OL/2023(2024)/32/E-I

32 E I

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கல்விப் பொதுத் தராதரப் பத்திர (சாதாரண தர)ப் பரீட்சை, 2023(2024)
General Certificate of Education (Ord. Level) Examination, 2023(2024)

ගණිතය	I
கணிதம்	I
Mathematics	**I**

පැය දෙකයි
இரண்டு மணித்தியாலம்
Two hours

Index Number: .....

Certified Correct

.....
Signature of Invigilator

Important:

* This question paper consists of **8** pages.
* Write your **Index Number** correctly in the appropriate places on **this page** and on **page three**.
* Answer **all** questions **on this question paper itself**.
* Use the space provided under each question for working and writing the answer.
* Indicate the **relevant steps** and the **correct units** when answering the questions.
* Marks are awarded as follows:

  In Part A
  2 marks for each question

  In Part B
  10 marks for each question

* Blank papers can be obtained for scratch work.

For Marking Examiners' Use Only

Part	Question Numbers	Marks
A	1 – 25	
B	1	
	2	
	3	
	4	
	5	
Total		

..... First Examiner	..... Code Number
..... Second Examiner	..... Code Number
..... Arithmetic Checker	..... Code Number
..... Chief Examiner	..... Code Number

[see page two

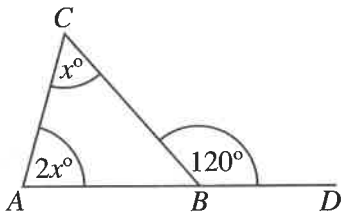
Part A

Answer ***all questions on this question paper itself.***

(Take the value of π as $\frac{22}{7}$.)

1. The annual assessed value of a shop located within the limits of a certain urban council that charges an annual rates percentage of 12%, is 24 000 rupees. How much has to be paid for a year as rates?

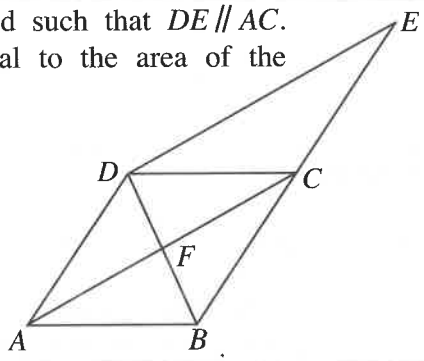
2. The side AB of the triangle ABC has been produced to D. Find the value of x based on the information given in the figure.



3. Find the least common multiple of the following algebraic terms.

$8xy$, $2xy^2$, $12y$

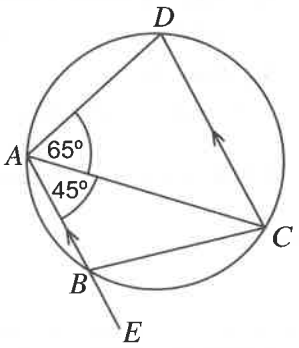
4. $ABCD$ is a parallelogram. E lies on the side BC produced such that $DE \parallel AC$. Name **three** triangles in this figure that are of area equal to the area of the triangle DCE.



5. If $\log_4 x = 3$, find the value of x.

6. Simplify: $\frac{3xy}{2} \div \frac{9y}{4}$

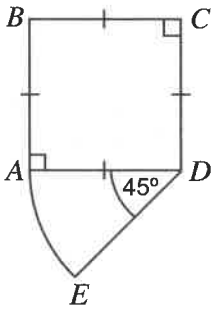
7. The points A, B, C and D lie on the circle shown in the figure. ABE is a straight line. Find the magnitude of $C\hat{B}E$ based on the given information.



[see page three

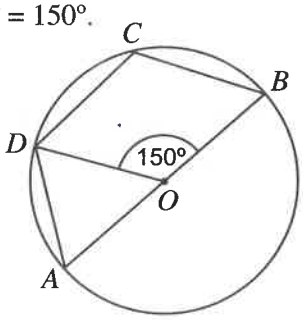
8. In the year 2023, Nimal's monthly income was 138 000 rupees. Nimal had to pay income tax of 6% on the income he earned above 100 000 rupees. Calculate the income tax that he had to pay for a month.

9. The diagram shows a composite figure consisting of a sector of a circle of radius 14 cm and central angle 45°, and a square. Find the perimeter of this figure.



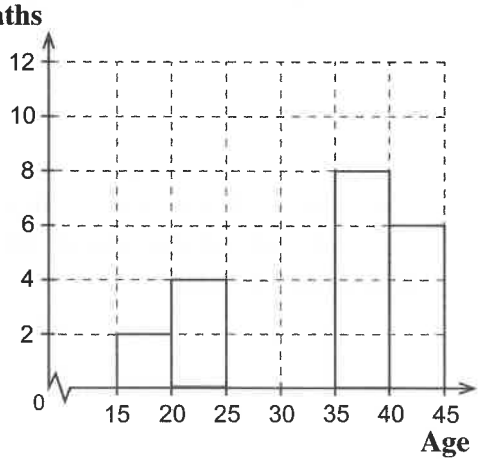
10. Find the equation of the straight line that passes through the points (0, 2) and (1, 5).

11. O is the centre of the given circle. AB is a diameter, and $D\hat{O}B = 150°$. Find the magnitude of $D\hat{C}B$.



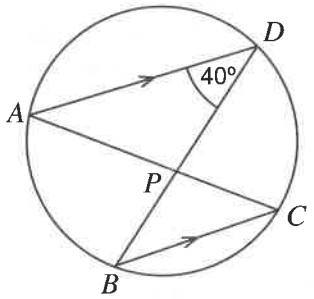
12. The number of deaths that occurred during a year in a certain city due to motorcycle accidents is shown in the following frequency distribution. Complete the histogram that has been drawn based on it.

Age (Years)	Number of deaths
15 – 20	2
20 – 25	4
25 – 35	12
35 – 40	8
40 – 45	6



[see page four

13. The points A, B, C and D lie on the circle shown in the figure. Moreover, $AD \parallel BC$. Find the magnitude of $C\hat{P}D$ based on the information given in the figure.

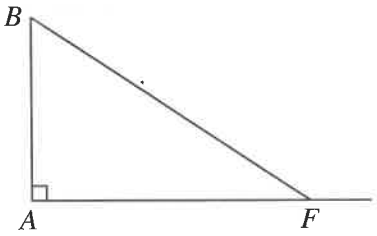


14. A container in the shape of a right prism of base area 77 cm^2 is filled with water to a height of 20 cm. When all this water is poured into a right circular cylindrical container of base radius 7 cm, to what height of the container will the water be filled?
(The volume of a right circular cylinder of base radius r and height h is $\pi r^2 h$.)

15. One factor of $3x^2 + 2x - 1$ is $(x+1)$. Find the other factor.

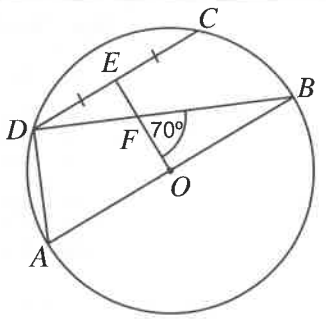
16. The second term of a geometric progression is 6 and its fifth term is 162. Find the common ratio of the progression.

17. A child is at location F on a level ground on which the foot of a vertical tree AB is located, as shown in the figure. In the figure, mark the angle of elevation a° with which the child sees the top of the tree. If $A\hat{B}F = 50^\circ$ find the value of a. (Disregard the height of the child.)



18. A plant is obtained from every bean seed in a certain packet of bean seeds, while the probability of getting an unhealthy plant from them is 0.02. How many unhealthy plants can be expected in a farm in which 300 of these bean seeds are planted?

19. The centre of the given circle is O and AB is a diameter. The midpoint of the chord DC is E. If $O\hat{F}B = 70^\circ$, find the magnitude of $A\hat{D}C$.

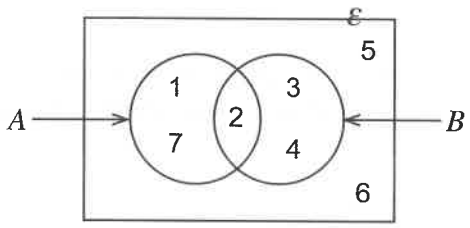


[see page five

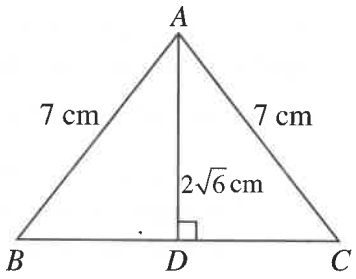
20. Solve: $\frac{2}{3a} - \frac{4}{9a} = \frac{1}{18}$

21. If the curved surface area of a solid right circular cylinder of base radius r cm and height h cm is four times the area of its base, how many times of the base radius is the height of the cylinder?

22. Write the elements of $A' \cup B$.

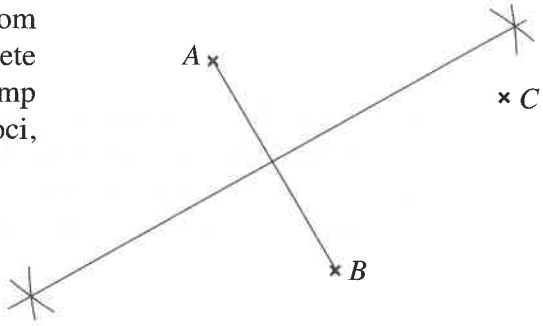


23. The figure shows an isosceles triangle ABC. Find the length of BC based on the given information.



24. Solve: $3 - 12x^2 = 0$

25. In the figure, A, B and C denote three houses. It is required to fix a lamp post at an equal distance from the three houses. The figure shows an incomplete sketch drawn to find the point at which the lamp post is to be located. Using the knowledge on loci, complete the sketch to find this point.



50

* *

[see page six

Part B

Answer ***all questions on this question paper itself.***

1. It has been planned to construct a wall in three stages with the participation of a group of men. In the first stage, 10 of them worked together for 4 days and completed $\frac{4}{7}$ of the total length of the wall.

(i) How many man days is the work done in the first stage of constructing the wall?

(ii) If $\frac{1}{3}$ of the remaining length of the wall is completed in the second stage, what fraction of the total length of the wall is this amount?

(iii) If only two men engaged in constructing the wall in the second stage, how many days did the two of them take for it?

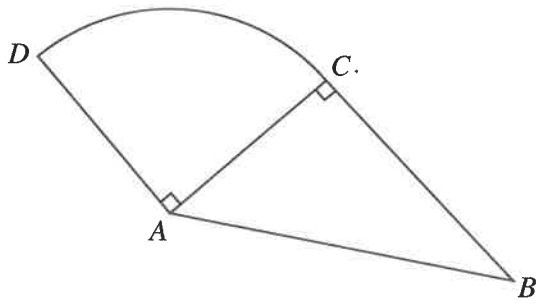
(iv) If a length of 200 metres remains to be built in the third stage of building the wall, find the total length of the wall.

10

2. The figure shows a vegetable plot consisting of a right angle triangular piece of land ABC and a piece of land ACD in the shape of a sector of a circle of central angle 90°.

(Take the value of π as $\frac{22}{7}$.)

(i) $AD = 7$ m. If a fence is built along the boundary of the sector ACD from C to D, find the length of the fence.



(ii) Find the area of the piece of land ACD.

(iii) If the area of the piece of land ABC is 42 m^2, find the length of BC.

(iv) It is required to adjoin a rectangular piece of land outside the vegetable plot, with BC as one side, of area three times the area of the piece of land in the shape of the sector. Find the width of this rectangular piece of land and draw a sketch of it with its measurements on the above figure itself.

10

[*see page seven*

3. Kamal invests 50 000 rupees to buy shares in a certain company of which the price of a share is 50 rupees. After receiving the dividends for the shares at the end of a year, he sells all the shares at 54 rupees per share. He receives a total amount of 57 500 rupees, as dividends and by selling the shares.

(i) How many shares did he buy?

(ii) How much does this company pay as dividends annually for a share?

(iii) Kamal plans to buy floor tiles at the price of 500 rupees per tile using the 57 500 rupees in hand. If VAT of 15% has to be paid in addition for each tile, how many tiles can he buy with this amount?

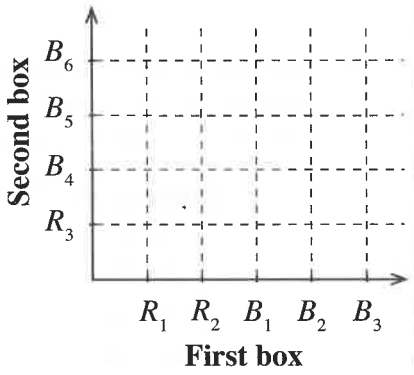
(iv) When he goes to buy the tiles, he finds that the VAT has been increased to 18%. Now, to buy the same number of tiles that he had planned to buy above, how much more money does he need?

10

4. In one of two boxes there are two red bulbs and three blue bulbs. There is one red bulb and three blue bulbs in the other box. All the bulbs are of the same shape and size. A student randomly picks a bulb from the first box and a bulb from the second box.

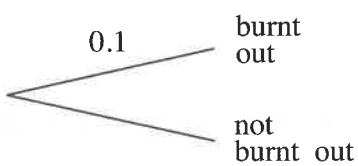
(i) By considering that the red bulbs are denoted by R_1, R_2 and R_3 and the blue bulbs are denoted by B_1, B_2, B_3, B_4, B_5 and B_6, represent the sample space of the above mentioned random experiment on the given grid using the symbol 'X'.

(ii) Encircle on the grid, the event of the two bulbs taken from the two boxes being of the same colour and find its probability.



(iii) It is given that the probability of a bulb taken from the first box being burnt out is 0.1 and the probability of a bulb taken from the second box being burnt out is 0.2. The student examines the bulb taken from the first box and only if it is a burnt out one, does he examine the bulb taken from the second box. Extend the tree diagram given below such that both these events are represented and write the relevant probabilities on its branches.

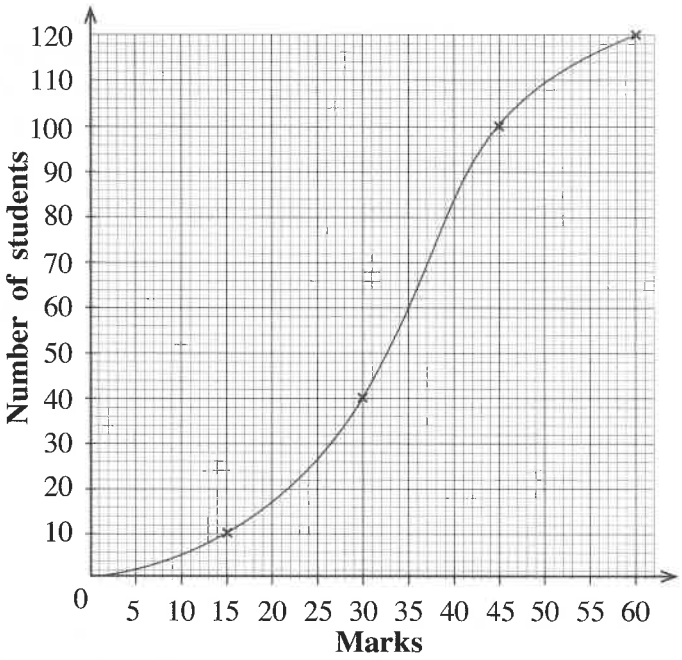
Bulb taken from the first box **Bulb taken from the second box**



(iv) Considering both the above mentioned events, find the probability of an examined bulb not being a burnt out one.

10

5. A cumulative frequency curve drawn using the marks obtained by 120 students of a certain school for a mathematics test is shown in the figure.



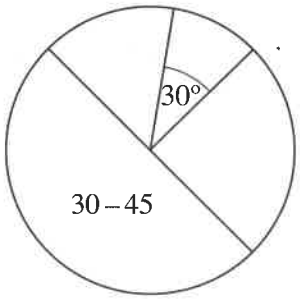
(*a*) (i) What is the maximum mark that a student has been able to obtain in this test?

(ii) How many students got 35 marks or less in this test?

(iii) From the students who took the test, it is required to select the group of 25% who have obtained the highest marks. For this, students who have obtained above which mark should be selected?

(*b*) An incomplete portion of the frequency table that was used to draw the cumulative frequency curve and an incomplete pie chart drawn using it are given below. Each sector of the pie chart represents the relevant number of students.

Interval of marks	Number of students
0 – 15	10
15 – 30	.....
30 – 45	.....
45 – 60	20
	120



(In the table the interval 15 – 30 denotes more than 15 and less than or equal to 30.)

(i) Fill in the blanks in the table based on the cumulative frequency curve.

(ii) Which interval of marks is represented by the sector in the pie chart with central angle 30°?

(iii) Find the central angle of the sector that represents the interval 45 – 60.

10

32 E II

අධ්‍යයන පොදු සහතික පත්‍ර (සාමාන්‍ය පෙළ) විභාගය, 2023(2024)
கல்விப் பொதுத் தராதரப் பத்திர (சாதாரண தர)ப் பரீட்சை, 2023(2024)
General Certificate of Education (Ord. Level) Examination, 2023(2024)

ගණිතය II
கணிதம் II
Mathematics II

පැය තුනයි
மூன்று மணித்தியாலம்
Three hours

අමතර කියවීම් කාලය - මිනිත්තු 10 යි
மேலதிக வாசிப்பு நேரம் - 10 நிமிடங்கள்
Additional Reading Time - 10 minutes

Use additional reading time to go through the question paper, select the questions and decide on the questions that you give priority to in answering.

Instructions:

* *Answer **ten** questions selecting **five** questions from* **Part A** *and **five** questions from* **Part B**.
* *Write the **relevant steps** and the **correct units** in answering the questions.*
* *Each question carries* **10** *marks.*
* *The volume of a sphere of radius r is $\frac{4}{3}\pi r^3$.*
* *The volume of a right circular cone of base radius r and height h is $\frac{1}{3}\pi r^2 h$.*

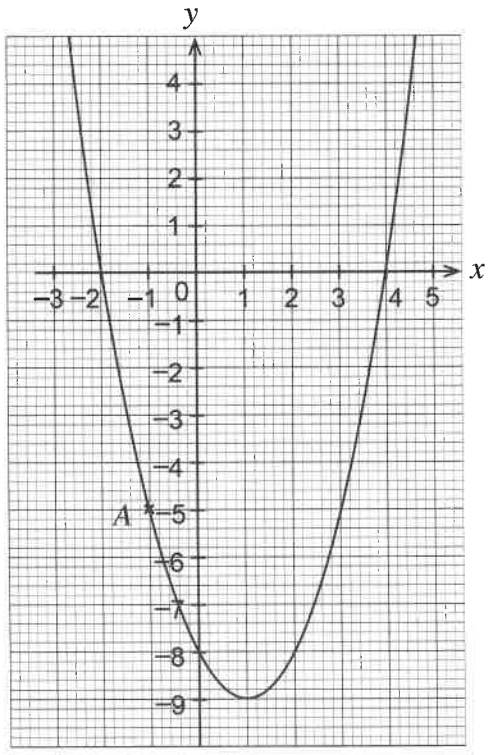
Part A

*Answer **five** questions only.*

1. Rani deposits an amount of 50 000 rupees for two years in a bank that compounds interest annually at an annual interest rate of 10%. Find the total interest amount that she receives and calculate the total amount in the deposit account at the end of the two years.

An interest amount equal to the above mentioned total interest amount can be obtained by investing the 50 000 rupees in a certain finance company for just one year at a simple interest rate. After the initial two years, if Rani invests the total amount in the bank account for another two years in the above finance company, find the interest she receives from the finance company.

2. The graph of a quadratic function of the form $y = f(x)$ is shown in the figure.



(i) Write the coordinates of the point A and the coordinates of the point at which the graph intersects the y-axis respectively.

(ii) Write the roots of the equation $f(x) = 0$ of the function $y = f(x)$ of which the graph has been drawn.

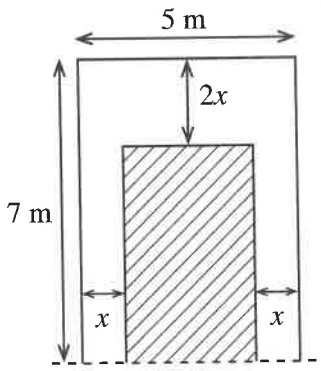
(iii) Write the interval of values of x on which the function is negative and increasing.

(iv) Write the function $y = f(x)$ in the form $y = (x - a)^2 + b$ by considering the equation of the axis of symmetry of the graph and the coordinates of its minimum point.

(v) Write the coordinates of the minimum point and the relevant quadratic function of the graph that is obtained by translating the given graph vertically upwards by four units in the coordinate plane, without changing its shape.

[*see page two*

3. A portion of a narrow pathway bordering a rectangular plot of land which is shaded in the figure is shown here. The area of this portion is 16 square metres. Using the information in the figure, show that x satisfies the equation $x^2 - 6x + 4 = 0$.



Taking the value of $\sqrt{5}$ as 2.24, find the solutions to the above equation and give reasons why only the smaller value of the two solutions is suitable for x.

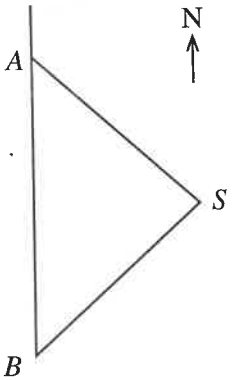
4. Books and pens were donated to the grade 10 and grade 11 students of a certain school in the following manner.

- A total of 516 books with 6 books for each grade 10 student and 8 books for each grade 11 student
- A total of 300 pens with 3 pens for each grade 10 student and 5 pens for each grade 11 student

By taking the number of students in grade 10 as x and the number of students in grade 11 as y, construct a pair of simultaneous equations and by solving them find separately the number of students in grade 10 and the number of students in grade 11.

In another school where it is proposed to distribute books and pens, although the total number of students in grades 10 and 11 is the same as the total number of students in these grades in the above mentioned school, the number of students in grade 11 is twice the number of students in grade 10. Show that 12 additional books are required to distribute books and pens in this school in the same manner as before.

5. Amal is at point A of a field, to the north of Bimal who is at point B. A statue S is located in this field. The bearing of S from A is 144°. Moreover $A\hat{B}S = 54°$ in the figure. The distance between Amal and the statue is 80.9 metres.



(i) Copy the figure in your answer script and include the given information in it.

(ii) Give reasons why the triangle ABS can be used to find the distance between Amal and Bimal using trigonometric ratios.

(iii) Using trigonometric ratios, show that the distance between Amal and Bimal is 100 metres.

(iv) A flag pole is located at point F, 30 metres to the west of Bimal. Include this information in the figure you drew and find the magnitude of $A\hat{F}B$.

6. The following grouped frequency distribution has been prepared using the information obtained on the mass of each student in a certain group of students.

Class interval (kg)	40 – 44	44 – 48	48 – 52	52 – 56	56 – 60	60 – 64	64 – 68
Frequency	3	5	9	11	7	3	2

(The class interval 40 – 44 denotes greater than or equal to 40 and less than 44.)

(i) To which class interval does the most number of students belong?

(ii) Find the mean mass of a student in this group to the nearest kilogramme.

(iii) The maximum total mass of the students who can be taken in one van which was found for this group of students who plan to go on a trip is 600 kilogrammes. By using the mean, find the maximum number of students that can be expected to travel in this van.

(iv) Find the maximum number of students that it may be possible to take in the above mentioned van, based on the given frequency table. Give reasons for your answer.

[see page three

Part B

*Answer **five** questions only.*

7. A decoration has been made by fixing blue and white bulbs in several concentric circles. The blue bulbs have been fixed such that the innermost first circle has 3 bulbs and each of the following circles have three more bulbs than the previous circle. The white bulbs have been fixed such that the innermost first circle has 2 bulbs, the next circle has 3 bulbs, the circle after that has 4 bulbs, and so forth.

(i) Write the number of blue bulbs fixed in the first three circles respectively.

(ii) How many more blue bulbs are there than white bulbs in the 10^{th} circle?

(iii) The number of circles in which bulbs have been fixed in the decoration is 16. Sunil states that a total of 550 blue and white bulbs are sufficient for this. Is his statement correct? Give reasons for your answer.

8. Use only a straight edge with a cm/mm scale and a pair of compasses for the following geometric constructions. Draw the construction lines clearly.

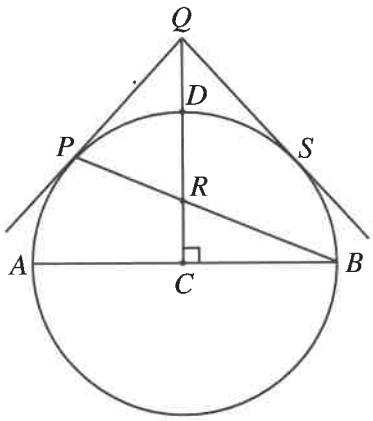
(i) Construct a straight line segment AB such that $AB = 6$ cm and construct its perpendicular bisector.

(ii) Construct the circle that touches AB at its midpoint P and has its centre O, 5 cm from A.

(iii) Construct the bisector of $A\hat{P}O$ and name the point at which it intersects the circle as Q.

(iv) Produce the line PO, take the point at which it meets the circle as T and construct the perpendicular from the point T to the line PQ. Give reasons why this perpendicular should pass through Q.

9. C is the centre and AB is a diameter of the circle in the given figure. P is a point on the circle. The radius CD is perpendicular to AB and it intersects PB at R. The tangent to the circle at P and CD produced meet at Q. The other tangent to the circle drawn from Q meets the circle at S.



Copy the figure in your answer script and join PA.

Show that $PACR$ is a cyclic quadrilateral and that $Q\hat{P}R = Q\hat{R}P$.

Join RS and show that RQS is an isosceles triangle.

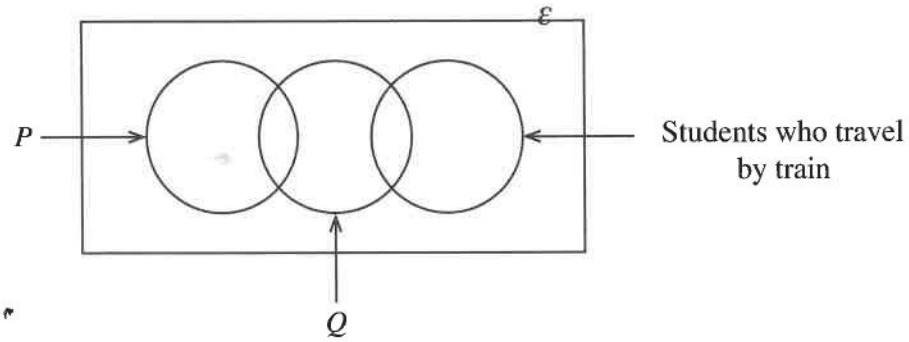
10. (*a*) A solid hemisphere of radius r cm made of metal is melted and 56 solid right circular cones of base radius $\frac{1}{4}$ the radius of the hemisphere, and height h cm are made. By assuming that there is no wastage of metal, show that the relationship between the radius of the hemisphere and the height of a cone is given by $r = \frac{7}{4}h$. If the height of a cone is 8 cm find the volume of the hemisphere. (Take the value of π as $\frac{22}{7}$.)

(*b*) $P = \dfrac{\sqrt{25.26} \times 0.78}{2.47}$.

Find the value of P to the first decimal place using the logarithms table.

[*see page four*

11. An incomplete Venn diagram providing information on the modes of transport used by 108 students to travel to school is given below. Each of these students use at least one of the three modes of transport, bus, car and train.



No students who travels by car travels by train.

(i) Copy the above incomplete Venn diagram in your answer script and name the sets denoted by P and Q.

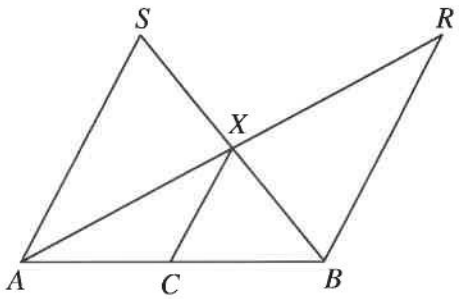
(ii) The number of students who travel by car or by train is 63. How many students travel by bus only?

(iii) If the number of students who travel by car is 23, find the number of students who travel by train.

(iv) If the number of students who travel by bus or train is 99 find the number of students who travel only by car.

(v) If the number of students who travel by bus and train is twice the number that travel by bus and car, find the number of students who use exactly one of these three modes of transport.

12. (*a*) Write the converse of the midpoint theorem.



(*b*) The midpoint of the side AB of the triangle ABX in the given figure is C. The straight line through B drawn parallel to CX meets AX produced at R. The straight line through A drawn parallel to CX meets BX produced at S.

(i) Copy the given figure in your answer script and include the given information.

(ii) Show that the triangles AXS and BXR are congruent.

(iii) Join SR and show that $SR = AB$.

(iv) Show that the area of $ABRS$ is 8 times the area of triangle ACX.