CBSE 12th Mathematics 2012 Unsolved Paper
Delhi Board

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TIME - 3HR. | QUESTIONS - 29

THE MARKS ARE MENTIONED ON EACH QUESTION

SECTION – A

Question number 1 to 10 carry 1 mark each.

Q.1. If a line has direction ratios 2, -1, -2, then what are its direction cosines? *1 mark*

Q.2. Find $'\lambda'$ when the projection of $\vec{a} = \lambda\hat{\imath} + \hat{\jmath} + 4\hat{k}$ or $\vec{b} = 2\hat{\imath} + 6\hat{\jmath} + 3\hat{k}$ is 4 units. *1 mark.*

Q.3. Find the sum of the vectors $\vec{a} = \hat{\imath} - 2\hat{\jmath} + \hat{k}$, $\vec{b} = -2\hat{\imath} + 4\hat{\jmath} + 5\hat{k}$ and $\vec{c} = \hat{\imath} - 6\hat{\jmath} - 7\hat{k}$. *1 mark*

Q.4. Evaluate: *1 mark*

$$\int_2^3 \frac{1}{x}\,dx.$$

Q.5. Evaluate: *1 mark*

$$\int (1 - x)\sqrt{x}\,dx.$$

Q.6. If $\Delta = \begin{vmatrix} 5 & 3 & 8 \\ 2 & 0 & 1 \\ 1 & 2 & 3 \end{vmatrix}$, write the minor of the element a_{23}. *1 marks*

Q.7. If $\begin{pmatrix} 2 & 3 \\ 5 & 7 \end{pmatrix}\begin{pmatrix} 1 & -3 \\ -2 & 4 \end{pmatrix} = \begin{pmatrix} -4 & 6 \\ -9 & x \end{pmatrix}$, write the value of x. *1 marks*

Q.8. Simplify: $\cos\theta \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix} + \sin\theta \begin{bmatrix} \sin\theta & -\cos\theta \\ \cos\theta & \sin\theta \end{bmatrix}$. *1 mark*

Q.9. Write the principle value of: *1 mark*

$$\cos^{-1}\left(\frac{1}{2}\right) - 2\sin^{-1}\left(-\frac{1}{2}\right).$$

Q.10. Let * be a 'binary' operation on N given by $a * b = LCM\,(a, b) \forall a, b \in$ N. *1 mark*

SECTION – B

Question numbers 11 to 22 carry 4 marks each.

Q.11. If $(\cos x)^y = (\cos y)^x$, Find $\frac{dy}{dx}$. *4 marks*

OR

If $\sin y = x \sin(a + y)$, prove that:

Q.12. How many times must a man toss a fair coin, so that the probability of having at least one head is more than 80%? *4 marks*

Q.13 Find the vector and Cartesian equations of the line passing through the point (1, 2, -4) and perpendicular to the two lines: *4 marks*

$$\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7} \text{ and } \frac{x-15}{3} = \frac{y+29}{8} = \frac{z-5}{-5}$$

Q.14. If a, b, c are three vectors such that $|\vec{a}| = 5, |\vec{b}| = 12$ and $|\vec{c}| = 13$, and

$\vec{a} + \vec{b} + \vec{c} = \vec{o}$, find the value of $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}$. *4 marks*

Q.15. Solve the following differential equation: *4 marks*

$$2x^2 \frac{dy}{dx} - 2xy + y^2 = 0$$

Q. 16. Find the particular solution of the following differential equation; *4 marks*

$$\frac{dy}{dx} = 1 + x^2 + y^2 + x^2y^2, \text{ given that } y = 1,$$

$$\text{when } x = 0.$$

Q. 17. Evaluate: *4 marks*

$$\int \sin x \sin 2x \sin 3x \, dx$$

OR

Evaluate:

$$\int \frac{2}{(1-x)(1+x^2)} dx$$

Q. 18. Find the point on the curve

$$y = x^3 - 11x + 5 \text{ at which the equstion of tangent is } y = x - 11.$$ *4 marks*

OR

Using differentials, find the approximate value of $\sqrt{49.5}$.

Q. 19. $If\ y = (tan^{-1}x)^2, show\ that$ *4 marks*

$$(x^2+1)^2\frac{d^2y}{dx^2} + 2x(x^2+1)\frac{dy}{dx} = 2.$$

Q. 20. Using properties of determinants, prove that: *4 marks*

$$\begin{vmatrix} b+c & q+r & y+z \\ c+a & r+p & z+x \\ a+b & p+q & x+y \end{vmatrix} = 2\begin{vmatrix} a & p & x \\ b & q & y \\ c & r & z \end{vmatrix}$$

Q.21. Prove that *4 marks*

$$tan^{-1}\left(\frac{cosx}{1+sinx}\right) = \frac{\pi}{4} - \frac{x}{2}, x\epsilon\ \left(-\frac{\pi}{2}, \frac{\pi}{2}\right).$$

OR

Prove that

$$sin^{-1}\left(\frac{8}{17}\right) + sin^{-1}\left(\frac{3}{5}\right) = cos^{-1}\left(\frac{36}{85}\right).$$

Q.22. Let A = IR – {3} and B = IR – {1}. Consider the function f A $\longrightarrow$ B defined by

$f\ (x) = \left(\frac{x-2}{x-3}\right)$ **. show that f is one − one and onto and hence find f^{-1}.** *4 marks*

SECTION – C

Question numbers 23 to 29 carry 6 marks each.

Q.23. Find the equation of the plane determined by the point A(3, -1, 2), B(5, 2, 4) and C(-1, -1, 6) and hence find the distance between the plane and the point P(6, 5, 9). *6 marks*

Q.24. Of the students in a collage, it is know that 60% reside in hostel and 40% are day scholars (not residing in hostel). Precious year results report that 30 % of all students who reside in hotel attain 'A' grade and 20 % of day scholars attain 'A' grade in their annual examination At the end of the year, one student is chosen at random from the college and he has an 'A' grade, what is the probability that the student is a hosteller ? *6 marks*

Q.25. A manufacturer produces nuts and bolts. It takes 1 hour of work on machine A and 3 hour on machine B to produce a package of nuts. It takes 3 hours on machine A and 1 hour on machine B to produce a package of bolts. He ears a profit of Rs 7 per package of bolts. Hew many packages of each should be produces each day so as to maximize his profit if he operates his machines for at the most 12 hours a day ? form the above as a liner programming problem and solve it graphically. *6 marks*

Q.26. Prove that *6 marks*

$$\int_0^{\pi/4} \left(\sqrt{tanx} + \sqrt{cot\,x}\right)dx = \sqrt{2}.\frac{\pi}{2}$$

OR

$$Evaluate \int_1^3 (2x^2 + 5x)\,dx \text{ as a limit of a sum.}$$

Q. 27. Using the method of integration, find the area of the region bounded by the lines $3x - 2y + 1 = 0, 2x + 3y - 21 = 0$ *and* $x - 5y + 9 = 0$. *6 marks*

Q. 28. Show that the height of a closed right circular cylinder of given surface and maximum volume, is equal to the diameter of its base. *6 marks*

Q. 29. Using matrices, solve the following system of linear equations: *6 marks*

$$x - y + 2z = 7$$
$$3x + 4y - 5z = -5$$
$$2x - y + 3z = 12.$$

OR

Using elementary operations, find the inverse of the following matrix:

$$\begin{bmatrix} -1 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$$

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