

Class: IX

Maximum Marks: 100

Subject: Compulsory Mathematics

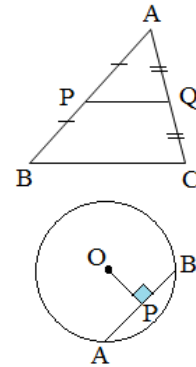
Time: 3 hours

*Candidates are required to answer in their own words as far as practicable. Credit shall be given to originality in expression, creativity and neatness in hand, not to rote learning.*

Attempt all the questions.

**Group-A** (6 × 1 = 6)

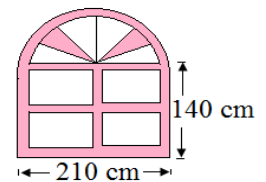
- Define value added tax (VAT).
  - A room is p ft long, q ft broad and r ft high. What is the area of the four walls of the room?
- Write down the roots of the quadratic equation  $ax^2 + bx + c = 0$ ,  $a \neq 0$ .
  - In a frequency distribution, if the lower limit of a class is 40 and width of the class is 10, what is the upper limit of the class?.
- In  $\triangle ABC$ ; P and Q are the mid-points of sides AB and AC respectively. Write the relation between PQ and BC.
  - In the given figure; O is the centre of circle and  $OP \perp AB$ . Write down the relation between AP and BP.



**Group-B** (17 × 2 = 34)

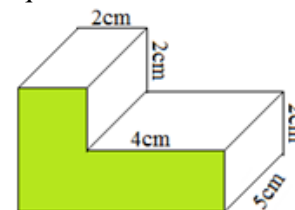
- Shinkhala, a student of class IX wishes to buy the school-bag costing Rs 1,500. How much should she pay for it after getting 10% discount? Find.
  - The meter reading of Bishal's house on Falgun 1<sup>st</sup> was 2021 and that on Chaitra 1<sup>st</sup> was 2050. If the minimum charge up to 20 units is Rs. 3 per unit and the cost per unit from 21 to 30 units is Rs. 7. Find the amount of the bill to be paid of the month of Falgun with Rs 50 service charge.

- The frame of the window given alongside is made of a rectangular bottom with a semi-circular top. Find its perimeter.



- How many concrete blocks each of  $25\text{cm} \times 15\text{cm} \times 10\text{cm}$  are required to construct a wall of dimension  $60\text{m} \times 6.5\text{m} \times 20\text{cm}$ ? Find it.

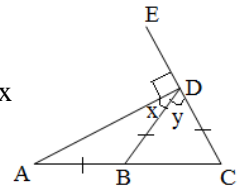
- Find the lateral surface area of the given prism.



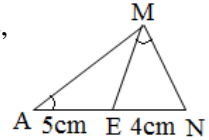
- Resolve into factors:  $x^4 + 6x^2 + 25$
  - Evaluate:  $\left(\frac{16}{25}\right)^{\frac{1}{2}} \left[ \left(\frac{64}{125}\right)^{-\frac{1}{3}} \div \left(\frac{16}{81}\right)^{-\frac{1}{4}} \right]$

7. (a) Solve:  $10^{x+1} + 10^x = 11$   
 (b) Simplify:  $\frac{a-b}{ab} + \frac{b-c}{bc} + \frac{c-a}{ca}$   
 (c) Solve:  $\frac{x}{3} + \frac{2}{x} = 1\frac{2}{3}$

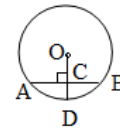
8. (a) In the figure alongside;  $AD \perp EC$  and  $AB = BD = CD$ , find the values of  $x$  and  $y$ .



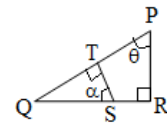
- (b) In the adjoining figure;  $\triangle MAN$  and  $\triangle MEN$  are similar. If  $\angle MAN = \angle NME$ ,  $AE = 5\text{cm}$  and  $EN = 4\text{cm}$ ; find the length of  $MN$ .



- (c) In the given circle,  $O$  is the centre and  $OC \perp AB$ . If  $AB = 16\text{cm}$  and  $OD = 10\text{cm}$  then find the length of  $CD$ .



9. (a) In the given figure; find the trigonometric ratios of  $\sin\theta$  and  $\tan\alpha$  in terms of sides of triangles.



- (b) In a discrete series, if  $\sum fx = 370 + 20p$ ,  $N = 23 + p$  and mean is 17, find the value of  $p$ .

10. (a) Define sample space. A bag contains 20 marbles of same shape and size. Out of them 8 are black and the rest are green. If a marble is taken from the bag at random, what is the probability that the marble so chosen is green?  
 (b) A card is drawn from a well shuffled deck of 52 playing cards. What is the probability that the card drawn will be a faced card?

### Group-C

(10 × 4 = 40)

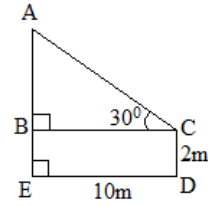
11. Out of 77 districts of Nepal, 27 districts have shared their boarder with India, 15 districts have shared their boarder with China and 37 districts have shared their boarder with neither of these countries.  
 (i) How many districts have shared their boarder with both the countries?  
 (ii) How many districts have shared their boarder with only one country?  
 (iii) Show the above information in Venn-diagram.
12. Hari bought 10 dozen of glass tumblers at the rate of Rs 45 per tumbler. If 12 glass tumblers were broken during transportation, at what rate of cost did he sell the remaining tumblers to gain 20% in the whole transaction?
13. A rectangular park is 120 m long and 75 m wide. It has a gravelled path 2.5m wide all around it on the outside. Find the area of the path and the cost of gravelling it at Rs. 120 per square metre.

14. Simplify:  $\left(\frac{x^a}{x^b}\right)^{a^2+ab+b^2} \times \left(\frac{x^b}{x^c}\right)^{b^2+bc+c^2} \times \left(\frac{x^c}{x^a}\right)^{c^2+ca+a^2}$

15. If  $\frac{a}{b} = \frac{b}{c} = \frac{c}{d}$ , prove that:  $\frac{a^2 - ab}{b^2} = \frac{b^2 - bc}{c^2} = \frac{c^2 - cd}{d^2}$

16. Prove that the perpendicular drawn from the centre of a circle to a chord bisects the chord.

17. Verify experimentally that the sum of any two sides of a triangle is greater than the third side. (Two figures of different measurements are necessary)
18. Construct a parallelogram PQRS in which  $PQ = 3.6\text{cm}$ ,  $QR = 4.7\text{ cm}$  and  $\angle PQR = 60^\circ$ .
19. In the given figure, ABC is a right angled triangle and BCDE is a rectangle. Find the length of AE.
20. Find the lower and upper quartiles of the following data.



Height (in cm)	5	15	25	35	45	55
Number of plants	8	5	12	10	24	16

### Group-D

(4 × 5 = 20)

21. The present rate of income tax fixed by Inland Revenue Department (IRD) for married couple is given below.

Status: Unmarried		Status: Married	
Income slab	Tax rate	Income slab	Tax rate
Up to Rs 400000	1%	Up to Rs 450000	1%
Rs 400000 – Rs 500000	10%	Rs 450000 – Rs 550000	10%
Rs 500000 – Rs 700000	20%	Rs 550000 – Rs 750000	20%

Mr. Sharma is an unmarried manager of an office and Mrs. Gautam is a cashier in a bank. If the monthly salary of each of them is Rs 50,000; find who pays the more income tax and by how much.

22. Mr. Ram built a house having two rectangular rooms of same width and height after destruction of his old house by the massive earthquake. The first room having two windows each of size 4 ft × 4.5 ft and two doors each of size 3 ft × 6.5 ft is 18 ft long, 12 ft wide and 9 ft high, the second room having a window of size 4.5 ft × 4.5 ft and a door common to the first room is 16 ft long.
- (i) Find the cost of carpeting both the rooms at Rs 150 per sq. ft.
- (ii) Find the cost of plastering the walls inside the rooms at the rate of Rs 80 per sq. ft.

23. There are some ducks and cows in a farmer's farm. All the ducks and cows are normal and healthy. If the number of heads of ducks and cows is 25 and the number of feet is 80 altogether, find the number of ducks and cows.



24. A piece of land PQRS is in the shape of parallelogram. The mid-point M of the edge PQ is joined to the corner R and the mid-point N of the edge SR is joined to the corner P by the pieces of rope. If the rope joined to the corners S and Q intersect the ropes MR and PN at the points A and B respectively. Prove that:
- (i) The part PNRM of the land is also in the shape of parallelogram.
- (ii) The ropes MR and PN trisect the rope SQ.

**The End**

## Marking Scheme

**Group-A**

**(6 × 1 = 6)**

1. (a)	Correct definition of VAT	1
(b)	$2r(p + q)$ sq. ft	1
2. (a)	$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	1
(b)	50	1
3. (a)	$PQ \parallel BC, PQ = \frac{1}{2} BC$	1
(b)	$AP = BP$	1

**Group-B**

**(17 × 2 = 34)**

4. (a)	Discount amount = 10% of Rs 1,500 = Rs 150	1
	S. P. = M.P. – D = Rs 1,500 – Rs 150 = Rs 1,350	1
(b)	Consumed electricity = 2050 – 2021 = 29 units = 20 units + 9 units	1
	Electricity charge = $20 \times \text{Rs } 3 + 9 \times \text{Rs } 7 + \text{Rs } 50 = \text{Rs } 173$	1
5. (a)	Radius of semi-circular top = 105 cm	1
	Perimeter of the frame = $l + 2b + \pi r$	1
	$= 210 \text{ cm} + 2 \times 140 \text{ cm} + \frac{22}{7} \times 105 \text{ cm}$	1
	$= 820 \text{ cm}$	1
(b)	Volume of block (v) = $25 \text{ cm} \times 15 \text{ cm} \times 10 \text{ cm} = 3,750 \text{ cm}^3$	1
	Volume of wall (V) = $6000 \text{ cm} \times 650 \text{ cm} \times 20 \text{ cm} = 7,80,00,000 \text{ cm}^3$	1
	No. of blocks (N) = $\frac{78000000}{3750} = 20,800$	1
(c)	Perimeter of cross-section (Pb) = $2 \text{ cm} + 4 \text{ cm} + 2 \text{ cm} + 6 \text{ cm} + 4 \text{ cm} = 18 \text{ cm}$	1
	L.S.A. = $18 \text{ cm} \times 5 = 90 \text{ cm}^2$	1
6. (a)	$(x^2)^2 + (5)^2 + 6x^2 = (x^2 + 5)^2 - 10x^2 + 6x^2$	1
	$(x^2 + 5)^2 - (2x)^2 = (x^2 + 2x + 5)(x^2 - 2x + 5)$	1
(b)	$\frac{4}{5} \left[ \frac{5}{4} \div \frac{3}{2} \right]$	1
	$\frac{4}{5} \left[ \frac{5}{4} \times \frac{2}{3} \right] = \frac{2}{3}$	1

7. (a)	$10^x(10+1) = 11$ $10^x = 1 \therefore x = 0$	1 1
(b)	$\frac{c(a-b) + a(b-c) + b(c-a)}{abc}$ $\frac{0}{abc} = 0$	1 1
(c)	$\frac{x^2+6}{3x} = \frac{5}{3}$ or, $x^2 - 5x + 6 = 0$ $(x-2)(x-3) = 0$ $\therefore x = 2$ or $3$	1 1
8. (a)	$\angle BAD = \angle ADB = x$ and $\angle DBC = \angle BCD = 2x$ $\angle BAD + \angle ACD = 90^\circ$ or, $x + 2x = 90^\circ \therefore x = 30^\circ$ $\angle ADC = x + y = 90^\circ$ or, $30^\circ + y = 90^\circ \therefore y = 60^\circ$	1 1
(b)	$\frac{MN}{EN} = \frac{AN}{MN}$ or, $\frac{MN}{4\text{cm}} = \frac{9\text{cm}}{MN}$ $MN^2 = 36\text{cm}^2 \therefore MN = 6\text{cm}$	1 1
(c)	Join O and C. $OA = OD = 10\text{cm}$ , $AC = 8\text{cm}$ Using Pythagoras theorem, $OC = 6\text{cm} \therefore CD = 10\text{cm} - 6\text{cm} = 4\text{cm}$	1 1
9. (a)	$\sin \theta = \frac{QR}{PQ}$ $\tan \alpha = \frac{QT}{TS}$	1 1
(b)	$\bar{x} = \frac{\sum fx}{N}$ or, $17 = \frac{370+20p}{23+p}$ $370+20p = 391+17p \therefore p = 7$	1 1
10. (a)	Correct definition of sample space. $P(G) = \frac{12}{20} = \frac{3}{5}$	1 1
(b)	$n(F) = 12, n(S) = 52$ $P(F) = \frac{12}{52} = \frac{3}{13}$	1 1

**Group-C**

**(10 × 4 = 40)**

11.	$n(I \cap C) = 2$	1
	$n_o(I) = 25, n_o(C) = 13$	1
	$n(\text{only one country}) = 25+13 = 38$	1
	Presentation in Venn-diagram	1

12.	<p>C.P. = 120 × Rs 45 = Rs 5,400</p> <p>Suppose, S.P. of each tumbler = Rs x</p> <p>∴ Total S.P. = Rs (120-12) x = Rs 108x</p> <p>S.P. = Rs 5,400 + 20% of Rs 5,400</p> <p>or, 108x = 6,480</p> <p>∴ x = 60</p> <p>(Give full marks for other relevant methods)</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>
13.	<p>Area of path = 2d (1 + b + 2d) = 2 × 2.5m (120m + 75m + 2 × 2.5m)</p> <p style="text-align: center;">= 1000m<sup>2</sup></p> <p>Cost of gravelling the path = Area × Rate = 1000 × Rs 120</p> <p style="text-align: center;">= Rs 1,20,000</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>
14.	$\left(x^{a-b}\right)^{a^2+ab+b^2} \times \left(x^{b-c}\right)^{b^2+bc+c^2} \times \left(x^{c-a}\right)^{c^2+ca+a^2}$ $x^{(a-b)(a^2+ab+b^2)} \times x^{(b-c)(b^2+bc+c^2)} \times x^{(c-a)(c^2+ca+a^2)}$ $x^{a^3-b^3} \times x^{b^3-c^3} \times x^{c^3-a^3}$ $x^{a^3-b^3+b^3-c^3+c^3-a^3}$ $x^0 = 1$	<p>1</p> <p>1</p> <p>1</p> <p>1</p>
15.	<p>c = dk, b = dk<sup>2</sup>, a = dk<sup>3</sup></p> $\text{L.H.S.} = \frac{a^2 - ab}{b^2} \frac{(dk^3)^2 - dk^3 \cdot dk^2}{(dk^2)^2} = \frac{d^2k^6 - d^2k^5}{d^2k^4} = \frac{d^2k^5(k-1)}{d^2k^4} = k(k-1)$ $\text{M.T.} = \frac{b^2 - bc}{c^2} = \frac{(dk^2)^2 - dk^2 \cdot dk}{(dk)^2} = \frac{d^2k^4 - d^2k^3}{d^2k^2} = \frac{d^2k^3(k-1)}{d^2k^2} = k(k-1)$ $\text{R.H.S.} = \frac{c^2 - cd}{d^2} = \frac{(dk)^2 - dk \cdot d}{d^2} = \frac{d^2k^2 - d^2k}{d^2} = \frac{d^2k(k-1)}{d^2} = k(k-1)$	<p>1</p> <p>1</p> <p>1</p> <p>1</p>
16.	<p>Correct figure + description</p> <p>Showing two triangles congruent with reasons</p> <p>Equating corresponding sides of congruent triangles</p>	<p>1</p> <p>1+1</p> <p>1</p>
17.	<p>Rough sketch</p> <p>Construction of parallelogram PQRS</p> <p>Conclusion</p>	<p>1</p> <p>1+1</p> <p>1</p>
18.	<p>Correct figures</p> <p>Table with correct measurements</p> <p>Conclusion</p>	<p>1</p> <p>1+1</p> <p>1</p>
19.	<p>BC = ED = 10m</p> <p>In right angled triangle,</p>	<p>1</p> <p>1</p>

	$\tan 30^\circ = \frac{AB}{BC}$	1
	$\frac{1}{\sqrt{3}} = \frac{AB}{10m}$	
	$AB = \frac{10}{\sqrt{3}} = 5.77$	1
	$AE = AB + BE = 5.77m + 2m = 7.77m$	
<b>20.</b>	Construction of correct cumulative frequency table	1
	Position of $Q_1 = 19^{\text{th}}$ item	1
	$Q_1 = 25$	1
	Position of $Q_3 = 57^{\text{th}}$ item and $Q_3 = 45$	1

**Group-D**

**(4 × 5 = 20)**

<b>21.</b>	<p>For Mr. Sharma, annual income = 12 × Rs 50,000 = Rs 6,00,000</p> <p>= Rs 4,00,000 + Rs (5,00,000 - 4,00,000) + Rs (6,00,000 - 5,00,000)</p> <p>= Rs 4,00,000 + Rs 1,00,000 + Rs 1,00,000</p> <p>Tax = 1% of Rs 4,00,000 + 10% of Rs 1,00,000 + 20% of Rs 1,00,000</p> <p>= Rs 34,000</p>	1
	<p>For Mrs. Gautam, annual income = 12 × Rs 50,000 = Rs 6,00,000</p> <p>= Rs 4,50,000 + Rs (5,50,000 - 4,50,000) + Rs (6,00,000 - 5,50,000)</p> <p>= Rs 4,50,000 + Rs 1,00,000 + Rs 50,000</p> <p>Tax = 1% of Rs 4,50,000 + 10% of Rs 1,00,000 + 20% of Rs 50,000</p> <p>= Rs 24,500</p>	1
	<p>Difference = Rs 34,000 - Rs 24,500 = Rs 9,500</p> <p>Mr. Sharma pays Rs 9,500 more tax.</p>	1

22.	<p>(i) Area of floor of both rooms = <math>18 \text{ ft} \times 12 \text{ ft} + 16 \text{ ft} \times 12 \text{ ft} = 408 \text{ sq.ft}</math>  Cost of carpeting the rooms = <math>408 \times \text{Rs } 150 = \text{Rs } 61,200</math></p> <p>(ii) Area of walls of the first room excluding 2 doors and 2 windows  <math>= 2h(l + b) - 2(l_1 \times b_1) - 2(l_2 \times b_2)</math>  <math>= 2 \times 9 \text{ ft} (18 \text{ ft} + 12 \text{ ft}) - 2(3 \text{ ft} \times 6.5 \text{ ft}) - 2(4 \text{ ft} \times 4.5 \text{ ft})</math>  <math>= 465 \text{ sq. ft}</math></p> <p>Area of walls of the second room excluding a door and a window  <math>= 2h(l + b) - l_1 \times b_1 - l_2 \times b_2</math>  <math>= 2 \times 9 \text{ ft} (16 \text{ ft} + 12 \text{ ft}) - 3 \text{ ft} \times 6.5 \text{ ft} - 4.5 \text{ ft} \times 4.5 \text{ ft}</math>  <math>= 464.25 \text{ sq. ft}</math></p> <p>Area of walls inside the rooms excluding doors and windows  <math>= 465 \text{ sq. ft} + 464.25 \text{ sq.ft} = 929.25 \text{ sq. ft}</math></p> <p>Cost of plastering the walls = <math>929.25 \times \text{Rs } 80 = \text{Rs } 74,340</math></p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>
23.	<p>Let the no. of cows be <math>x</math> and that of ducks be <math>y</math></p> <p>Case-I: <math>x + y = 25</math> ... (i)</p> <p>Case-II: <math>4x + 2y = 80</math>  or, <math>2(2x + y) = 80</math>  or, <math>2x + y = 40</math> ... (ii)</p> <p>Subtracting (i) from (ii), <math>x = 15</math></p> <p>Substituting the value of <math>x</math> in (i), <math>y = 25 - 15 = 10</math></p> <p>No. of cows = 15 and no. of ducks = 10</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
24.	<p>Correct figure + Given + To prove</p> <p><math>PM = NR</math> and <math>PM // NR</math></p> <p><math>PNRM</math> is a parallelogram</p> <p><math>QA = AB</math> and <math>AB = BS</math></p> <p><math>QA = AB = BS</math></p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>

**The End**