

FORMULAS FOR REFERENCE

SPHERE	Surface area	= $4\pi r^2$
	Volume	= $\frac{4}{3}\pi r^3$
CYLINDER	Area of curved surface	= $2\pi rh$
	Volume	= $\pi r^2 h$
CONE	Area of curved surface	= πrl
	Volume	= $\frac{1}{3}\pi r^2 h$
PRISM	Volume	= base area \times height
PYRAMID	Volume	= $\frac{1}{3} \times$ base area \times height

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SECTION A(1) (33 marks)

Answer ALL questions in this section and write your answers in the spaces provided.

1. Simplify $\frac{(a^3)^5}{a^{-6}}$ and express your answer with positive indices. (3 marks)

2. (a) Solve the inequality $x + 1 < \frac{x + 25}{6}$.
- (b) Write down the greatest integer satisfying the inequality $x + 1 < \frac{x + 25}{6}$. (3 marks)

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3. Factorize

(a) $3b - ab$,

(b) $9 - a^2$,

(c) $9 - a^2 + 3b - ab$.

(3 marks)

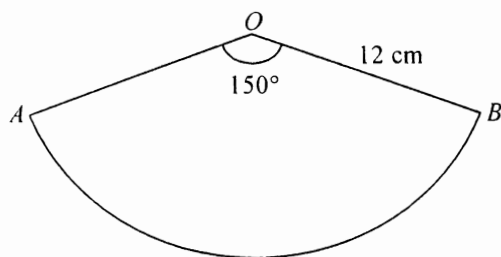
4. In Figure 1, the radius of the sector OAB is 12 cm. Find the length of \widehat{AB} in terms of π . (3 marks)

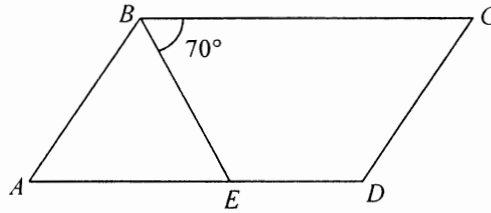
Figure 1

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5. In Figure 2, $ABCD$ is a parallelogram. E is a point lying on AD such that $AE = AB$. It is given that $\angle EBC = 70^\circ$. Find $\angle ABE$ and $\angle BCD$. (3 marks)



6. The weight of Tom is 20% more than that of John. It is given that Tom weighs 60 kg.
- (a) Find the weight of John.
- (b) The weight of Susan is 20% less than that of Tom. Are Susan and John of the same weight? Explain your answer. (4 marks)

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7. In Figure 3, the coordinates of the points A and B are $(-2, 7)$ and $(-5, 5)$ respectively. A is rotated clockwise about the origin O through 90° to A' . B' is the reflection image of B with respect to the y -axis.

- (a) Write down the coordinates of A' and B' .
- (b) Are the lengths of AB and $A'B'$ equal? Explain your answer.

(4 marks)

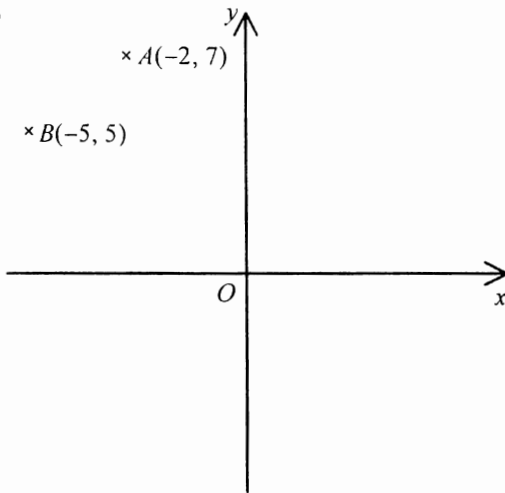


Figure 3

8. There are ten cards numbered 2, 3, 5, 8, 11, 11, 12, 15, 19 and k respectively, where k is a positive integer. It is given that the mean of the ten numbers is 11.

- (a) Find the value of k .
- (b) A card is randomly drawn from the ten cards. Find the probability that the number drawn is a multiple of 3.

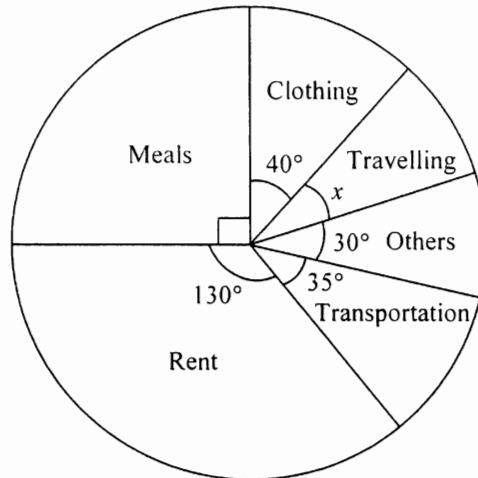
(5 marks)

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9. In Figure 4, the pie chart shows the expenditure of Ada in February 2006. It is given that she spent \$ 1 750 on transportation in that month.



The expenditure of Ada in February 2006

Figure 4

Find

- (a) x ,
(b) her total expenditure in that month,
(c) her expenditure on travelling in that month.

(5 marks)

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Section A(2) (33 marks)

Answer ALL questions in this section and write your answers in the spaces provided.

10. Let $f(x) = (x-a)(x-b)(x+1) - 3$, where a and b are positive integers with $a < b$. It is given that $f(1) = 1$.

- (a) (i) Prove that $(a-1)(b-1) = 2$.
- (ii) Write down the values of a and b .

(3 marks)

(b) Let $g(x) = x^3 - 6x^2 - 2x + 7$. Using the results of (a)(ii), find $f(x) - g(x)$. Hence find the exact values of all the roots of the equation $f(x) = g(x)$. (4 marks)

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11. In Figure 5, $ABCDEF$ is a thin six-sided polygonal metal sheet, where all the measurements are correct to the nearest cm.

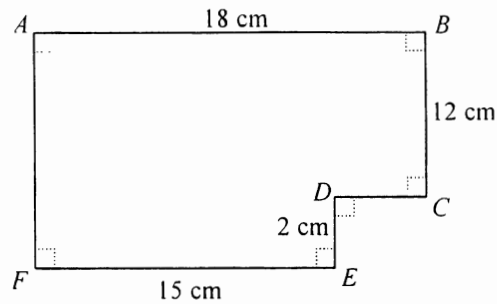


Figure 5

- (a) Write down the maximum absolute error of the measurements. (1 mark)

- (b) Find the least possible area of the metal sheet. (3 marks)

- (c) The actual area of the metal sheet is $x \text{ cm}^2$. Find the range of values of x . (4 marks)

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12. In Figure 6, CM is the perpendicular bisector of AB , where C and M are points lying on the x -axis and AB respectively. BD and CM intersect at K .

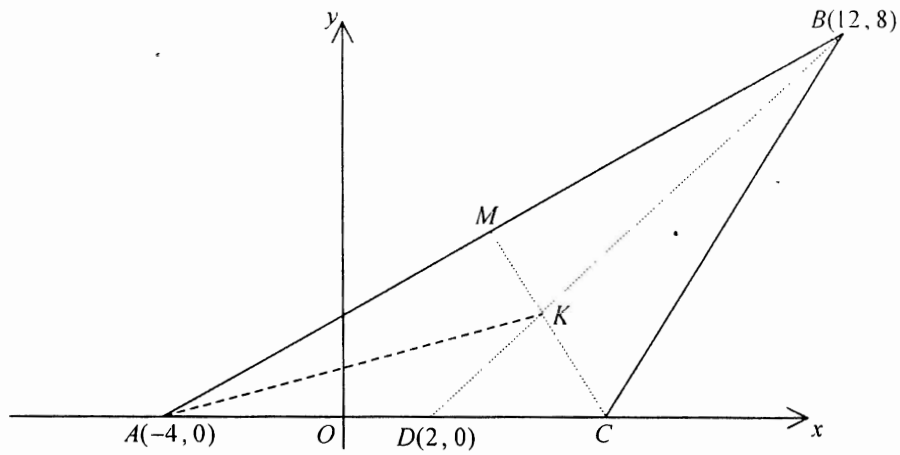


Figure 6

- (a) Write down the coordinates of M . (1 mark)

- (b) Find the equation of CM . Hence, or otherwise, find the coordinates of C . (3 marks)

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13. In Figure 7(a), the frustum of height 8 cm is made by cutting off a right circular cone of base radius 3 cm from a solid right circular cone of base radius 6 cm. Figure 7(b) shows the solid X formed by fixing the frustum onto a solid hemisphere of radius 6 cm. The solid Y in Figure 7(c) is similar to X . The ratio of the surface area of X to the surface area of Y is 4:9.

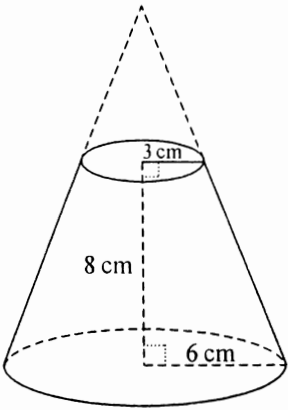
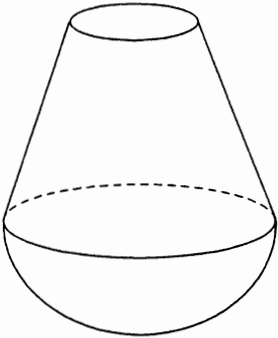
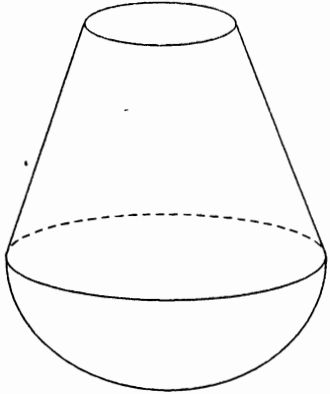


Figure 7(a)



Solid X

Figure 7(b)



Solid Y

Figure 7(c)

(a) Find the volume of X and the volume of Y . Give your answers in terms of π . (7 marks)

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SECTION B (33 marks)

Answer any **THREE** questions in this section and write your answers in the spaces provided.

Each question carries 11 marks.

14. The stem-and-leaf diagrams below show the distributions of the scores (in marks) of the students of classes *A* and *B* in a test, where *a*, *b*, *c* and *d* are non-negative integers less than 10. It is given that each class consists of 25 students.

Class A

<u>Stem (tens)</u>	<u>Leaf (units)</u>
0	<i>a</i> 9
1	2 5 7 8 8
2	3 3 5 6 7 9
3	2 3 5 6 9 9 9
4	1 2 2 4 <i>b</i>

Class B

<u>Stem (tens)</u>	<u>Leaf (units)</u>
0	<i>c</i> 3 3 4 5
1	1 1 2 2 3 3 5 6 7 8
2	1 1 5 5 5 7 8
3	5 9
4	<i>d</i>

- (a) (i) Find the inter-quartile range of the score distribution of the students of class *A* and the inter-quartile range of the score distribution of the students of class *B*.
- (ii) Using the results of (a)(i), state which one of the above score distributions is less dispersed. Explain your answer.
- (4 marks)
- (b) The passing score of the test is 20 marks. From the 50 students, 3 students are randomly selected.
- (i) Find the probability that exactly 2 of the selected students pass the test.
- (ii) Find the probability that exactly 2 of the selected students pass the test and both of them are in the same class.
- (iii) Given that exactly 2 of the selected students pass the test, find the probability that both of them are in the same class.
- (7 marks)

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15. The cost of a souvenir of surface area $A \text{ cm}^2$ is $\$C$. It is given that C is the sum of two parts, one part varies directly as A while the other part varies directly as A^2 and inversely as n , where n is the number of souvenirs produced. When $A = 50$ and $n = 500$, $C = 350$; when $A = 20$ and $n = 400$, $C = 100$.
- (a) Express C in terms of A and n . (3 marks)
- (b) The selling price of a souvenir of surface area $A \text{ cm}^2$ is $\$8A$ and the profit in selling the souvenir is $\$P$.
- (i) Express P in terms of A and n .
- (ii) Suppose $P:n = 5:32$. Find $A:n$.
- (iii) Suppose $n = 500$. Can a profit of $\$100$ be made in selling a souvenir? Explain your answer.
- (iv) Suppose $n = 400$. Using the method of completing the square, find the greatest profit in selling a souvenir. (8 marks)

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17. In Figure 9(a), ABC is a triangular paper card. D is a point lying on AC such that BD is perpendicular to AC . It is known that $AB = 40$ cm, $BC = 60$ cm and $AC = 90$ cm.

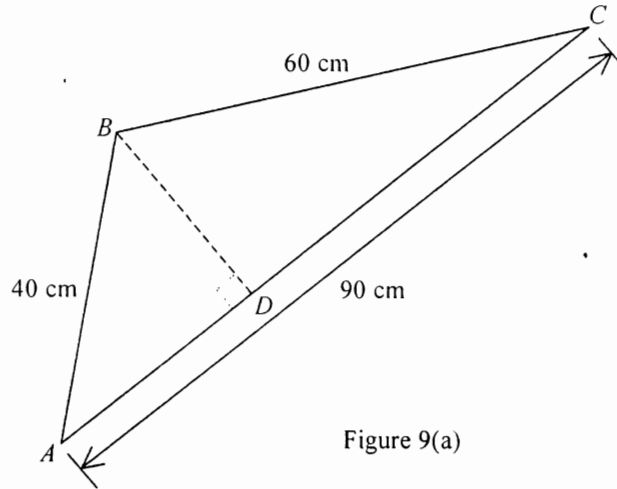


Figure 9(a)

- (a) Find AD . (2 marks)
- (b) The triangular paper card in Figure 9(a) is folded along BD such that AB and BC lie on a horizontal plane as shown in Figure 9(b).

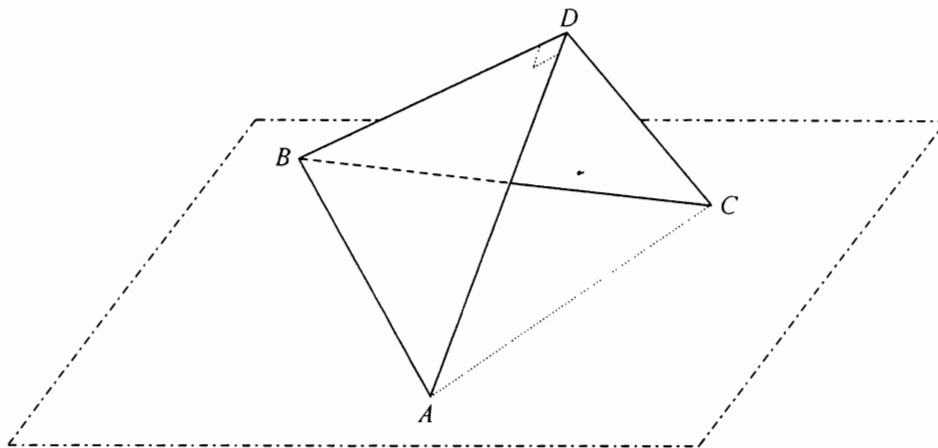


Figure 9(b)

- (i) Suppose $\angle DAC = 62^\circ$.
- (1) Find the distance between A and C on the horizontal plane.
 - (2) Using Heron's formula, or otherwise, find the area of $\triangle ABC$ on the horizontal plane.
 - (3) Find the height of the tetrahedron $ABCD$ from the vertex D to the base $\triangle ABC$.
- (ii) Describe how the volume of the tetrahedron $ABCD$ varies when $\angle ADC$ increases from 30° to 150° . Explain your answer.

(9 marks)

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