

Find the value of the following without using trigonometric tables:

$$\frac{\cos 50^\circ}{2 \sin 40^\circ} + \frac{4(\operatorname{cosec}^2 59^\circ - \tan^2 31^\circ)}{3 \tan^2 45^\circ} - \frac{2}{3} \tan 12^\circ \cdot \tan 78^\circ \cdot \sin 90^\circ$$

18. Prove that $\cos \theta (\sin \theta - 2 \sin^3 \theta) = \sin \theta (2 \cos^3 \theta - \cos \theta)$

19. If $\sec \theta + \tan \theta = p$, show that $\frac{p^2 + 1}{2p} = \sec \theta$

20. Find the mode of the following frequency distribution:

Class	14 – 16	16-18	18-20	20-22	22-24
Frequency	2	3	6	5	4

Section – D

Questions from 21 to 31 carry four marks each.

21. 6 retired teachers, 8 retired doctors and 10 retired defense officers are willing to render their services to a village. Each of teacher, doctor and defense officers serves equal number of different persons in that village.

- Find least number of persons served by each.
- Suggest the value depicted in the question.

22. Represent the following pair of linear equations graphically

$$x + y = 7$$

$$5x + 2y = 20$$

From the graph, find the points where the lines represented by these equations intersect the x-axis.

23. The present age of a father is three years more than three times the age of the son. Three years hence, father's age will be 10 years more than twice the age of the son. Determine their present ages.

24. Find the values of p and q so that 1 and -2 are the zeroes of the polynomial $p(x) = x^3 + 10x^2 + px + q$. Also find its third zero.

25. In the figure given below, $\triangle PQR$ is right angled at Q and the points S and T trisect the side QR. Then prove that $8PT^2 = 3PR^2 + 5PS^2$.



26. Prove that the ratio of the areas of two similar triangles is equal to the square of the ratio of their corresponding sides.

27. If $\tan \theta + \cot \theta = 4$ find the values of $\tan^4 \theta + \cot^4 \theta$

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