MATHEMATICS
Delhi — 2006

SECTION - A

Question numbers 1 to 10 carry 3 marks each.

Q. 1. Solve for x and y:

$47x + 31y = 63$
$31x + 47y = 15$ Or

Solve for x and y.

$$\frac{ax}{b} - \frac{by}{a} = a + b$$
$$ax - by = 2ab$$

Q. 2. Given that $P = \frac{2}{x^2 - x - 6}, Q = \frac{3}{x^2 + x - 3}, R = \frac{4}{x^2 - 4x + 3}$, *find* $(P + Q) + r$.

Q. 3. If (x - 2) (x + 3) is the HCF of the polynomials

$P(x) = (x^2 - 3x + 2)(2x^2 + 7x + a)$ and
$Q(x) = (x^2 + 4x + 3)(3x^2 - 7x + b)$.
Find the values of a and b.

Q. 4. Solve for x: $12abx^2 — (9a^2 — 8b^2)x - 6ab = 0$ *Or*

A two-digit number is such that the product of its digits is 35. When 18 is added to the number, the digits interchange their places. Find the number.

Q. 5. The 6th term of an Arithmetic Progression (AP) is —10 and the term is —26. Determine the 15^{th} term of the AP.

Q. 6. Find the sum of all the two digit natural numbers when are divisible by 4.

Q. 7. A household article is available for Rs. 2,500 cash or Rs. 520 cash down payment followed by four equal monthly instalments. If the rate of interest charged under the instalment plan is 25% per annum, find the amount of each instalment.

Q. 8. A man borrows Rs. 36,410 from a finance company and has to repay it in three equal annual instalments. Find the amount of each instalment if the rate of interest is 10% per annum compounded annually.

Q. 9. In Figure 1, $\angle ACB = 90^0$, $CD \perp AB$, prove that CD2 = BD. AD.

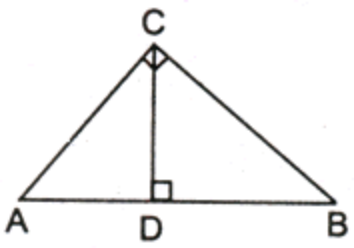

Fig. 1

Q. 10. In Figure 2, PA = 3 cm, AB = 9 cm, CD = 5 cm. Find the length of PC.

SECTION - B

Question numbers 11 to 20 carry 4 marks each.

Q. 11. Draw the graphs of the equations:

4x – y – 8 = O and 2x - 3y + 6 = O

Also determine the vertices of the triangle formed by the lines and the x-axis.

Q. 12. A train travels a distance of 300 km at a uniform speed. If the speed of the train is increased by 5km an hour, the journey would have taken two hours less. Find the original speed of the train.

Q. 13. The radius of the base and the height of a solid right circular cylinder are in the ratio 2 : 3 and its volume is 1617 Cu. cm. Find the total surface area of the cylinder. $Use \pi = \frac{22}{2}$

Q. 14. Prove that:

$$\frac{\sin\theta+\cos\theta}{\sin\vartheta-\cos\theta}+\frac{\sin\theta-\cos\theta}{\sin\vartheta+\cos\theta}=\frac{2\sec^2\theta}{\tan^2\theta-1}$$

Or

Evaluate without using Trigonometric Tables:

$$\frac{\sec^2(90^0-\theta)-\cot^2\theta}{(\sin^2 25^0+\sin^2 65^0)}+\frac{2\cos^2 60^0\tan^2 28^0\tan^2 62^0}{3(\sec^2 43^0-\cot^2 47^0)}$$

Q. 15. Construct a triangle ABC is which BC = 7 cm, $\angle A = 60^0$ and altitude AD = 5 cm. Write steps of construction also.

Q. 16. Show that the points A (1, 2), B(S, 4), C(3, 8) and D(— 1,6) are the vertices of a square. Or

Find the co-ordinates of the point equidistant from three given points A (5, 1), B (- 3, -7) and C (7, -1).

Q. 17. Find the value of *p* for which the point (-1, 3), (2, p) and (5, -1) are collinear.

Q. 18. The Arithmetic Mean of the following frequency distribution is 50. Find the value of p.

Classes	0 -20	20 - 40	40 - 60	60 -80	80 - 100
Frequency	17	p	32	24	19

Q. 19. The following table shows the monthly expenditure of a family. Draw a Pie for the data:

Item	Rent	Food	Clothing	Education	Misc.
Amount (In Rs.)	1500	3600	1200	2100	2400

Q. 20. A box contains 20 balls bearing numbers 1, 2, 3, 4, ..., 20. A ball is drawn at random from the box. What is the probability that the number on the ball is

(a) an odd number
(b) divisible by 2 or 3
(c) prime number
(d) Not divisible by 10.

SECTION - C

Question numbers 21 to 25 carry 6 marks each.

Q. 21. Prove that the ratio of the areas of two similar triangles is equal to the ratio of the squares of their corresponding sides.
Using the above, prove that the area of the equilateral triangle described on the side of a right angled isosceles triangle is half the area of the equilateral triangle described on its hypotenuse.

Q. 22. Prove that the angle subtended by an are at the centre is double the angle subtended by it at any point on the remaining part of the circle. Using the above, find x in Figure 3.

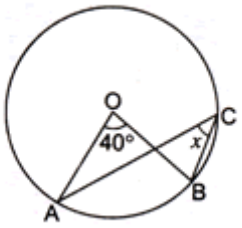

Fig. 3

Q. 23. The rain water from a roof 22 m x 20 m drains into a cylindrical vessel having diameter of base 2 m and height 3.5 m. lithe vessel is just full, find the rainfall in cm. *Or*

A bucket made up of a metal sheet is in the form of a frustum of a cone of height 16 cm with radii of its lower and upper ends as 8 cm and 20 cm respectively. Find the cost of the bucket if the cost of metal sheet used is Rs. 15 per 100 cm2. $Use \pi = 3.14$

Q. 24. The angles of depression of the top and the bottom of a building 50 metres high as observed from the top of a tower are 30^0 and 60^0 respectively. Find the height of the tower and also the horizontal distance between the building and the tower. *Or*

The angle of elevation of the top of a tower as observed from a point on the ground is ' α ' and on moving ' β ' metres towards the tower, the angle of elevation is ' '. Prove that the height of the tower is $\frac{\alpha \tan \alpha \tan \beta}{\tan \beta - \tan \alpha}$.

Q. 25. Annual income from salary of Mrs. Usha, who is a senior citizen, is Rs. 3,85,000. She donates Rs. 10,000 to Prime Minister's Relief Fund (100% exemption) and Rs. 10,000 to a Charitable Society (50% exemption). She contributes Rs. 70,000 towards PPF annually and pays a quarterly premium of Rs. 3,500 towards Life Insurance. She also purchases NSCs for Rs. 20,000. She pays Rs. 1,600 per month towards income tax for 11 months. What is her tax liability for the last month of the financial year?

Use the following for calculating income tax:

1. Savings: 100% exemption for savings upto Rs. 1,00,000
2. Rate of Income tax for Senior citizens:

Slab	*Income Tax*
Upto Rs. 1,85,000	No tax
From Rs. 1,85,001 to Rs. 2,50,000	20% of the taxable income above Rs. 1,85,000
From Rs. 2,50,001 and above	Rs. 13,000 + 30% of the income exceeding Rs. 2,50,000

3. Education cess: 2% of the income tax