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	$= \pi rl$
	Volume	$= \frac{1}{3}\pi r^2 h$
PRISM	Volume	= base area × height
PYRAMID	Volume	$= \frac{1}{3}$ × base area × height

SECTION A (39 marks)
Answer ALL questions in this section.
There is no need to start each question on a fresh page.

1. **In this question, working need not be shown and you are required to give the answers only.**

(a) Solve the inequality $3x + 1 \geq 7$.

(b) Find the H.C.F. of $(x-1)^3(x+5)$ and $(x-1)^2(x+5)^3$.

(c) Find the size of an interior angle of a regular octagon (8-sided polygon).

(d) In Figure 1, $ABCD$ is a rectangle. Find BD .

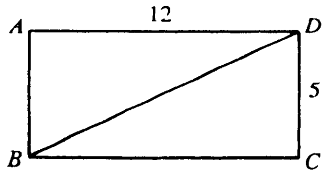

Figure 1

(e) In Figure 2, ABC is a right-angled triangle.
If $\cos A = \frac{1}{3}$, find AC .

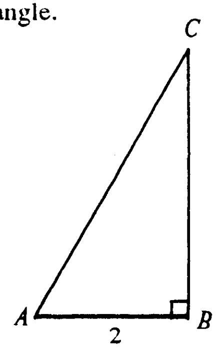

Figure 2

(5 marks)

2. (a) Simplify $(a+b)^2 - (a-b)^2$.

(b) Find the remainder when x^3+1 is divided by $x+2$.

(4 marks)

3. (a) Find the sum of the first 20 terms of the A.P. 1, 5, 9, ...

(b) Find the sum to infinity of the G.P. 9, 3, 1, ...

(4 marks)

4. Mr. Cheung bought a flat in 1993 for \$2 400 000 . He made a profit of 30% when he sold the flat to Mr. Lee in 1994 .

(a) Find the price of the flat that Mr. Lee paid.

(b) Mr. Lee then sold the flat in 1995 for \$3 000 000 . Find his percentage gain or loss.

(4 marks)

5. It is given that $x : y+1 = 4 : 5$.

(a) Express x in terms of y .

(b) If $2x+9y = 97$, find the values of x and y .

(5 marks)

6. Solve the trigonometric equation

$$2\sin^2\theta + 5\sin\theta - 3 = 0$$

for $0° \le \theta < 360°$.

(5 marks)

7. Solve the following equations without using a calculator:

(a) $3^x = \dfrac{1}{\sqrt{27}}$;

(b) $\log x + 2\log 4 = \log 48$.

(6 marks)

8. In Figure 3, the line $y = k$ $(k>0)$ cuts the curve $y = x^2 - 3x - 4$ at the points $A(\alpha, k)$ and $B(\beta, k)$.

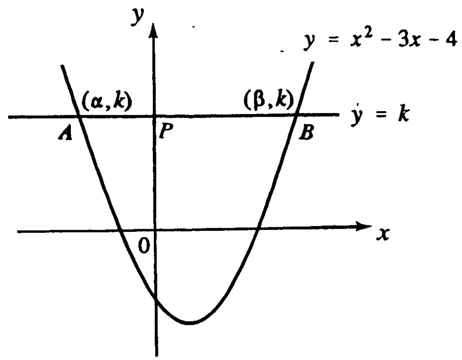

Figure 3

(a) (i) Find the value of $\alpha + \beta$.

(ii) Express $\alpha\beta$ in terms of k .

(b) If the line AB cuts the y-axis at P and $BP = 2PA$, find the value of k .

(6 marks)

SECTION B (60 marks)

Answer any FIVE questions in this section.
Each question carries 12 marks.

9. The cumulative frequency polygon in Figure 4 shows the distribution of the yearly average scores of all the Secondary 2 students in School A.

   (a) Find

   (i) the total number of Secondary 2 students in school A;

   (ii) the median of the yearly average scores, correct to the nearest integer.

   (2 marks)

   (b) The students will be allocated to 3 different groups in Secondary 3 according to their yearly average scores. The top 25% will be in Group I and the bottom 25% will be in Group III. The rest will be in Group II. Find, correct to the nearest integer,

   (i) the minimum yearly average score for students to be allocated to Group I;

   (ii) the minimum yearly average score for students to be allocated to Group II.

   (2 marks)

   (c) Fill in the class marks and frequencies in Table 1 (Page 7).

   (3 marks)

   (d) From Table 1, find the mean and standard deviation of the yearly average scores. (Working need not be shown.) (2 marks)

   (e) Find the percentage of students whose yearly average scores are within one standard deviation from the mean.
   (The distribution of the yearly average scores is not necessarily a normal distribution.)

   (3 marks)

The cumulative frequency polygon of the yearly average scores of all the Secondary 2 students in School A

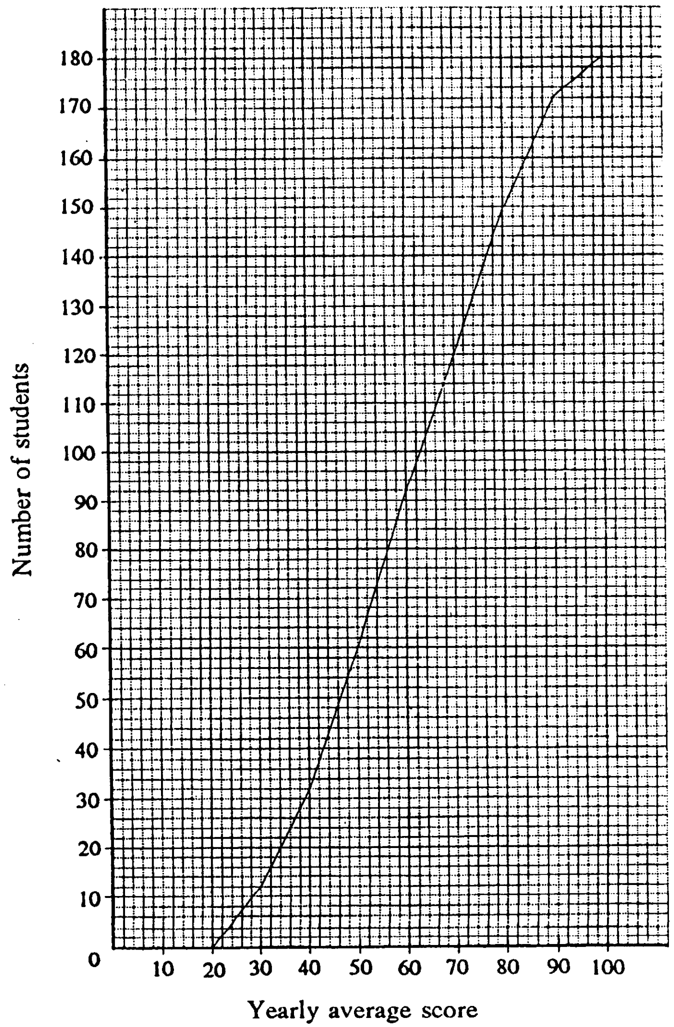

Figure 4

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9.(Cont'd) **If you attempt Question 9, fill in the details in the first three boxes above and tie this sheet INSIDE your answer book.**

Table 1 **The frequency distribution table of the yearly average scores of all the Secondary 2 students in School A**

Yearly average score (x)	Class mark	Frequency
$20 < x \le 30$	25	
$30 < x \le 40$		20
$40 < x \le 50$		
$50 < x \le 60$		32
$60 < x \le 70$		
$70 < x \le 80$		30
$80 < x \le 90$		22
$90 < x \le 100$	95	

10. In Figure 5, $A(1,9)$ and $B(9,7)$ are points on a circle $\mathscr{C}$. The centre G of the circle lies on the line ℓ : $4x - 3y + 12 = 0$.

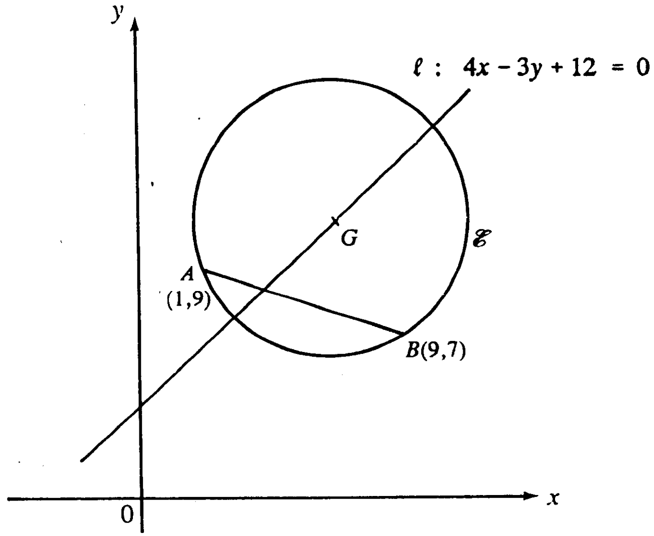

Figure 5

(a) Find the equation of the line AB. (2 marks)

(b) Find the equation of the perpendicular bisector of AB, and hence the coordinates of G. (5 marks)

(c) Find the equation of the circle $\mathscr{C}$. (2 marks)

(d) If DE (not shown in Figure 5) is another chord of the circle $\mathscr{C}$ such that AB and DE are equal and parallel, find

(i) the coordinates of the mid-point of DE, and

(ii) the equation of the line DE.

(3 marks)

Go on to the next page

11. If Wai Ming studies in the evening for a test the next day, the probability of him passing the test is $\frac{4}{5}$. If he does not study in the evening for the test, he will certainly fail.

(a) **(You may use Figure 6.1 to help you answer this part.)**

(i) If Wai Ming studies in the evening for a test the next day, find the probability p that he will fail the test.

(ii) If Wai Ming does not study in the evening for a test the next day, find the probability q that he will pass the test and the probability r that he will fail the test.

(3 marks)

(b) **(You may use Figure 6.1 and Figure 6.2 to help you answer this part.)**

There are four teams competing for the World Women's Volleyball Championship (WWVC) with two games in the semi-finals:

China against U.S.A. and Japan against Cuba.

The winner of each game will be competing in the final for the Championship. The four teams have an equal chance of beating their opponents.

(i) Find the probability that China will win the Championship.

(ii) The final of the WWVC will be shown on television on a Sunday evening and Wai Ming has a test the next day. Wai Ming will definitely watch the TV programme if China gets to the final and the probability of him studying afterwards for the test is $\frac{1}{3}$. If China fails to get to the final, he will not watch that programme at all and will study for the test.

(I) Find the probability that Wai Ming will study for the test.

(II) Find the probability that Wai Ming will pass the test.

(9 marks)

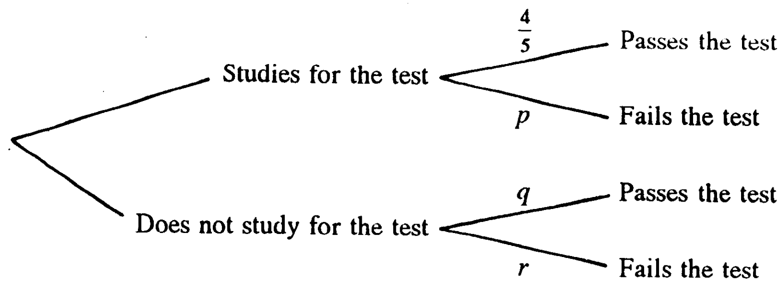

Figure 6.1

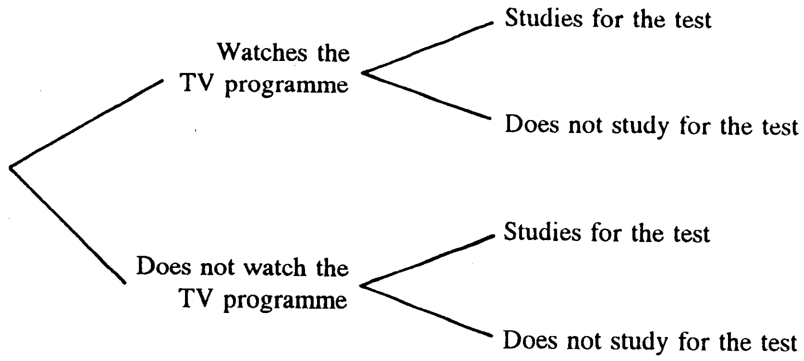

Figure 6.2

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12. A box of Brand X chocolates costs \$25 and contains 20 chocolates.
A box of Brand Y chocolates costs \$37.50 and contains 40 chocolates.

Mrs. Chiu wants to spend not more than \$300 to buy at least 240 chocolates for her students. She wants to buy at least 3 boxes of each brand of chocolates but not more than 10 boxes altogether.

(a) If Mrs. Chiu buys x boxes of Brand X chocolates and y boxes of Brand Y chocolates, then x, y are integers such that $x \geq 3$ and $y \geq 3$. Write down the inequalities in terms of x and y which say

(i) the total number of chocolates is at least 240 ;
(ii) the total cost is not more than \$300 ;
(iii) the total number of boxes is not more than 10 .

(3 marks)

(b) The points representing the ordered pairs (x, y) satisfying all the constraints in (a) are contained in the shaded region in the graph on Page 12. List all these ordered pairs (x, y). (2 marks)

(c) Find the least amount Mrs. Chiu has to pay in buying chocolates for her students. (4 marks)

(d) Mrs. Chiu goes to a shop to buy the chocolates. She finds that she can get a free gift for every purchase of \$300. In order to get the free gift, she decides to spend exactly \$300 on buying the chocolates. Find

(i) all possible combinations (x, y) of the numbers of boxes of Brand X and Brand Y chocolates, and
(ii) the greatest number of chocolates

Mrs. Chiu can buy.

(3 marks)

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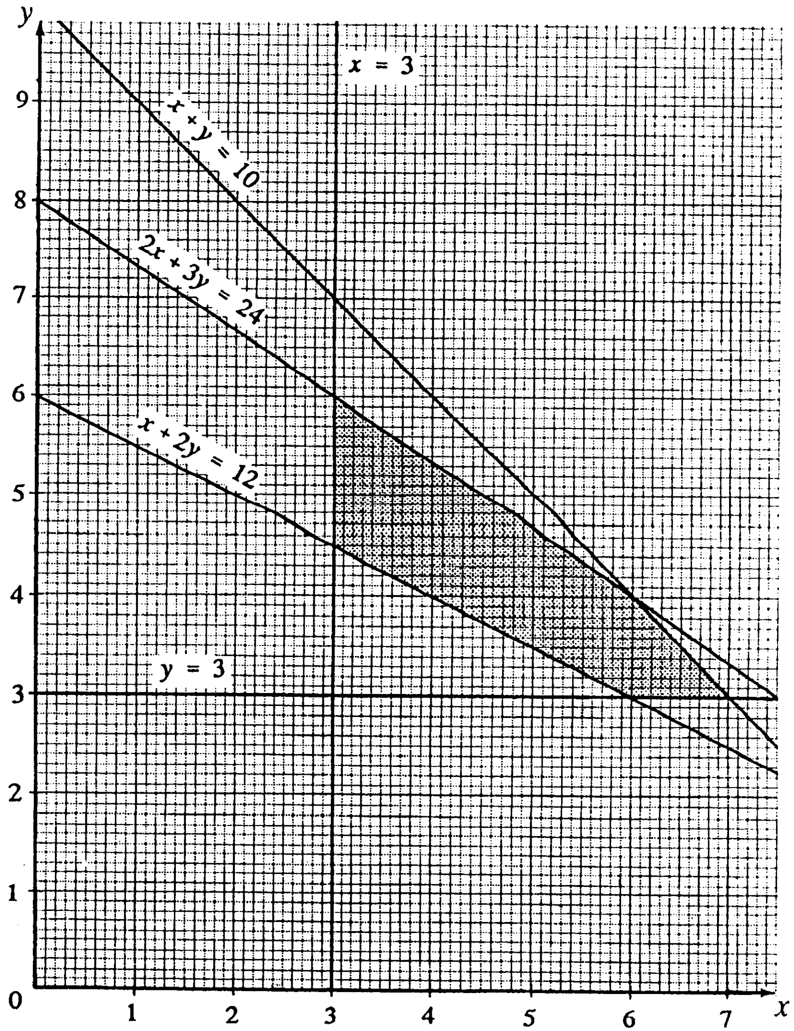
12.(Cont'd) If you attempt Question 12 and have working shown on this page, fill in the details in the first three boxes above and tie this sheet INSIDE your answer book.



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13. A right cylindrical vessel of base radius 4 cm and height 11 cm is placed on a horizontal table. A right conical vessel of base radius 6 cm and height 12 cm is placed, with its axis vertical, in the cylindrical vessel. The conical vessel is full of water and the cylindrical vessel is empty. Figure 7.1 shows the longitudinal sections of the two vessels where A is the vertex of the conical vessel.

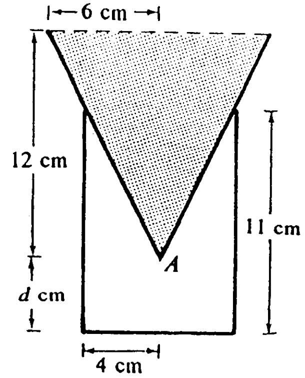

Figure 7.1

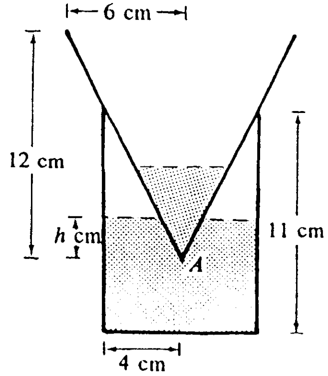

Figure 7.2

(a) Find, in terms of π, the volume of water in the conical vessel. (1 mark)

(b) The vertex A is d cm from the base of the cylindrical vessel. Use similar triangles to find d. (3 marks)

(c) Suppose water leaks out from the conical vessel through a small hole at the vertex A into the cylindrical vessel.

(i) Find, in terms of π, the volume of water that has leaked out when the water level in the cylindrical vessel reaches the vertex A.

(ii) If 104π cm^3 of water has leaked out and the water level in the cylindrical vessel is h cm above the vertex A (see Figure 7.2), show that

$$h^3 - 192h + 672 = 0 \quad \ldots\ldots\ldots (*).$$

(iii) Show that equation (*) in (ii) has a root between 0 and 6. Use the method of bisection to find this root, correct to 1 decimal place.

(8 marks)

Go on to the next page

14. **Answers to this question should be written in the blanks provided on p.16 - p.17.**

In Figure 8.1, AP and AQ are tangents to the circle at P and Q. A line through A cuts the circle at B and C and a line through Q parallel to AC cuts the circle at R. PR cuts BC at M.

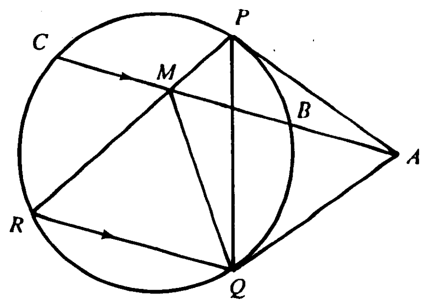

Figure 8.1

(a) Prove that

(i) M, P, A and Q are concyclic;

(ii) $MR = MQ$.

(6 marks)

(b) If $\angle PAC = 20°$ and $\angle QAC = 50°$, find $\angle QPR$ and $\angle PQR$.
(You are not required to give reasons.) (4 marks)

(c) The perpendicular from M to RQ meets RQ at H (see Figure 8.2).

(i) Explain briefly why MH bisects RQ.

(ii) Explain briefly why the centre of the circle lies on the line through M and H.

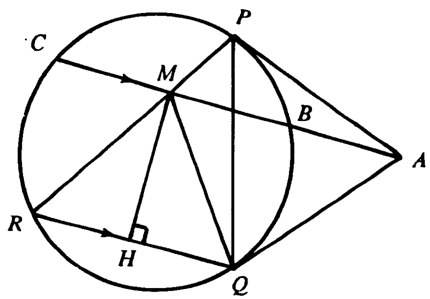

Figure 8.2

(2 marks)

14.

Candidate Number	Centre Number	Seat Number	Page Total

If you attempt Question 14, fill in the details in the first three boxes above and tie this sheet INSIDE your answer book.

Answers to Question 14

(a)(i) ∵ $\angle PMA = \angle PRQ$ (__________)

and $\angle PRQ = \angle PQA$, (__________)

∴ $\angle PMA = \angle PQA$.

Hence M, P, A and Q are concyclic. (converse of $\angle$s in same segment)

(ii) ∵ $\angle RQM = \angle AMQ$, (__________)

$\angle AMQ = \angle APQ$ (__________)

and ______ $= \angle PRQ$, ($\angle$ in alt. segment)

∴ $\angle RQM = \angle PRQ$.

Hence $MR = MQ$. (__________)

(b) ____

____

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____

____

____

Answers to Question 14 (Cont'd)

Page Total

(c)(i)

(ii)

15. Figure 9 shows a triangular road sign ABC attached to a vertical pole OAB standing on the horizontal ground. The plane ABC is vertical with $OA = 2$ m, $AB = 0.6$ m, $AC = 0.7$ m and $BC = 0.8$ m. D is a point on the horizontal ground vertically below C and is due north of the foot O of the pole.

The sun is due west. When its angle of elevation is $30°$, the shadow of the road sign on the horizontal ground is $A'B'C'$.

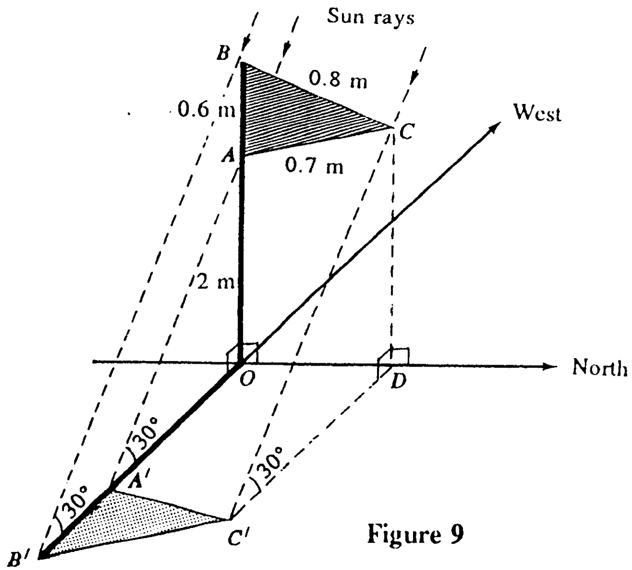

Figure 9

(a) Find the lengths of OA' and $A'B'$. (3 marks)

(b) Calculate $\angle BAC$ and hence find the length of OD. (4 marks)

(c) Find the area of the shadow $A'B'C'$. (2 marks)

(d) If the angle of elevation of the sun is less than $30°$,

(i) state whether the shadow of AB is longer than, shorter than, or equal to $A'B'$ in (a); and hence

(ii) state with reasons whether the area of the shadow of the road sign ABC is larger than, smaller than, or equal to that of $A'B'C'$ in (c).

(3 marks)

END OF PAPER