 2017 was \$4 200 000, find the value of t. (Correct the answer to 3 significant figures.) (2 marks)

Answers written in the margins will not be marked.

11. An electronics company is planning to purchase a total of 500 smartphones and tablets for retail selling. Let x be the number of smartphones purchased. The table below shows the costs and the proposed selling prices of each smartphone and tablet.

	Smartphone	Tablet
Cost ($/each)	3600	2800
Selling price ($/each)	4988	3588

(a) According to research results, the number of smartphones the company purchased should not be less than half of the number of tablets. Find the range of values of x then. (2 marks)

(b) The available amount of money for the company to purchase goods is not more than $1 538 000. Find the range of values of x accordingly. (3 marks)

(c) (i) Find the total profit in terms of x. (2 marks)

(ii) To satisfy the conditions in (a) and (b), find the maximum profit possibly made by the company. (3 marks)

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2023-24 E2

5. (a) Simplify $\dfrac{\sin^3\theta + \sin\theta\sin^2(90^\circ - \theta)}{\cos\theta}$.

(b) Hence, solve $\dfrac{\sin^3\theta + \sin\theta\sin^2(90^\circ - \theta)}{\cos\theta} = \dfrac{1}{\tan(\theta + 10^\circ)}$.

(5 marks)

Answers written in the margins will not be marked.

7. In Figure 1, the true bearing of R from P is 118°. It is given that $PR = 2$ km and $\angle PQR = 84°$. P and R are equidistant from Q.

   (a) Find the true bearing of Q from P.

   (b) Find the shortest distance from R to PQ.

   ~~(c) S is a point such that $PQRS$ is a rhombus. Find the compass bearing of S from P. (S is not shown in the figure.)~~

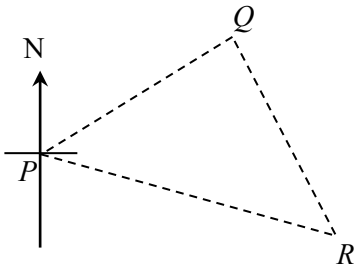

Figure 1

(6 marks)

Answers written in the margins will not be marked.

14. Refer to Figure 4, at 10:02:05 a.m., the angle of depression of an airport A on the ground from a plane at P was 5°. The plane was flying horizontally at a constant speed of 840 km/h and it took 5 minutes to fly from P to Q. The angle of depression of A from Q was 10°. It is given that B is vertically above A such that B, Q and P lie on a straight line.

(a) Find the height of B above the ground. (4 marks)

(b) The plane started the landing procedure when the angle of depression of A from the plane became 20°.

(i) Find the time at which the plane started the landing procedure, correct to the nearest second.

(ii) After the start of the landing procedure, the plane reduced its speed and flew directly towards A. The landing procedure was completed when the plane arrived at A at 10:13:05 a.m. Find the average speed of the plane during the landing procedure. Give your answer in km/h.

(6 marks)

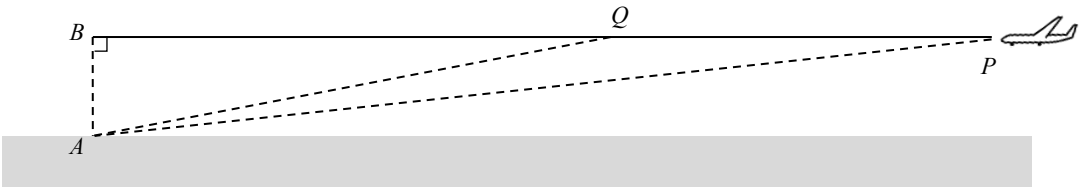

Figure 4

Answers written in the margins will not be marked.

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