

2021-2022-S5 2nd TERM EXAM-MATH-CP 1

2021-2022 S5
2nd TERM EXAM
MATH CP
PAPER 1

2021 – 2022
S5 Second Term Examination

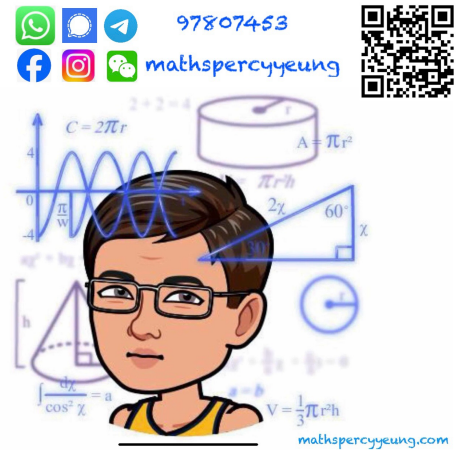
MATHEMATICS Compulsory Part PAPER 1

Question–Answer Book

24th June, 2022
8:15 am – 10:30 am (2 hours 15 minutes)
This paper must be answered in English

INSTRUCTIONS

1. Write your name, class and class number in the spaces provided on this cover.
2. This paper consists of THREE sections, A(1), A(2) and B.
3. Attempt 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.
4. Unless otherwise specified, all working must be clearly shown.
5. Unless otherwise specified, numerical answers should be either exact or correct to 3 significant figures.
6. The diagrams in this paper are not necessarily drawn to scale.



Sections	Marks
A (1 – 6)	
A (7 – 15)	
A Total	/70
B Total	/35
TOTAL	/105

Section A(1) (35 marks)

1. Simplify $\frac{(2\alpha^2\beta^{-3})^4}{\alpha\beta^{-8}}$ and express your answer with positive indices. (3 marks)

2. Make b the subject of the formula $\frac{a + 2b}{3b + 4c} = 5$. (3 marks)

3. Factorize
(a) $9x^2 - 49$,
(b) $3xy - 7y - 9x^2 + 49$. (4 marks)

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4. The cost of a bag is \$480 and it is sold at a profit percentage of 25%.

(a) Find the selling price of the bag.

(b) If the bag is sold at a discount of 20% on its marked price, find the marked price of the bag.

(4 marks)

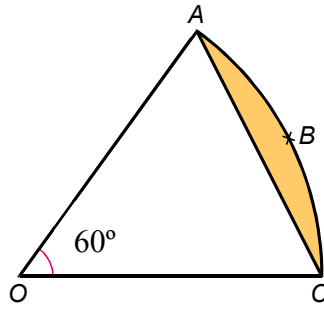
5. B is the reflected image of A with respect to the x -axis. B is rotated anti-clockwise about the origin O through 90° to C . It is given that the coordinates of A are $(8, -4)$.

(a) Write down the coordinates of B and C .

(b) Find the mid-point of BC .

(4 marks)

6. In the figure, $OABC$ is a sector with the centre O . $\angle AOC = 60^\circ$ and the length of ABC is 2π cm.



- (a) Find the length of OC .
(b) Find the area of segment ACB . (Give your answer in terms of π .)

(4 marks)

7. (a) Solve the compound inequality $\frac{1+x}{2} > \frac{2-x}{3} + 4$ and $3x - 21 \leq 0$.

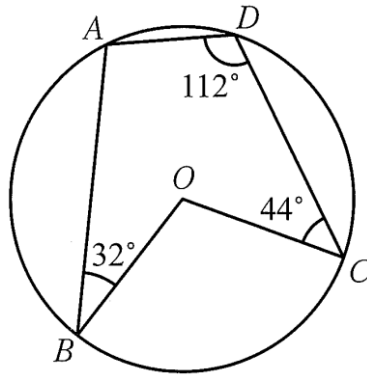
- (b) How many integers satisfy both inequalities in (a) ?

(4 marks)

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8. In the figure, O is the centre of the circle. A , B , C and D are points lying on the circle. It is given that $\angle ABO = 32^\circ$, $\angle ADC = 112^\circ$ and $\angle DCO = 44^\circ$. Find $\angle BOC$ and $\angle BAD$. (4 marks)



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9. The graph of $y = 3x^2 + (k - 2)x + 12$, where $k > 0$, touches the x -axis.

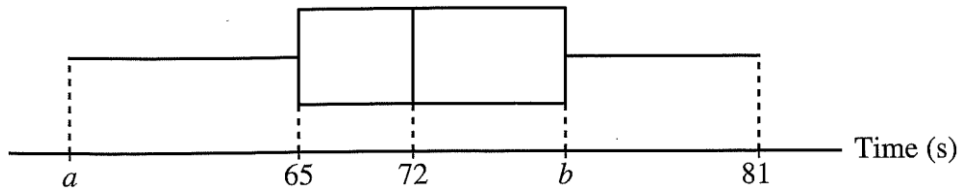
- (a) Find the value(s) of k .
- (b) Find the x -intercept of the graph.

(5 marks)

Section A(2) (35 marks)

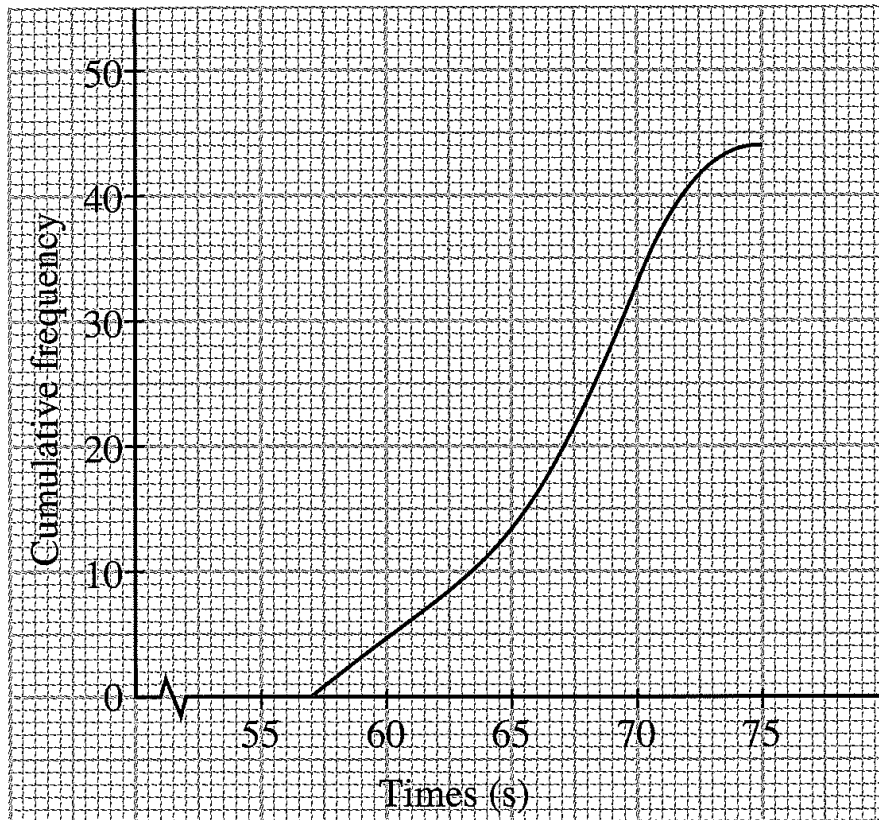
10. Solve $2\cos^2 x - 2 = -3\sin(90^\circ + x)$ where $0^\circ \leq x \leq 360^\circ$. (3 marks)

12. The box-and-whisker diagram below shows the distribution of the times taken by 44 students to finish a 400 m race.



The inter-quartile range and the range of the distribution are 11 s and 20 s respectively.

- (a) Find a and b . (2 marks)
- (b) The students joined a training program. The cumulative frequency curve below shows the distribution of the times taken by the 44 students to finish a 400 m race after the training.



- (i) The program trainer claims that at least 25% of the 44 students show improvement in the time taken to finish a 400 race after the training. Do you agree? Explain your answer.
- (ii) Candy claims that the distribution of the times taken to finish a 400 m race after training is less dispersed. Do you agree? Explain your answer.

(4 marks)

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13. (a) Prove that $x + 3$ is a factor of $P(x) = x^3 + 4x^2 - 27x - 90$. (1 mark)

(b) Given that $x^2 - 2x - 15$ is a factor of $Q(x) = x^3 + ax^2 + bx + 30$, find the values of a and b . (3 marks)

(c) Hence, solve $P(x) + Q(x) = 0$. (3 marks)

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15. A hemispherical vessel is held vertically on a horizontal surface. At the beginning, the vessel is fully filled with water. Then, a solid right cylinder of base radius 24 cm is held vertically in the vessel as shown in Figure (a). The base of the cylinder is 6 cm above the lowest point of the vessel.

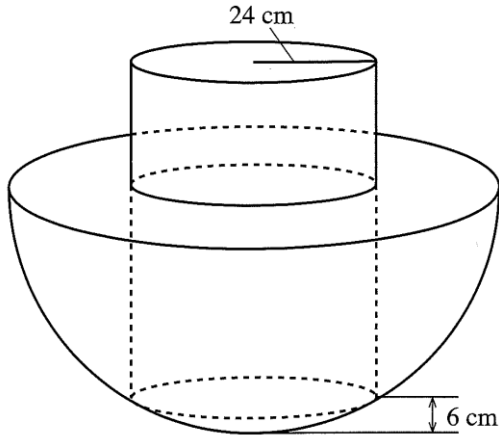


Figure (a)

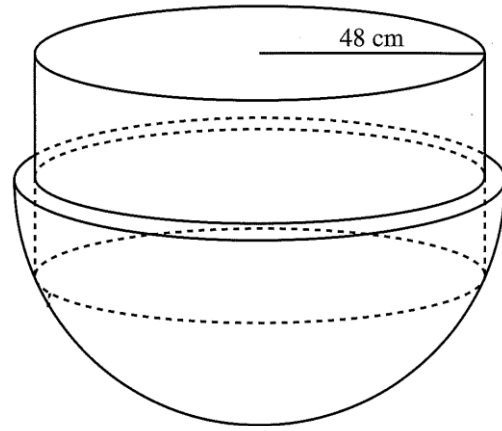


Figure (b)

- (a) Find the volume of water remaining in the vessel in terms of π . (3 marks)
- (b) The solid right cylinder in Figure (a) is removed and left the water in the vessel. Then another solid right cylinder of base radius 48 cm is held vertically in the vessel as shown in Figure (b). Will the water overflow? Explain your answer. (3 marks)

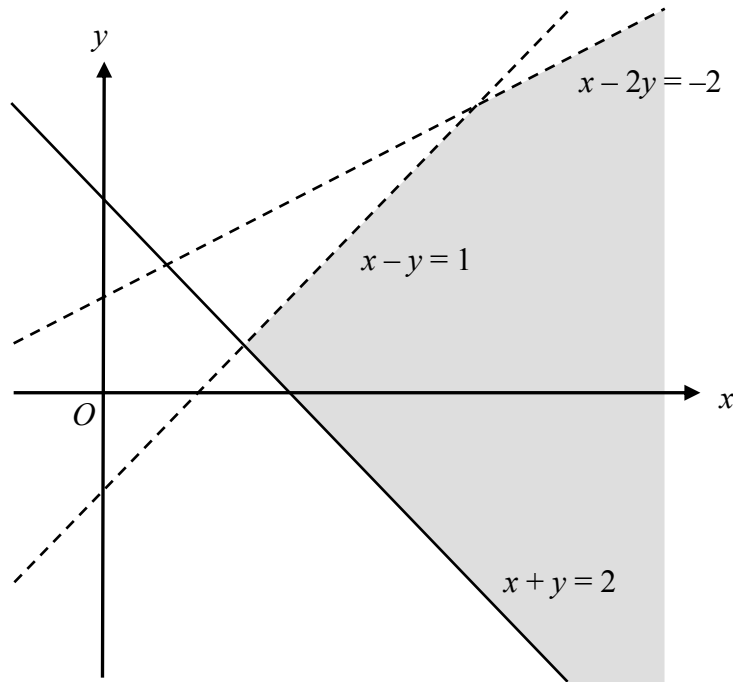
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Section B (35 marks)

16. In the figure, the shaded region represents the solutions of a system of inequalities. Write down the system of inequalities. (3 marks)



17. A bag contains 3 red balls, 4 green balls and 5 yellow balls. Three balls are drawn at random from the bag.

- (a)** Find the probability that
 - (i)** the three balls drawn are of the same colour;
 - (ii)** the three balls drawn are of different colours. (4 marks)
- (b)** If the three balls drawn are of the same colour, 10 tokens will be awarded. If the three balls drawn are of different colours, 5 token will be awarded. Otherwise no token will be awarded. Find the expected number of tokens to be awarded. (2 marks)

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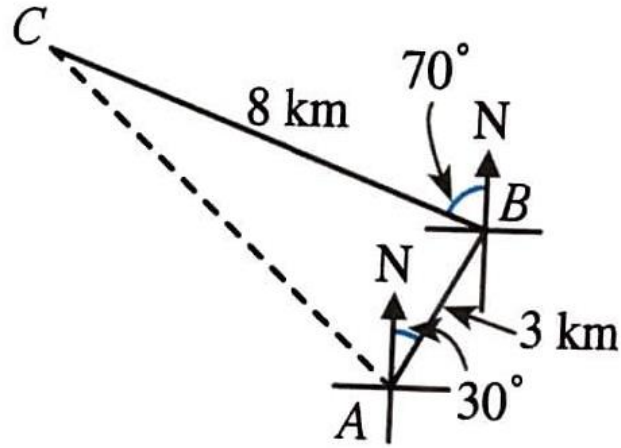
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19. A ship sails 3 km from A to B on a bearing of $N30^\circ E$ and then sails 8 km from B to C on a bearing of $N70^\circ W$.



- (a) Find the distance between A and C . (3 marks)
- (b) Find the compass bearing of C from A . (2 marks)
- (c) Someone claims that the shortest distance between C and AB is smaller than 7.86 km. Do you agree? Explain your answer. (2 marks)

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21. The table below shows the mean, the median, the standard deviation and the range of the marks in two quizzes.

Quiz	Mean	Median	Standard Deviation	Range
Quiz 1	50.2	X	12.3	60
Quiz 2	60.5	63	14.2	80

- (a) Find X if the marks in Quiz 1 are normally distributed. (1 mark)
- (b) A student, Peter, gets 43 marks in Quiz 1 and 52 marks in Quiz 2. In which quiz does he perform better? Explain your answer. (2 marks)
- (c) In order to adjust the marks, 3 marks are added to all students in Quiz 2.
- (i) Write down the new mean and the new standard deviation in Quiz 2.
- (ii) Describe the change in the standard score of Peter in Quiz 2. (3 marks)

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