**Sample Question Paper**
**Subject: Mathematics**
**Class – XII**
**Full Marks: 70 Time: 3 Hours**

**General Instructions:**

Read the following instructions very carefully and strictly follow them:
1. This Question paper contains 38 questions. All questions are compulsory.
2. This Question paper is divided into five Sections - A, B, C, D and E.
3. In Section A, Questions no. 1 to 18 are multiple choice questions (MCQs) with only one correct option and Questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
4. In Section B, Questions no. 21 to 25 are Very Short Answer (VSA)-type questions, carrying 2 marks each.
5. In Section C, Questions no. 26 to 31 are Short Answer (SA)-type questions, carrying 3 marks each.
6. In Section D, Questions no. 32 to 35 are Long Answer (LA)-type questions, carrying 5 marks each.
7. In Section E, Questions no. 36 to 38 are Case study-based questions, carrying 4 marks each.
8. There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and one subpart each in 2 questions of Section E.

| Q No. | Question | Marks |
|---|---|---|
| | **Section-A** Marks)<br>This section comprises multiple choice questions (MCQs) of 1 mark each: | 20x1=20 |
| 1. | The principal value of $sin^{-1}(-½)$ is:<br>a) $\pi/6$ b). π/3 c) –π/6 d) –π/3 | 1 |
| 2. | Let A= {a, b, c}. Then the total number of distinct relation on A is<br>a) 64 b) 32 c) 256 d) 512 | 1 |
| 3. | The value of $cos^{-1}$(½)+2$sin^{-1}$(½) is:<br>a) $\frac{2\pi}{3}$ b) $-\frac{2\pi}{3}$ c) $\frac{\pi}{3}$ d) $-\frac{\pi}{3}$ | 1 |
| 4. | The value of k, for which A=$\begin{bmatrix} k & 8 \\ 4 & 2k \end{bmatrix}$ in a singular matrix is:<br>a) 4 b) –4 c) ±4 d) 0 | 1 |
| 5. | If $2x + 3y = sin\, y$, then $\frac{dx}{dy}$ is:<br>a) $\frac{2}{\cos y - 3}$<br>b) $\frac{2}{\sin y - 3}$<br>c) $\frac{2}{3 - \cos y}$<br>d) $\frac{2}{3 - \sin y}$ | 1 |
| 6. | If $x = 4t$, $y = \frac{4}{t}$, then $\frac{dx}{dy}$ is: | 1 |

| | | |
|---|---|---|
| | a) $\frac{1}{t^2}$ b) $-\frac{1}{t^2}$ c) $\frac{4}{t^2}$ d) $-\frac{4}{t^2}$ | |
| 7. | The rate of change of the area of a circle with respect to its radius **r** at **r**=6 cm is:<br><br>a) 10π b) 12 π c) 8 π d) 11 π | 1 |
| 8. | The value of $x$ for which $x(\hat{\imath}+\hat{\jmath}+\hat{k})$ is a unit vector, is:<br><br>a) $\pm 1/3$ b) $\pm\sqrt{3}$ c) $\pm 1$ d) $\pm 1/\sqrt{3}$ | 1 |
| 9. | A line makes angle 90˚, 60˚ and 30˚ with the positive direction of x-axis, y-axis and z-axis respectively. Then the direction cosines of the line are:<br>a) $0, ½, \frac{\sqrt{3}}{2}$<br>b) $1, ½, \frac{\sqrt{3}}{2}$<br>c) $0, \frac{\sqrt{3}}{2}, ½$<br>d) $½, \frac{\sqrt{3}}{2}, 0$ | 1 |
| 10. | If P(B)=0.5 and P(A⋂B) =0.32, then P(A/B) is:<br><br>a) 0.64 b) 1.6 c) 0.46 d) 0.66 | 1 |
| 11. | The anti-derivative (or integral) of the function $(\sqrt{x}+\frac{1}{\sqrt{x}})$ equals:<br><br>a) $\frac{1}{3}x^{1/3}+2x^{1/2}+c$<br>b) $\frac{2}{3}x^{2/3}+\frac{1}{2}x^{2}+c$<br>c) $\frac{2}{3}x^{3/2}+2x^{1/2}+c$<br>d) $\frac{3}{2}x^{3/2}+\frac{1}{2}x^{1/2}+c$ | 1 |
| 12. | $\int x^2(1-\frac{1}{x^2})\,dx$ is equal to?<br><br>a) a) $\frac{x^3}{3}-x+c$<br>b) $\frac{x^2}{2}-x+c$<br>c) $\frac{x^3}{3}+x+c$<br>d) $\frac{x^2}{2}+x+c$ | 1 |
| 13. | The maximum value of the function f($x$) = $-(x-1)^2+10$ is<br>a) 1 b) $-1$ c) 10 d) $-10$ | 1 |
| 14 | If $\lvert\vec{a}\rvert=\sqrt{3}$ , $\lvert\vec{b}\rvert$ =2 and angle between $\lvert\vec{a}\rvert$ and $\lvert\vec{b}\rvert$ is 60º, then | 1 |

| | | |
|---|---|---|
| | $\vec{a}.\vec{b}$ is<br><br>a) 2 b) ½ c) $\sqrt{3}$ d) $1/\sqrt{3}$ | |
| 15. | The value of $\int_0^1 \frac{dx}{1+x^2}$ is<br><br>a) 0 b) 1 c) π/2 d) π/4 | 1 |
| 16. | The order and degree of differential equation $xy\frac{d^2y}{dx^2} + x\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} = 0$ is<br><br>a) 1,2 b) 2,1 c) 1,1 d) 2,2 | 1 |
| 17. | In the interval $(\frac{\pi}{2}, \pi)$, the function f($x$)= sin$x$ is<br><br>a) Strictly increasing<br>b) Strictly decreasing<br>c) Neither increasing nor decreasing<br>d) d None of the above | 1 |
| 18. | If A and B are events such that P(A/B) = P(B/A), then:<br><br>a). A⊂B but A≠B b). A=B<br>c). A⋂B=Φ d). P(A) = P(B) | 1 |
| Questions number 19 and 20 are Assertion and Reason based questions two statements are given, one labeled Assertion (A) and the other labeled Reason (R). Select the correct answer from the codes (A), (B), (C) and (D) as given below.<br>a) Both (A) and (R) are true and (R) is the correct explanation of the (A).<br>b) Both (A) and (R) are true, but (R) is not the correct explanation of (A).<br>c) (A) is true, but (R) is false.<br>d) (A) is false, but (R) is true. | | |
| 19. | Assertion (A): The matrix<br>$\begin{bmatrix} 0 & 1 & 3 \\ -1 & 0 & 5 \\ -3 & -5 & b \end{bmatrix}$ is skew –symmetric<br>if b = 0.<br>Reason (R): A square matrix A is said to be skew-symmetric if A′= $-A$ | 1 |
| 20. | Assertion (A): In the set A= {1,2,3}, a relation is defined as R= {(1,1), (2,2)} is reflexive.<br>Reason (R): A relation R is reflexive in A if (a, a)∈ $R$ $for$ $all$ a∈ $A$. | 1 |
| | **Section-B**<br>This section comprises 5 very Short Answers (VSA) type questions of 2 marks each. | |
| 21. | (A). Compute the product: $\begin{bmatrix} 1 & -2 \\ 2 & 3 \end{bmatrix}\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \end{bmatrix}$<br><br>OR<br><br>(B). For the matrix A= $\begin{bmatrix} 1 & 5 \\ 6 & 7 \end{bmatrix}$, verify that (A+A’) is a symmetric matrix. | 2<br><br><br><br>2 |

| | | |
|---|---|---|
| 22 | (A). Find the values of $x$, if $\begin{vmatrix} 2 & 4 \\ 5 & 1 \end{vmatrix} = \begin{vmatrix} 2x & 4 \\ 6 & x \end{vmatrix}$<br><br>OR<br><br>(B). Using determinant, find the area of the triangle with the vertices (1, 0), (6, 0) and (4, 3). | 2<br><br>2 |
| 23. | Find the value of k so that the function $f(x)= \begin{cases} kx+1, if\ x \le 5 \\ 3x-5, if\ x > 5 \end{cases}$<br>Is continuous at $x = 5$. | 2 |
| 24 | (A). Evaluate: $\int \frac{cos2x - cos2\alpha}{cosx - cos\alpha}\, dx$<br><br>OR<br><br>(B). Evaluate: $\int \frac{x^2}{1-x^6}\, dx$ | 2<br><br>2 |
| 25 | (A). If A and B are two events such that P(A) = $\frac{1}{4}$, P(B) = ½ and P(A ∩ B) = $\frac{1}{8}$, find P(not A and not B).<br>OR<br>(B). Probability of solving a specific problem independently by A and B are 1/2 and 1/3 respectively. If both try to solve the problem independently, find the probability that the problem is solved. | 2<br><br>2 |
| | **Section-C**<br>This section comprises 6 Short Answer (SA) type questions of 3 marks each. | |
| 26. | If y = $(\tan^{-1} x)^2$, show that $(x^2 + 1)^2 y_2 + 2x(x^2 + 1)y_1 = 2$, where $y_1 = \frac{dy}{dx}$ and $y_2 = \frac{d^2y}{dx^2}$ . | 3 |
| 27 | (A). Evaluate: $\int (x^2 + 1) \log x \, dx$<br>OR<br>(B) Evaluate: $\int \frac{x-3}{(x-1)^3} e^x \, dx$ | 3<br><br>3 |
| 28 | (A). Find a unit vector perpendicular to each of the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$, where $\vec{a} = 3\hat{\imath} + 2\hat{\jmath} + 2\hat{k}$ and $\vec{b} = \hat{\imath} + 2\hat{\jmath} - 2\hat{k}$.<br>OR<br>(B). Find the position vector of a point R which divides the line joining the two points P and Q whose position vectors are $\hat{\imath} + 2\hat{\jmath} - \hat{k}$ and $-\hat{\imath} + \hat{\jmath} + \hat{k}$ respectively, in the ratio 2:1<br>(i) internally | 3<br><br>3 |

| | | |
|---|---|---|
| | (ii) externally | |
| 29. | Find the vector and cartesian equation of the line passing through the point (1, 2, 3) and parallel to the vector $3\hat{i} + 2\hat{j} - 2\hat{k}$. | 3 |
| 30 | (A). A stone is dropped into a quiet lake and waves move in circles at the speed of 5 cm/s. At the instant when the radius of the circular wave is 8 cm, how fast is the enclosed area increasing?<br>OR<br>(B). Find the intervals in which the function f given by<br>$f(x) = 4x^3 - 6x^2 - 72x + 30$ is<br>(i) strictly increasing<br>(ii) strictly decreasing | 3<br><br><br>3 |
| 31 | (A). Prove that $\int_0^a \frac{\sqrt{x}}{\sqrt{x}+\sqrt{a-x}}\,dx = \frac{a}{2}$<br>OR<br>(B). Evaluate: $\int \frac{2x}{(x^2+1)(x^2+3)}\,dx$ | 3<br><br>3 |
| | **Section-D**<br>This section comprises 4 Long Answer (LA) type questions of 5 marks each. | |
| 32. | Minimise $Z = -3x + 4y$ subject to $x + 2y \le 8$, $3x + 2y \le 12$, $x \ge 0$, $y \ge 0$. (Solve graphically.) | 5 |
| 33 | (A). Evaluate $\int_0^{\pi/2} log\ sinx\ dx$<br>OR<br>(B). Show that the semi-vertical angle of the cone of maximum volume and of given slant height is $\tan^{-1}\sqrt{2}$. | 5<br><br>5 |
| 34 | (A). Find the shortest distance between the lines whose vector equations are:<br>$\vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda(\hat{i} - 3\hat{j} + 2\hat{k})$ and $\vec{r} = (4\hat{i} + 5\hat{j} + 6\hat{k}) + \mu(2\hat{i} + 3\hat{j} + \hat{k})$.<br>OR<br>(B) Solve the following:<br>(i) If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a}+\vec{b}+\vec{c} = \vec{0}$, find the value of $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}$<br>(ii) Find the area of the parallelogram whose adjacent sides are determined by the vectors $\vec{a} = \hat{i} - \hat{j} + 3\hat{k}$ and $\vec{b} = 2\hat{i} - 7\hat{j} + \hat{k}$. | 5<br><br>3<br><br>2 |

| | | |
|---|---|---|
| | | |
| 35 | (A). Show that $(x\,dy - y dx) = \sqrt{x^2 + y^2}\ dx$ is a homogeneous differential equation and solve it.<br>OR<br>(B). Solve the linear differential equation $(1 + x^2)\frac{dy}{dx} + 2xy = \frac{1}{1+x^2}$, given that y = 0 when x = 1. | 5<br><br><br>5 |
| | **Section-E**<br>This section comprises 3 case study-based questions of 4 marks each. | |
| 36. | **Case Study - 1** Raju, Rahim and Ria go to the market to purchase grocery items. Raju buys 4 kg onion, 3 kg wheat and 2 kg rice. Rahim buys 2 kg onion, 4 kg wheat and 6 kg rice. Ria buys 6 kg onion, 2 kg wheat and 3 kg rice. Raju pays ₹60, Rahim pays ₹90 and Ria pays ₹ 70. Based upon the above information, answer the following questions:<br>(i) Form the equation required to solve the problem of finding the cost of each item and express it in the form of A$x$ = B.<br>(ii) Find \|A\| and confirm if it is possible to find $A^{-1}$.<br>(iii) (a) Find $A^{-1}$ if possible.<br>OR<br>(b) Find $A^2 - 5I$, where I is an identity matrix. | <br><br><br><br><br>1<br><br>2<br>2 |
| 37. | **Case Study - 2** Suppose f is a real function on a subset of real number and c is any point on the domain of f. Then f is continuous at c if,<br>$\lim_{x\to c^-} f(x) = \lim_{x\to c^+} f(x) = f(c)$<br>The function f is given by:<br>$f(x) = \begin{cases} ax + 5, if\ x < 5 \\ 10, if\ x = 5 \\ bx + 20, if\ x > 5 \end{cases}$<br>The given function is continuous at x = 5. Based upon the above information, answer the following questions:<br>(i) Find the relation between a and b.<br>(ii) Find the value of a.<br>(iii) Find the value of f(3). | <br><br><br><br><br><br><br>2<br>1<br>1 |
| 38. | **Case Study - 3** A bag contains 4 red and 4 black balls; another bag contains 2 red and 6 black balls. One of two bags is selected at random and a ball is drawn from the bag.<br>Based upon the above information:<br>(i) Find the probability that the ball drawn was a red ball.<br>(ii) What is the probability that the red ball is drawn from the first bag? | <br><br><br><br>2<br>2 |

****