

Using differentials, find the approximate value of $\sqrt{0.037}$, correct upto three decimal places.

Q. 13. Evaluate: $\int \frac{2x+1}{18-4x-x^2} dx$.

Q. 14. Evaluate: $\int_0^{\pi/2} \frac{\sin 2\theta}{\sin^4 \theta + \cos^4 \theta} d\theta$.

Q. 15. Evaluate: $\lim_{x \rightarrow \frac{\pi}{2}} (\sec x - \tan x)$.

Q. 16. Using matrices, solve the following system of equations:

$$3x + 4y - z = 23$$

$$2x + 2y - 3z = 20$$

$$4x - y + 2z = 12.$$

Q. 17. Prove that the volume of the largest cone that can be inscribed in a sphere of radius R is $\frac{8}{27}$ of the volume of the sphere.

Or

Prove that the curves $x = y^2$ and $xy = k$ cut at right angles if $8k^2 = 1$.

Q. 18. Using integration, find the area of the region in the first quadrant enclosed by the x-axis, the line and the circle $x^2 + y^2 = 32$.

SECTION - B

Q. 19. For what value of λ , are the vectors $\vec{a} = \hat{i} + 3\hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} - \hat{j} - \hat{k}$ and $\vec{c} = \lambda\hat{i} + 7\hat{j} + 3\hat{k}$ coplanar?

Or

For what value of λ , are the four points A (3, 2, 1) B (4, λ , 5), C (4, 2, -2) and D (6, 5, -1) coplanar?

Q. 20. Using vectors prove that an angle in a semicircle is a right angle.

Q. 21. Show that the sphere $x^2 + y^2 + z^2 - 6x - 12y + 8z + 45 = 0$ touches the plane $2x - 2y - z - 10 = 0$.

Q. 22. Find the equation of the line through the point $(-1, 2, 3)$ which is perpendicular to

the lines $\frac{x}{2} = \frac{y-1}{-3} = \frac{z+2}{-2}$ and $\frac{x+3}{-1} = \frac{y+2}{2} = \frac{z-1}{3}$.

Q. 23. Prove that the equation of the plane making intercepts a, b and c on the co-ordinate

axes, is of the form $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$.

Q. 24. A body of weight 5 kg is suspended by two strings 7 cm and 24 cm long. Their other ends being fastened to the end points of a rod of length 25 cm. If the rod be so held that the body hangs immediately below its mid-point, find the tension in the strings.

Q. 25. Two forces, when acting at right angles, have their resultant of magnitude $\sqrt{10}N$ and when they act at 60° , the magnitude of the resultant is $\sqrt{13}N$. Find the magnitude of the two forces.

Q. 26. A particle is projected upwards with a velocity of 4 m/sec and after t seconds, another particle is projected upwards from the same point with the same velocity. Prove

that the particles will meet at a height of $\frac{4u^2 - g^2t^2}{8g} m$ after a time period of $\left(\frac{t}{2} + \frac{u}{g}\right)$ seconds start.

Or

A particle is projected so as to graze the tops of two walls, each of height 10 m at distances of 10 m and 60 m respectively from the point of projection. Find the angles of projection.

SECTION - C

Q. 19. Find the face value of a bill discounted at 6% per annum 146 days before the legally due date, if the bankers gain is Rs. 18.

Or

The difference between Bankers discount and True Discount on a bill legally due 3 months hence at 5% per annum is Rs. 50. Find the face value, Bankers Discount and True Discount.

Q. 20. A bill of exchange drawn on May 1, 2003 for Rs. 73,200 for 6 months was discounted by a bank at 6% per annum for Rs. 72,443,20. On what day was the bill discounted?

Q. 21. A box contains 2 gold and 3 silver coins. Another box contains 3 gold and 3 silver coins. A box is chosen at random and a coin is drawn from it. If the selected coin is a gold coin. Find the probability that it was drawn from the second box.

Q. 22. 10% of the tools produced by a machine are defective. Find the probability distribution of the number of defective tools in a sample of 3 drawn at random.

Q. 23. Two partners A and B invest Rs. 20,000 and Rs. 30,000 respectively in a business. They decided to distribute 50% of the total profit equally and the remaining in the ratio of their investments. If B receives Rs. 3,000 more than A, find the total profit and profit received by each.

Q. 24. What equivalent payments made at the beginning of each month for 8 years will pay for a house priced at Rs. 5,00,000, if money is worth 12% per annum, compounded monthly? [Use $(1.01)^{-95} = 0.3904$]

Q. 25. If the Cost function $C(x)$ is given by $C(x) = 25 - 4x + 2x^2$, where x is the output

$$\frac{d}{dx}[AC(x)] = \frac{MC(x) - AC(x)}{x}$$

Prove that

Also find the marginal Cost when 50 units are produced.

Q. 26. A housewife wishes to mix two kinds of foods X and Y in such a way that the mixture contains at least 10 units of Vitamin A, 12 units of Vitamin B and 8 units of Vitamin C. The vitamin contents of one kg of each food is given below.

	Vitamin A	Vitamin B	Vitamin C
Food X	1	2	3
Food Y	1	2	1

One kg of Food X and Food Y respectively cost Rs.6 and Rs.10. Find the least cost of mixture graphically, making it a linear programming problem.

Or

A man has Rs. 1,500 for purchase of rice and wheat. A bag of rice and a bag of wheat cost Rs. 180 and Rs. 120 respectively. He has a storage capacity of 10 bags only. He earns a profit of Rs. 11 and Rs. 9 respectively per bag of rice and wheat. Formulate it as a linear programming problem and solve it graphically for maximum profit.