S3 Final Examination (2025-2026)

Mathematics

(2 hours)

Date: 5 June 2026

Time: 8:30 a.m. - 10:30 a.m.

Instructions to students:

1. This paper consists of THREE parts, Conventional Questions, Multiple-choice Questions and Bonus Question. There are Section A and Section B in Conventional Questions. Section A carries 60 marks, Section B carries 20 marks, Multiple-choice Questions carry 20 marks and Bonus Question carries 3 marks.

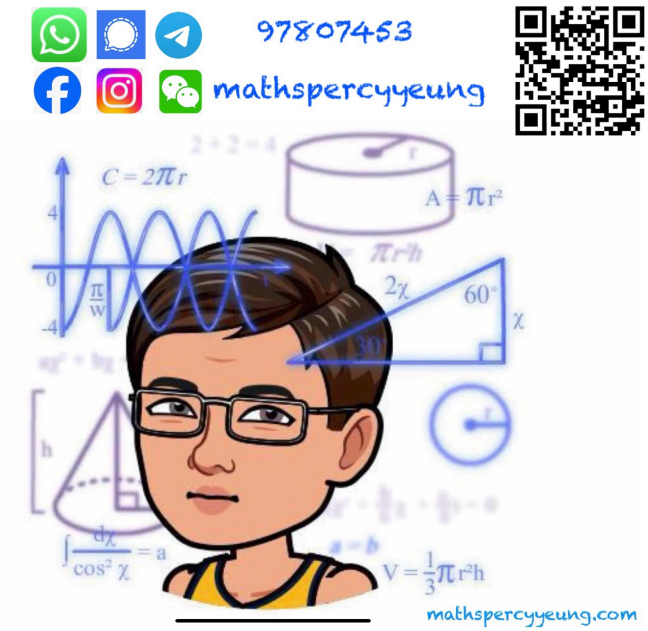
2. The maximum score of this paper is 100.

3. Attempt **ALL** questions in Conventional Questions and Multiple-choice Questions. Write your answers in the spaces provided in this Question / Answer Book.

4. Unless otherwise specified, show your workings clearly.

5. Unless otherwise specified, numerical answers should either be exact or correct to 3 significant figures.

6. The diagrams in this paper are not necessarily drawn to scale.



CONVENTIONAL QUESTIONS

SECTION A (60 marks)

1. Simplify $\frac{a^2b^3c^5}{(ab^2)^{-2}}$ and express your answer with positive indices. (3 marks)

2. 7 lemons and 2 pears are sold for \$49, while 5 lemons and 4 pears are sold for \$53. Find the price of a lemon. (3 marks)

3. Factorize

(a) $6m^2 + mn - 12n^2$,

(b) $12m^2 + 2mn - 24n^2 - 9mk + 12nk$.

(3 marks)

4. (a) Solve the inequality $\frac{6x+1}{2} + 8 > x$.

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

(3 marks)

5. Brand *A* rice costs \$24/kg and Brand *B* rice costs \$16/kg. When Natalie mixes some brand *A* rice and some brand *B* rice, the cost of the mixed rice is \$19.2/kg. Find the percentage of brand *A* rice in the mixed rice. (3 marks)

6. A box contains 3 red balls and 2 blue balls. In a lucky draw, a participant draws a ball randomly from the box and a gift will be given according to the table below:

Colour of the ball drawn	Value of the gift given
Red	\$5
Blue	\$20

(a) Find the probabilities of drawing a blue ball and a red ball respectively.

(b) Find the expected value of the gift given in one draw.

(4 marks)

7. A bag contains four balls numbered 1, 2, 6 and 9. Two balls are drawn at random from the bag at the same time.

   (a) List all the possible outcomes by using a suitable table.

   (b) Find the probabilities that the sum of the two numbers on the balls is less than 10.

(4 marks)

8. In Figure 1, $ABCD$ is a parallelogram. E and F are points lying on AC such that $\angle ADE = \angle CBF$.

   (a) Prove that $\triangle ADE \cong \triangle CBF$.

   (b) Prove that $EBFD$ is a parallelogram.

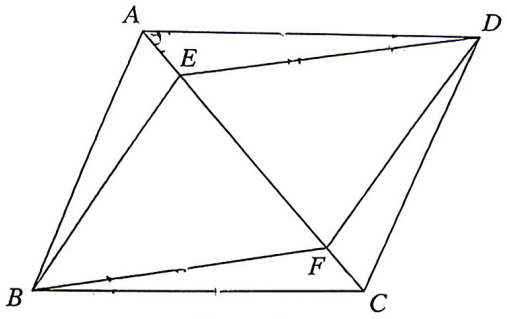


Figure 1

(4 marks)

9. In Figure 2, I is the incentre of $\triangle ABC$. BI is produced to meet AC at point D. If $\angle CBD = 15°$ and $\angle CID = 66°$, find $\angle BAC$ and $\angle IDC$.

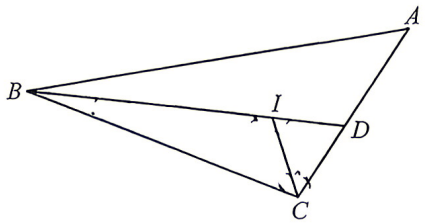


Figure 2

(4 marks)

10. The following stem-and-leaf diagram shows the ages of 10 users in a sports centre.

Ages of 10 users in a sports centre

Stem (10)	Leaf (1)
1	4 a 8
2	7 b
3	5 5 6 6 c

If the mean, the median and the mode of the ages of these 10 users are 28, 32 and 36 respectively, find the values of a, b and c. (5 marks)

11. Sarah deposited a sum of money in Bank A at an interest rate of 4% p.a., compounded quarterly. At the same time, Sarah deposited a sum of money in Bank B at a simple interest rate of 5% p.a. Let \$$a$ and \$$b$ be the principal Sarah deposited in Bank A and Bank B respectively. If the amount received after 10 years in each of the Bank A and Bank B are \$100 000, find a and b, correct to the nearest dollar. (4 marks)

12. In Figure 3, a woman is inside an elevator of a building which is 85 m above the ground. The angles of depression of bus C and car D from the woman are 62° and 50° respectively. Assume B, C and D lie on a straight line. Find the distance between the bus and the car.

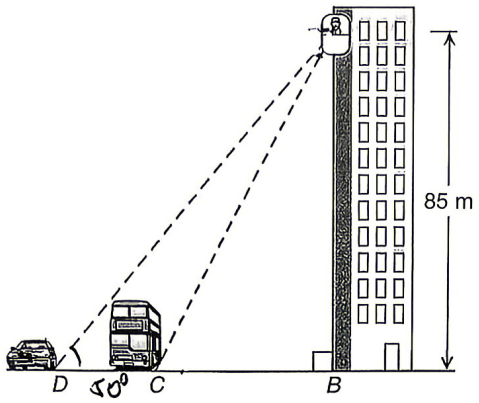


Figure 3

(3 marks)

13. In Figure 4, a truck at P travels westwards along a straight road at a constant speed of 36 km/h. It takes 20 minutes for the truck to arrive at R. The compass bearings of a building Q from P and R are S57°W and S33°E respectively.

(a) Find the distance between P and Q.

(b) If B is a point which is closest to Q on the path where the truck is travelling along, find the time required for the truck to reach B in minute.

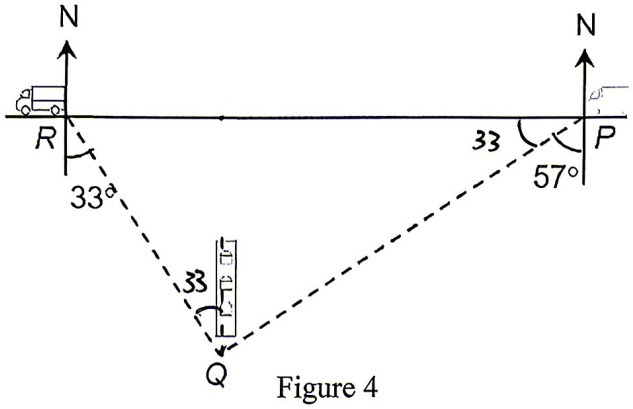


Figure 4 (5 marks)

14. L_1 is a straight line with x-intercept -3 and y-intercept 3. L_2 is a straight line parallel to L_1 and passes through the points $C(1, 3)$ and $D(5, k)$.

(a) Find the value of k. (3 marks)

(b) It is given that L_3 is the perpendicular bisector of CD. If L_3 cuts x-axis and y-axis at X and Y respectively, find

(i) the mid-point of CD and the slope of L_3, (4 marks)

(ii) the coordinates of X and Y. (3 marks)

(c) Find the area of quadrilateral $CXDY$. (2 marks)

Section B (20 marks)

15. Simplify $9.6\times10^{2n+1}\times0.1^{3-2n}-4.8\times100^{1-n}\div0.01^{3n-1}$ and express the answer in scientific notation. (3 marks)

16. Figure 5(a) shows a conical vessel filled with water.

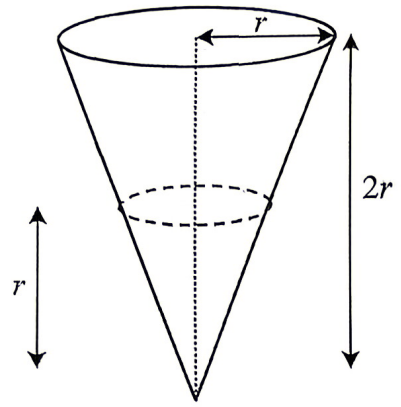


Figure 5(a)

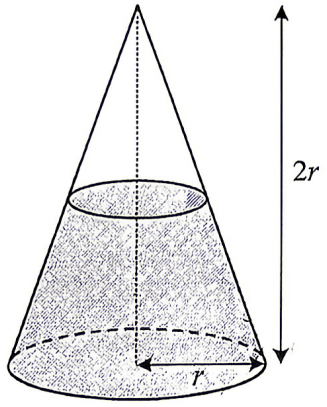


Figure 5(b)

(a) Find the volume of water in terms of r. (3 marks)

(b) The conical vessel is inverted as shown in Figure 5(b). Shelly claims that the depth of water now less than $0.05r$. Do you agree? Explain your answer. (3 marks)

(c) Find the wet curved surface area, in terms of r, of the conical vessel shown in Figure 5(b). (2 marks)

17. The coordinates of A and D are $(-9, -6)$ and $(3, 0)$ respectively. It is given that A, B, C and D are collinear and $AB : BC : CD = 2 : 1 : 3$.

(a) Find the coordinates of B and C. (3 marks)

(b) L is a straight line passing through C and E $(2, e)$. If L is an altitude of $\triangle ABE$, find the value of e. Hence, find the coordinates of U, where U is the orthocenter of $\triangle ABE$. (3 marks)

(c) Denote the orthocenter of $\triangle BCE$, $\triangle CDE$ and $\triangle ADE$ by R, S, T respectively. Find the coordinates of R and S. What is the geometric relationship of R, S, T and U? Explain your answer. (3 marks)

Multiple-choice Questions (20 marks)

Each question carries 2 marks. Put ✓ in the correct boxes.

	18	19	20	21	22	23	24	25	26	27
A										
B										
C										
D										

18. In Figure 6, ADB and AEC are straight lines. Find the value of x.

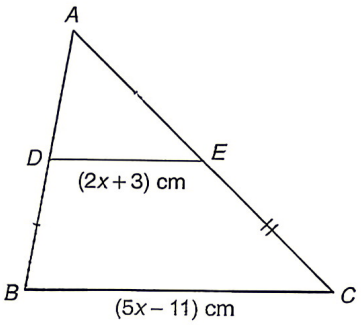


Figure 6

A. 14
B. 17
C. 24
D. 27

19. Find the weighted mean of the following data.

Datum	28	12	40	33
Weight	1	4	3	2

A. 26.2
B. 27.8
C. 29.4
D. 31

20. Figure 7 shows a bucket in the shape of a frustum of a right circular cone. The radii of the upper base and the lower base are 8 cm and 3 cm respectively. It is given that $VM = 6$ cm and $MN = 10$ cm. Find the capacity of the bucket correct to 3 significant figures.

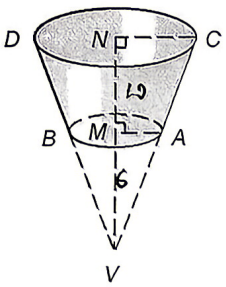


Figure 7

A. 820 cm^3
B. 920 cm^3
C. 1020 cm^3
D. 1120 cm^3

21. If the sum of three consecutive odd numbers is not less than 24, find the smallest possible value of the largest number.

A. 7
B. 9
C. 10
D. 11

22. In Figure 8, $ABCD$ is a parallelogram. E and F are points on AD and AB respectively such that $AE : BC = 1 : 3$ and $AF : DC = 3 : 4$. If the area of $\triangle AEF$ is 6 cm^2, find the area of the quadrilateral $BCEF$.

A. 16 cm^2
B. 24 cm^2
C. 26 cm^2
D. 32 cm^2

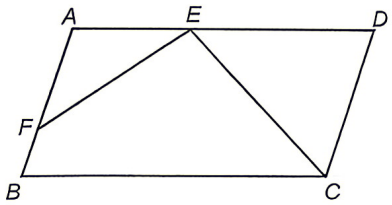


Figure 8

23. When a sphere is heated, it expands into a larger sphere and the surface area increases by 44%. Find the percentage increase of the volume of a sphere, corrected to the nearest integer.

A. 20%
B. 44%
C. 73%
D. 199%

24. In Figure 9, G is the centroid of $\triangle PQR$. PG, QG and RG are produced to meet QR, PR and PQ at S, T and U respectively. $PU = 7$ cm, $RT = 6$ cm and $RS = 5$ cm. Area of $\triangle PQS$: Area of $\triangle PUR =$

A. 1 : 1.
B. 1 : 2.
C. 5 : 7.
D 5 : 12.

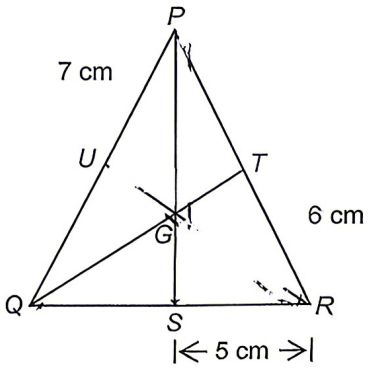


Figure 9

25. In Figure 10, the contour map is drawn to the scale 1 : 20 000. A straight road CD is measured to be 2 cm on the map. Find the gradient of road CD in the form $1 : n$.

A. 1 : 3
B. 1 : 4
C. 1 : 5
D. 1 : 6

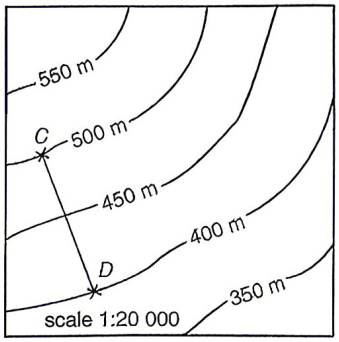


Figure 10

26. The inclination of a straight road is 26°. Express the gradient of the road in the form $1 : n$, where n is correct to the nearest integer.

A. 1 : 2
B. 1 : 4
C. 1 : 10
D. 1 : 20

27. At 1:00 p.m., a bus travels due east from A with a constant speed of 40 km/h and a car travels due north from A with a constant speed of 60 km/h. At 3:00 p.m., the bus arrives at B and the car arrives at C. Find the true bearing of B from C, correct to the nearest degree.

A. 034°
B. 098°
C. 124°
D. 146°

Bonus Question (3 marks)

28. A cube is inscribed in a spherical container as shown in Figure 11(a). Then, a sphere is inscribed in the cube as shown in Figure 11(b). Later, a cube is inscribed in the sphere as shown in Figure 11(c). All the cubes and spheres are fitted inside the container such that it reaches its maximum volume. Denote the volume of larger sphere and smaller sphere by S_0, S_1 respectively and the volume of larger cube and smaller cube by C_0, C_1 respectively. Find $\frac{S_0}{C_0}$, $\frac{C_0}{S_1}$, show that $\frac{S_0}{S_1} = \frac{C_0}{C_1} = k$ and find k. (Express k in surd form if necessary.)

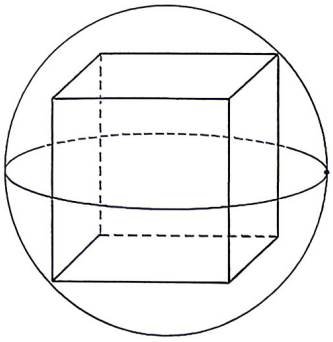


Figure 11(a)

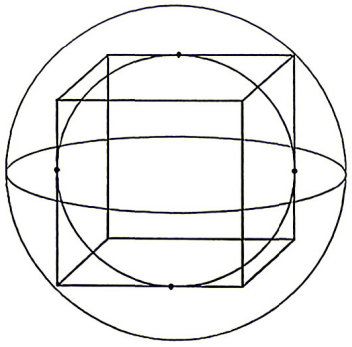


Figure 11(b)

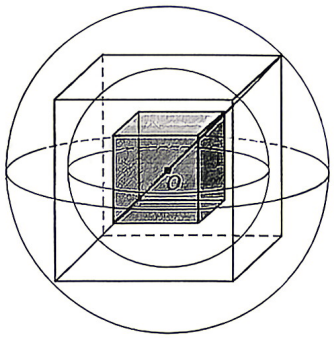


Figure 11(c)

(3 marks)

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