

MATHEMATICS
Class X

Time : 3 hrs.

M.M.

100

Note : The questions in Section A carry 3 marks each, those in Section B carry 4 marks each and those in Section C carry 6 marks each.

Section A

Q.1. Solve the following system of equations:

$21x - 13y = 55$ and $13x + 21y = 5$

Q.2. Given that $P(x) = 6x(x^3 - 1)$ and $Q(x) = 2x^2(x^2 + 1)(x^2 + x + 1)$, find the H.C.F. and L.C.M. of $P(x)$ and $Q(x)$.

OR

Find the H.C.F. and L.C.M. of $16(x^3 - 1)(x^2 - x + 1)$ and $24((x^3 + 1)(x^2 + x + 1))$.

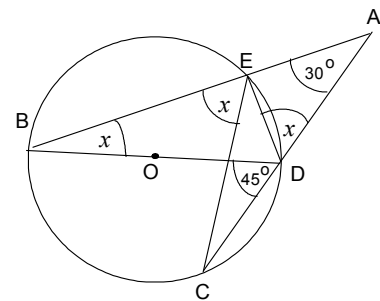
Q.3. If $A = \frac{x}{x^2 - 1}$ and $B = \frac{1}{x(x - 1)}$, Express $A + B$ as a rational expression.

OR

If $P = \frac{x+1}{x-1}$, $Q = \frac{2x}{x^2-1}$ and $R = \frac{x^2+1}{x+1}$, express

$(P - Q) \div R$ as a rational expression.

Q.4. Find the value of the angles marked x in the figure on the right.



Q.6.

Q.7. Sum of n terms of an A.P. is $2n^2 - n$. Find the A.P.

Q.8. Find the ratio of the volumes of a cube and a cuboid if the side of the cube is equal to length of 0.5 .

the cuboid and the length, breadth and height of the cuboid are in the ration $3 : 2 : 1$.

Q.9. While calculating mean weight of 50 students of his class, Anil by mistake took his weight as 54 kg. instead of 45 kg. and found the mean to be 42. Find the correct mean weight of his class.

OR

Sunil spends 40% of his income on household expenses, 20% on education of his children, 20% on House Rent, 10% on petrol and saves the rest amount. Depict this information in a pie chart.

Q.10. If the lowest form of the rational expression $\frac{x^2 - ax - b}{x^2 + 2x - 15}$ is $\frac{x - 4}{x + 5}$, find the values of a and b .

Q.11. Find the sum of first 20 terms of an A.P. whose 6th term is zero and the 20th term is 20 more than the 15th term.

Q.12. (a) Find the value of $\frac{1}{2} \sin^2 30^\circ + \frac{1}{2} \tan^2 60^\circ - \sec^2 50^\circ + \cot^2 40^\circ$

(b) Prove that $\frac{1 - \sin \theta}{\cos \theta} = \frac{\cos \theta}{1 + \sin \theta}$

OR

Prove that $\sqrt{\frac{1 + \cos \theta}{1 - \cos \theta}} = \frac{1}{\cos \theta \cot \theta}$

Section B

Q.11. Draw the graph of the following equations on the same graph and hence find the coordinates of the vertices of the triangle formed by them.

$x - 2y - 4 = 0$, $8x - 5y + 1 = 0$ and $4x + 3y - 27 = 0$

OR

Solve the following system of equations graphically:

$3x - 2y = 11$, $4x + 3y = 9$ and hence find the area enclosed by these lines and y-axis.

Q.12. Find the value(s) of k for which the equation $x^2 - kx + (k + 3) = 0$ has real roots.

OR

If $\tan^2 x + \cot^2 x = \frac{10}{3}$, find x .

Q.13. Evaluate and express the result as a rational expression:

$\left[\frac{x^2 - 7x + 6}{x^2 + x - 30} \div \frac{x^2 + x - 2}{x^2 + x - 6} \right] \div \frac{x^2 - x - 20}{x^2 + 7x + 12}$

Q.14. For what value(s) of k , the following system of equations will have infinite solutions:

$2x + ky = 1$ and $(3k + 1)x + 15y = k + 2$

Q.15. In a $\triangle ABC$, AD is the altitude on BC and $AB^2 + AC^2 = BC^2$. Prove that $\angle BAC = 90^\circ$.

Q.16. The quantities of blue, red and green balls in a bag are in A.P. If the red balls are increased by 5, the probability of drawing a red ball increases by $\frac{1}{15}$. Find the number of red balls in bag. Also, if the probability of drawing a green ball is $\frac{2}{15}$ more than the probability of drawing a blue ball, find the quantities of blue and green balls.

Q.17. An electric iron is available either at Rs 1500 cash or for Rs 500 Cash Down Payment & four equal monthly installments of Rs 260 each. Calculate the rate of interest charged under the installment scheme.

Q.18. A cyclist covers a distance of 60 km in 1 hour more than usual time if he decreases his speed by 2 km/hr and can cover the same distance in 1 hour less than the usual time if he increases his speed by 3 km/hr. Find his usual speed.

OR

A tree breaks at a point 24 m above its foot and its top touched the ground at a distance equal to the square root of its total height. Find its total height.

Q.19. Find the coordinates of the vertices of a triangle, the coordinates of the mid-points of whose sides are $(-2, \frac{-1}{2})$, $(\frac{3}{2}, 1)$, $(\frac{13}{2}, \frac{-7}{2})$.

Q.20. The angles of depression of the top and bottom of a 20 m high building from the top of a hill are 30° and 60° respectively. Find the height of the hill and its distance from the building. (Take $\sqrt{3} = 1.73$)

OR

The angles of elevation of the top and bottom of a flag staff, fixed on the top of a tower, from a point on the ground are α and β respectively. If the height of the flag staff is h metres, prove that the point of observation is $\frac{h}{\tan \alpha - \tan \beta}$ metres away from the foot of the tower.

Section C

Q.21. Construct a $\triangle ABC$ right angled at A, given that $BC = 10$ cm and the altitude on $BC = 4$ cm. Also write the steps of construction.

Q.22 Prove that the angle subtended by an arc at the centre of the circle is double the angle subtended by that arc at any point on the circle in the alternate segment

A solid cone, with height and base radius of 28 cm each, is cut along a plane parallel to its base so that the bottom and top radii of the remaining part are in the ratio 1 : 4. Find its volume. Also find the cost of painting its outer surface @ Re 0.70 per sq.cm.

OR

A wooden toy is conical at the top, cylindrical in the middle and hemispherical at the bottom (see figure). If the height and radius of the cylindrical portion are both equal to 21 cm and the total height of the toy is 70 cm, find the cost of painting it @ Re 0.70 per sq.cm and the amount of wood used to make it.

Q.22. Find the mean of the following data:

Class Marks	Frequency
150 - 170	57
170 - 190	60
190 - 210	73
210 - 230	24
230 - 250	10

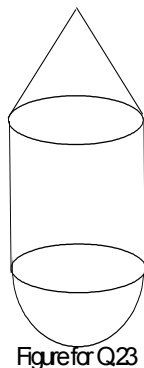


Figure for Q23

The annual income of Mrs. Saxena is Rs 3,00,000. She contributes Rs 2500 per month to Provident Fund, pays a quarterly LIC premium of Rs 1500, invests Rs 20,000 in NSC's and donates Rs 10,000 to a trust carrying 50% rebate. A sum of

Rs 2500 is deducted at source from each of her salary for eleven months. Find the income tax payable in the last month (Use the taxation table given in the NCERT Text Book).

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Answers to Numerical Problems

1. $x = 2, y = -1$
2. $HCF = 2x(x^2 + x + 1), LCM = 6x^2(x^2 + 1)(x^2 - 1)$
3. $\frac{x^2 + x + 1}{x^2 - x}$
4. $\frac{1}{x-1}$
5. 1, 5, 9, 13,
6. 9 : 2
7. 41.82 kg
8. $a = 7, b = -12$
9. 360
- 10.(a) $\frac{5}{8}$
11. $(-2, -3), (3, 5), (6, 1)$ OR $\frac{51}{4} sq.units$
12. $k = -2$ or $k = 6$ OR $30^\circ, 60^\circ$
13. $\frac{x^2 - 8x + 12}{x^2 + 8x + 12}$
14. $k = 3$
16. 15, 12, 18
17. 19.67%
18. 12 km/hr
19. $(3, -5), (-7, 4), (10, -2)$
20. 10 m, 17.3 m
23. 22638 cu.cm, Rs 4096.40 OR 48510 cu.cm, Rs 5497.80
24. 188.39
25. Rs 1205.00