St. Stephen's Girls' College
Final Examination 2021-2022

Form 3 **JWCW, MYCC, YLN**
129 students

MATHEMATICS
Paper I
Time Allowed: 1 hour 30 minutes

Name: _____ ( )

Class: _____

Instructions:

- Attempt ***ALL*** questions.
- Write your answers in the spaces provided in this ***Question-Answer Paper*.**
- ***ALL*** working must be clearly shown.
- The diagrams in this paper are not necessarily drawn to scale.
- This paper carries 100 marks.
- Unless otherwise specified, numerical answers should either be exact or correct to 3 significant figures.

Question No.	Marks
1	(3)
2	(4)
3	(4)
4	(5)
5	(6)
6	(5)
7	(3)
8	(5)

Question No.	Marks
9	(7)
10	(8)
11	(9)
12	(7)
13	(9)
14	(11)
15	(6)
16	(8)
Total	(100)

1. Simplify $\frac{(x^2y^{-3})^3}{x^5y^{-8}}$ and express your answer in positive indices. (3 marks)

2. Factorize

   (a) $3x^2y - 7xy - 6y$, (1 mark)

   (b) $9x^2 - 4$, (1 mark)

   (c) $3x^2y - 7xy - 6y - 9x^2 + 4$. (2 marks)

3. Make y the subject of the formula $x = \frac{4y}{5-y}$. (4 marks)

4. Solve the inequality $\frac{4x-1}{7} + 5 > \frac{-x+3}{4}$ and represent the solutions graphically. (5 marks)

5. In a bakery, the price of a waffle is \$10 and the price of an egg tart is \$6.5. Kary pays with a \$100 note to buy two waffles and n egg tarts from the bakery and gets \$$v$ in change.
   (a) Express v in terms of n. (3 marks)
   (b) If Kary buys at least 9 egg tarts, find the greatest possible change. (3 marks)

6. In a company, 30% of the employees live in Kowloon, 54 employees live in New Territories and the rest live on Hong Kong Island. It is known that the number of employees living in Kowloon is 6 more than that on Hong Kong Island.
   (a) Find the total number of employees in the company. (2 marks)
   (b) If an employee is randomly selected, find the probability that the employee lives on Hong Kong Island. (3 marks)

7. Consider four points $A(3, -1)$, $B(-1, 4)$, $C(-3, y)$ and $D(2, 3)$. If $AB \perp CD$, find y. (3 marks)

8. P and Q are two solid spheres. The surface area of P is 900π cm^2.

   (a) Find the radius of sphere P. (2 marks)

   (b) The radius of sphere Q is equal to the diameter of sphere P. Find the total volume of the two spheres. Express your answer in terms of π. (3 marks)

9. Figure 1 shows an inverted right circular conical container with some water. The container is held vertically. The depth of water in the container is 22.5 cm. Mary then pours 760π cm^3 of water out of the container. She now finds that the depth of water in the container is 15 cm as shown in Figure 2.

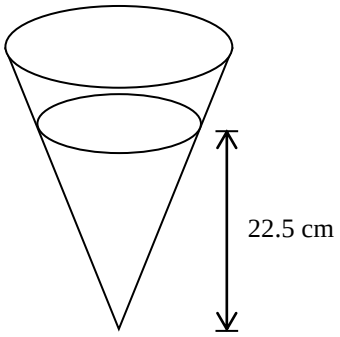


Figure 1

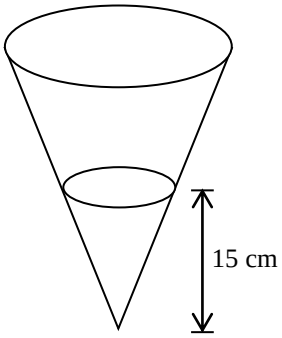


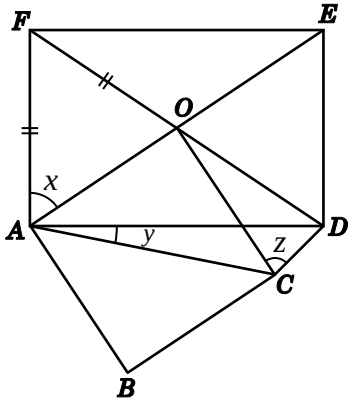
Figure 2

(a) Find the ratio of the volume of water in Figure 1 to the volume of water in Figure 2. (2 marks)

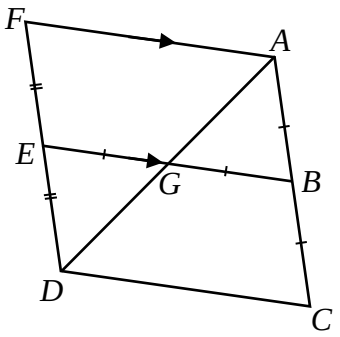
(b) Find the final volume of water in the container in terms of π. (2 marks)

(c) Find the final area of the wet curved surface of the container. (3 marks)

10. In the figure, *ADEF* is a rectangle and *OABC* is a square. It is given that *FD* and *AE* intersect at *O*, and $AF = OF$. Find the values of *x*, *y* and *z*. (8 marks)



11. In the figure, *ABC*, *FED*, *AGD* and *EGB* are straight lines.
It is given that $AF \parallel EB$ and $AB = BC = BG = GE$.



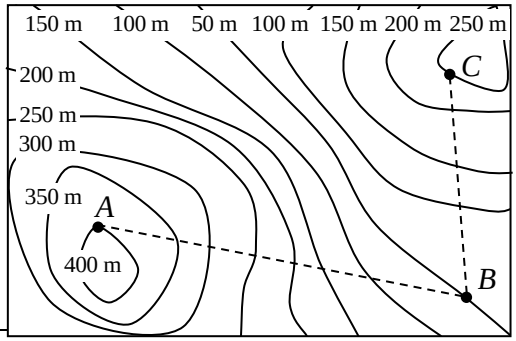
(a) Prove that $AF = EB$. (3 marks)

(b) Prove that $ACDF$ is a parallelogram. (3 marks)

(c) It is given that $BG = 10$ cm and $AG = 12$ cm.

Find the area of $ACDF$. (3 marks)

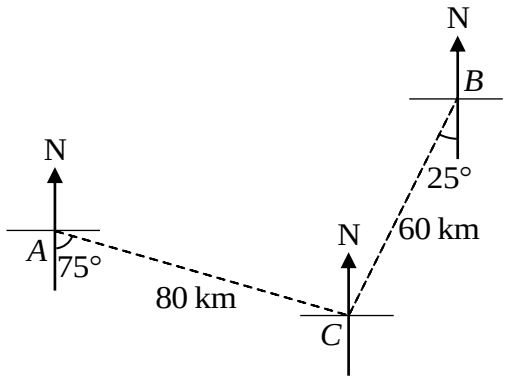
12. The figure shows a part of a contour map with a scale of $1:20\,000$. On the map, AB is measured as 5 cm and BC is measured as 3 cm.



(a) Find the angle of elevation of C from B. (4 marks)

(b) Someone claims that if one straight path is constructed from B to C and another from B to A, the path BC will be steeper than the path AB. Do you agree? Explain your answer. (3 marks)

13. The ship C is 80 km and 60 km away from the port A and port B respectively. The bearing of C from A is S75°E and the bearing of C from B is S25°W .



(a) If the ship C wants to travel towards the west, find the shortest possible distance of it from A. (2 marks)

(b) If the ship C wants to travel towards the east, find the shortest possible distance of it from B. (2 marks)

(c) (i) Find the distance between A and B.

(ii) Find the bearing of A from B.

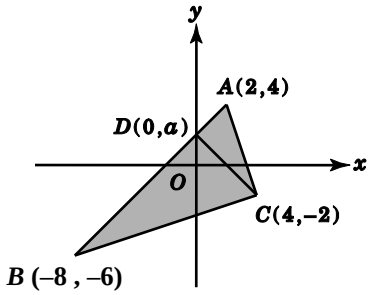
(5 marks)

14. In the figure, the coordinates of A, B and C are (2 , 4), (–8 , –6) and (4 , –2) respectively. AB cuts the y-axis at $D(0 , a)$.

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

(b) Determine whether $CD \perp AB$. (3 marks)

(c) Find the area of $\triangle ABC$. (5 marks)



15. Two male students and two female students form a group to work on a project. Two of the students are selected randomly from the group to hold a presentation.

(a) By drawing a tree diagram, list all the possible outcomes. (2 marks)

(b) Is the probability of selecting two students of the same gender for the presentation less than $\frac{1}{2}$?

Explain your answer. (4 marks)

16. The height of a solid right pyramid is 39 cm. Its base is an equilateral triangle of which the length of each side is 54 cm. The height of each lateral triangular face drawn from the vertex of the pyramid is 42 cm.

(a) Find the volume of the pyramid. (4 marks)

(b) The pyramid is cut into three parts, as shown in Figure 3, by two planes which are parallel to its base. The heights of the three parts are the same. Find the total surface area of the middle part. (4 marks)

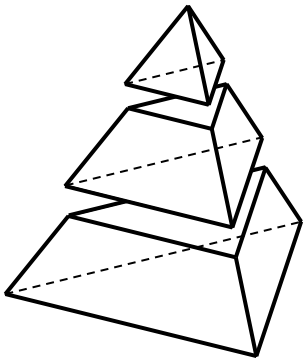


Figure 3

*** End of Paper ***