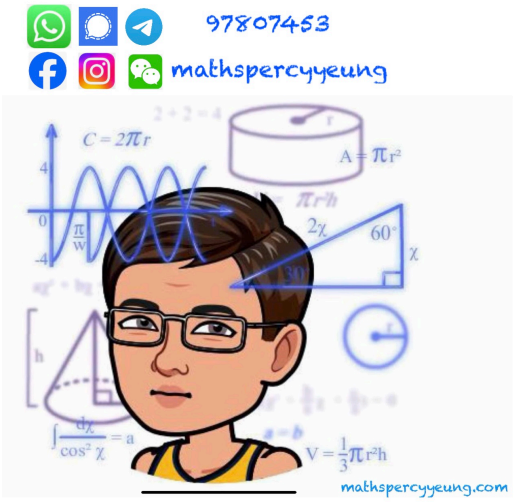
MSC F3 2022-23 Math E2 P1 QP

2022-2023 Second Term Examination

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 spaces 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.

Section A (40 marks)

1. (a) Factorize $12a^2 - 2ab - 2b^2$.

   (b) Hence factorize $12(1-y)^2 - 2(1-y)y - 2y^2$.

(5 marks)

2. (a) Solve the inequality $\frac{2x+1}{3} - \frac{3x-5}{4} > 2$.

   (b) Find the greatest integral value of x.

(4 marks)

Answers written in the margins will not be marked.

3. Jacky intends to borrow \$200 000 from a bank. If the interest is compounded half-yearly, the compound interest after 1.5 years is \$31 525.

   (a) Find the annual interest rate.

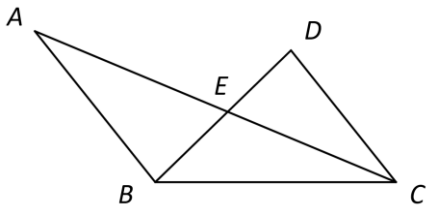
   (b) The bank officer said that there is a new plan with a simple interest rate 11% per annum. Considering the interest of each phan after 1.5 years, should Jacky change to borrow the money with the new plan?

(7 marks)

Answers written in the margins will not be marked.

4. In the figure, E is a point on BD such that CE and EB are the angle bisectors of $\angle BCD$ and $\angle ABC$ respectively. CE is produced to A such that $BA \parallel CD$ and $\angle BAE = 32°$. Find $\angle BEA$.

(5 marks)



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5. (a) Simplify $\left(\frac{1}{\cos(90°-\theta)}+\frac{1}{\sin(90°-\theta)}\right)\times\frac{\sin(90°-\theta)}{1+\tan\theta}$.

(b) Hence, solve $\left(\frac{1}{\cos(90°-\theta)}+\frac{1}{\sin(90°-\theta)}\right)\times\frac{\sin(90°-\theta)}{1+\tan\theta}=\tan 20°$.

(6 marks)

Answers written in the margins will not be marked.

6. It is given that A (0, 6) and B (9, 0) are two points on the rectangular coordinate plane. C is a point on AB where $AC:CB=1:2$.

   (a) Find the coordinates of C.

   (b) L is a straight line passing through C and perpendicular to AB. If L cuts the x-axis at D, find the coordinates of D.

   (c) It is given that the coordinates of E are (0, k), where k is a constant. Find the coordinates of E such that C, D and E are collinear.

(7 marks)

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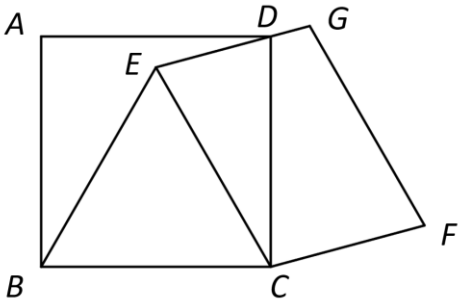
7. In the figure, $ABCD$ is a square. $\triangle BCE$ is an equilateral triangle. It is given that $\angle CED = \angle CFG$, $\angle DCF = 75°$ and D lies on EG.

   (a) Find $\angle CEG$.

   (b) Show that quadrilateral $CFGE$ is a parallelogram.

(6 marks)



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Section B (40 marks)

8. The back-to-back stem-and-leaf diagram below shows the scores of a quiz by two groups of students.

Score of a quiz by two groups of students

Group *A* Leaf (1 mark)	Stem (10 marks)	Group *B* Leaf (1 mark)
4 3 2 0	6	3 3 4 4 5
8 8 8 *a* 5 4 3	7	7 7 8
5 3 1	8	1 1 2 5 *b* 9 9
2	9	

(a) If the median scores of two groups of students are the same, find the value of a. (2 marks)

(b) If the mean score of Group *B* students is less than the mode score of Group *A* students by 1.8, find the value of b. (4 marks)

(c) It is found that the datum '78 marks' was recorded incorrectly in Group *B*. The correct score should be '77 marks'.

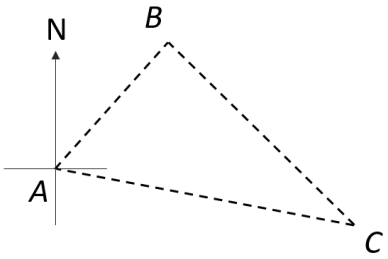
(i) Write down the median score and mode score after the mark correction.

(ii) Will the mean score increase, decrease or remain unchanged after the mark correction? Explain your answer.

(3 marks)

Answers written in the margins will not be marked.

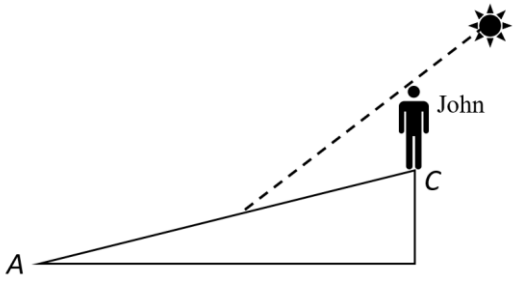
9. John goes hiking. He starts from A and walks a 200 m horizontal distance to B and then walks a 300 m horizontal distance to C. It is given that the compass bearing of B from A is N 40° E and the compass bearing of B from C is N 50° W.



(a) Find the distance between A and C. (3 marks)

(b) Find the compass bearing of A from C. (2 marks)

(c) It is given that the gradient of the path AC is $1:8$. The sun shines in the direction from C to A and forms the shadow of John on the path AC. The height of John is 1.8 m and the length of the shadow formed is 3 m. Find the angle of elevation that the sun shines with. (4 marks)



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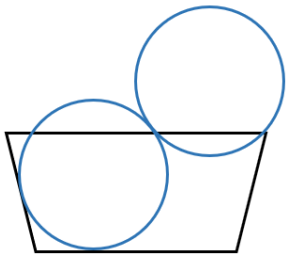
10. At an ice cream store, the paper cup for selling ice cream is of the shape of a frustum of a right circular cone. The upper radius and lower radius are 5 cm and 4 cm respectively. The height of the cup is 3 cm.



(a) Find the volume of the paper cup. (5 marks)

(b) Two identical ice cream balls of the shape of spheres with radii 3 cm are placed in the cup as shown in the figure. If the ice cream completely melts, will the ice cream spill out of the cup? (Assume there is no ice cream spillage while melting.) (3 marks)

(c) To avoid spillage, the owner of the store reduces the radii of ice cream balls by 10%. Will the ice cream spill out with the new size of ice cream balls? (3 marks)

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11. In a lucky draw, a participant needs to draw a ball from each of bags *A* and *B*. Bag *A* contains 3 white balls and 1 red ball. Bag *B* contains 2 white balls and 1 red ball. The prizes given to the participants are as shown below.

Balls drawn	Prize	Value of each prize
2 red	1st	\$100
1 red	2nd	\$20
0 red	3rd	\$10

(a) List all the possible outcomes in a table and find the probabilities of drawing

(i) 2 red balls,

(ii) 1 red ball,

(iii) 0 red ball.

(5 marks)

(b) If the participant has to pay \$25 for playing lucky draw once, is the lucky draw favourable to the participant? Explain your answer. (3 marks)

(c) The participant can also choose to throw a fair dice with six faces marked from 'one' to 'six'. If the result is 'six', the participant will get the 1st prize. If the result is 'five', the participant will get the 2nd prize. If the result is 'four', the participant will get the 3rd prize. If the result is 'one' to 'three', the participant will not get any prize. Is throwing a dice more favourable to the participant than drawing balls? (3 marks)

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End of Paper