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 = $\frac{1}{3} \times \text{base area} \times \text{height}$

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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)

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2. (a) Solve the inequality $x+1 < \frac{x+25}{6}$.

(b)	Write down the greatest integer satisfying the inequality	$x+1<\frac{x+25}{6}$
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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 \overrightarrow{AB} in terms of π . (3 marks)

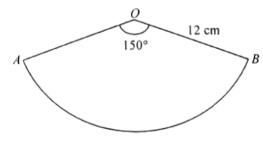


Figure 1

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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 $\angle BCD$.

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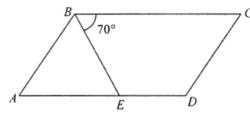


Figure 2

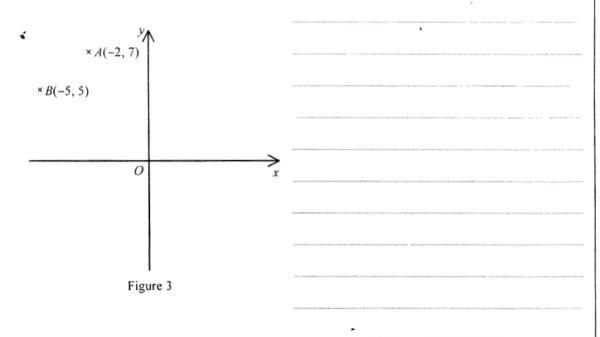
6.	The weight of Tom is	20%	more than that of John.	It is given that	Tom weighs	60 kg
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- (a) Find the weight of John.
- (b) The weight of Susan is 20% less than that of Tom. Are Susan and John of the same weight? Explain your answer.

(4 marks)

- 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)



- 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 \$1750 on transportation in that month.

Clothing

40° Travelling

30° Others

130° Transportation

Rent

The expenditure of Ada in February 2006

Figure 4

Find

£

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- (a) x,
- (b) her total expenditure in that month,

c)	ner ex	penaiture	on	travelling	ın	tnat	montn

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	f(x) = f(1) = 1	(x-a)(x-b)(x+1)-3, where a and b are positive integers with $a < b$. It is given in .
(a)	(i)	Prove that $(a-1)(b-1) = 2$.
	(ii)	Write down the values of a and b .
4		(3 mar
(b)		$g(x) = x^3 - 6x^2 - 2x + 7$. Using the results of (a)(ii), find $f(x) - g(x)$. Hence find t values of all the roots of the equation $f(x) = g(x)$. (4 matrix)

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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.

2 cm

Figure 5

15 cm

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

12 cm

(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)

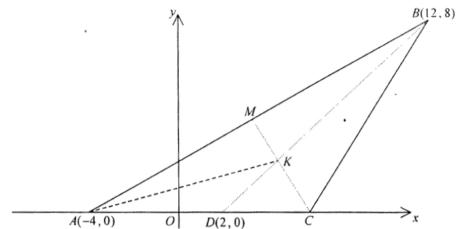


Figure 6

(a)	Write down the coordinates of M .	(1 mark)
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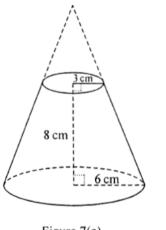
(b) Find the equation of CM. Hence, or otherwise, find the coordinates of C. (3 marks)

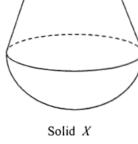
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(c)	(i)	Find the equation of BD.
	(ii)	Using the result of (c)(i), find the coordinates of K . Hence find the ratio of the area of ΔAMC to the area of ΔAKC .
4		(5 marks
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13. In Figure 7(a), the frustum 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.





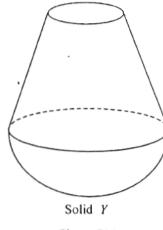


Figure 7(a)

Figure 7(b)

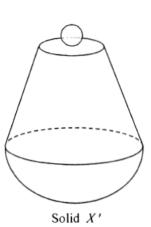
Figure 7(c)

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

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(b) In Figure 7(d), the solid X' is formed by fixing a solid sphere of radius 1 cm onto the centre of the top circular surface of X while another solid Y' is formed by fixing a solid sphere of radius 2 cm onto the centre of the top circular surface of Y. Are X' and Y' similar? Explain your answer. (2 marks)



Solid Y'

Figure 7(d)

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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.

	<u>Class A</u>							
	Stem (tens)	<u>Le</u>	af (ui	nits)				
*	0	a	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	b		

Class B										
Stem (tens)	Le	af (ui	nits)							
0	c	3	3	4	5					
1	1	1	2 5	2	3	3	5	6	7	8
2	1	1	5	5	5	7	8			
3	5	9								
4	d									

- (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)

(7 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.

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15.	part the r	varies d number	is souvenir of surface area $A \text{cm}^2$ is $\$ C$. It is given that C is the sum of two parts, one irectly as A while the other part varies directly as A^2 and inversely as n , where n is of souvenirs produced. When $A = 50$ and $n = 500$, $C = 350$; when $A = 20$ and $C = 100$.	
	(a)	Expres	as C in terms of A and n . (3 marks)	
	(b)		elling price of a souvenir of surface area $A \text{ cm}^2$ is \$8A and the profit in selling the nir is \$P.	
		(i)	Express P in terms of A and n .	
	4	(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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16. In Figure 8, G and H are the circumcentre and the orthocentre of ΔABC respectively. AH produced meets BC at O. The perpendicular from G to BC meets BC at R. BS is a diameter of the circle which passes through A, B and C.

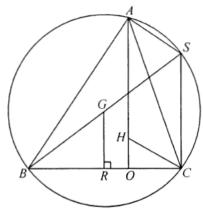


Figure 8

- (a) Prove that
 - (i) AHCS is a parallelogram,
 - (ii) AH = 2GR.

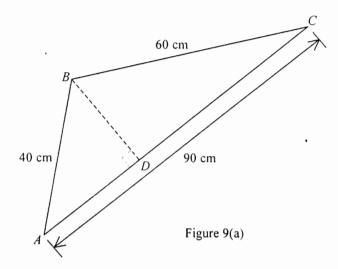
(5 marks)

- (b) A rectangular coordinate system, with O as the origin, is introduced in Figure 8 so that the coordinates of A, B and C are (0,12), (-6,0) and (4,0) respectively.
 - (i) Find the equation of the circle which passes through A, B and C.
 - (ii) Find the coordinates of H.
 - (iii) Are B, O, H and G concyclic? Explain your answer.

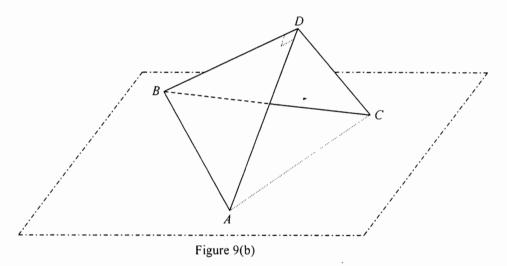
(6 marks)

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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.



- (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).



- (i) Suppose $\angle DAC = 62^{\circ}$.
 - (1) Find the distance between A and C on the horizontal plane.
 - 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)