Model Questions Class 12 Subject : Mathematics

Group A [1x11=11]

Rewrite the correct option in your answer sheet

1. The value of $\frac{-1+\sqrt{-3}}{2}+\frac{-1-\sqrt{-3}}{2}$ is
   a) 1 b) 2 c) 0 d) -1
2. In how many ways can the letter of the word 'CALCULUS' be arranged?
   a) 1260 b) 5040 c) 720 d) 3780
3. The value of $\tan^{-1} 3+\tan^{-1}\frac{1}{3}$ is
   a) π b) 1 c) $\frac{\pi}{2}$ d) ∞
4. If $\sin x=1$, which one is the solution of x,
   a) $n\pi \pm(-1)^n\frac{\pi}{2}$ b) $2n\pi \pm\frac{\pi}{2}$ c) $2n\pi+\frac{\pi}{2}$ d) $n\pi+\frac{\pi}{2}$
5. Which of the following gives the area of parallelogram
   a) $\vec{a}\times\vec{b}$ b) $\vec{a}\,.\vec{b}$ c) $|\vec{a}\times\vec{b}|$ d) $\frac{1}{2}|\vec{a}\times\vec{b}|$
6. The length of minor axis of $\frac{x^2}{25}+\frac{y^2}{16}=1$ is
   a) 10 b) 25 c) 8 d) 16
7. In binomial distribution which one indicate the variance.
   a) np b) $\sqrt{np}$ c) npq d) $\sqrt{npq}$
8. The value of $\int\frac{dx}{\sqrt{x^2+a^2}}$ is
   a) $\sin^{-1}\frac{x}{a}+C$ b) $\tan^{-1}\frac{x}{a}+C$ c) $\sinh^{-1}\frac{x}{a}+C$ d) $\cosh^{-1}\frac{x}{a}+C$
9. By using the L-Hospital rule, the solution of $\lim_{x\to\infty}\left(\frac{x^3}{e^x}\right)$ is
   a) $\frac{\infty}{\infty}$ b) 0 c) 1 d) e
10. The solution of the system $3x-y=5$ and $3x-y=18$ is
    a) Inconsistent and dependent b) consistent and independent
    c) Inconsistent and dependent d) inconsistent and independent
11. A person of mass 50kg jumped from a certain height and landed on a ground with a velocity of 10ms^{-1}. He is brought to rest in one tenth of second. What is the force acting on the person
    a) 500gN b) 5000N c) 50 N d) 0 N

OR

Consumer's surplus is given by

a) $P_0Q_0-\int_0^{Q_0}P\,dQ$ b) $P_0Q_0-\int_0^{Q_0}f(Q)\,dQ$
c) $\int_0^{Q_0}P\,dQ-P_0Q_0$ d) $\int_0^{Q_0}f(Q)\,dQ-P_0Q_0$

Group B [5x8=40]

12. a) Find the general term of $\left(x^2+\frac{1}{x}\right)^6$
    b) Find the value of $\left(1+\frac{1}{1!}+\frac{1}{2!}+\frac{1}{3!}+\cdots\right)\left(1-\frac{1}{1!}+\frac{1}{2!}-\frac{1}{3!}+\cdots\right)$
    c) Given the algebraic structure $(G,\times)$ with $G=\{-1,1\}$ and where $\times$ stands for the operation of multiplication, find the inverses of elements of G.
13. State the principle of mathematical induction method. Applying it prove that:
    $$1\cdot2+2\cdot3+3\cdot4+\cdots+n\cdot(n+1)=\frac{1}{3}n(n+1)(n+2)$$
14. a) If $x+y+z=xyz$ show that $\tan^{-1}x+\tan^{-1}y+\tan^{-1}z=\pi$.
    b) Show that $\vec{a}\times(\vec{b}+\vec{c})+\vec{b}\times(\vec{c}+\vec{a})+\vec{c}\times(\vec{a}+\vec{b})=0$.
15. The following table gives the normal weight of a baby during the first six month of life

Age in month	1	2	3	5	6
Weight	5	7	8	10	12

    a) Find the regression equation of weight on the age
    b) Also estimate the weight of baby at the age of 4 month
16. a) State mean value theorem
    b) What is the expression of $\int\frac{dx}{x^2+49}$
    c) Find the solution of $\frac{dy}{dx}=\frac{y}{x}$ by separation of variable method.
    d) Write any four indeterminate form
    e) Find the slope with x –axis of the tangent of $x^2+y^2=25$ at $(-3,4)$
17. Integrate by using partial fractional method $\int\frac{2x^2+3}{x^3+3x^2+2x}dx$
18. Use simplex method and maximum $z=5x-3y$ subject to $3x+2y\le6, x-3y\le4, x,y\ge0$.
19. State Newton third law of motion. A shot of 400kg if projected form a 40 metric tons gun with a velocity of 600 meter/sec. Find the velocity with which the gun would commence to recoil, if free to move in the line of projection.

OR

The revenue function and the total cost function are $R(x)=18x-2x^2$ and $C(x)=2x+24$, find

a) The value of maximum profit.
b) Find the quantity at which neither profit nor loss gained.

Group C [8X3=24]

20. a) There are 50 workers employed in a sugar factory. If the total daily wage of the employees is Rs. 5800 when a man get Rs. 120 and a woman gets Rs. 100 daily, find the numbers of men and women employed in the factory by using matix.
    b) $\sum_{n=1}^{\infty}\frac{n^2}{(n+1)!}=e-1$
21. a) Show that the line joining the points $(1,2,3)$ and $(-1,-2,-3)$ is perpendicular to the line joining points $(-2,1,5)$ and $(3,3,2)$.
    b) Find the equation of plane through the intersection of the planes $x+y+z=6$, $2x+3y+4z+5=0$ and perpendicular to the plane $4x+5y-3z=8$.
22. a) Verify Rolle's theorem for the function $f(x)=x(x-3)^2$ for $x\in[0,3]$
    b) Solve $\frac{dy}{dx}+\frac{1}{x}y=x^2$ given that $y=1$ when $x=1$.

Group A [1x11=11]

Rewrite the correct option in your answer sheet

1. If $1, \omega, \omega^2$ are the cube roots of unity then
   a) $\omega = \omega^2$ b) $\omega^2 = \omega^3$ c) $1 + \omega + \omega^2 = 0$ d) $1 + \omega = \omega^2$
2. Number of 5 digit odd numbers that can be formed from the integers 0, 1, 2, 3, 4 are
   a) 36 b) 48 c) 96 d) 120
3. If $cosec^{-1}x = \sin^{-1}\frac{1}{x}$ then which of the following is not the value of x?
   a) $\frac{1}{x}$ b) $\frac{1}{2}$ c) $-\frac{3}{2}$ d) 1
4. The principle value of θ which satisfies $\cot\theta = 1$ and $\cos\theta = -\frac{1}{\sqrt{2}}$
   a) $\frac{3\pi}{4}$ b) $\frac{5\pi}{4}$ c) $\frac{4\pi}{3}$ d) $\frac{7\pi}{6}$
5. If $\vec{a}\cdot\vec{b} = 3, |\vec{a}\times\vec{b}| = 4$ then the angle between $\vec{a}$ and $\vec{b}$ is
   a) $\frac{\pi}{2}$ b) $\cos^{-1}\frac{3}{4}$ c) $\cos^{-1}\frac{3}{5}$ d) $\cos^{-1}\frac{4}{5}$
6. The distance between the point $(2, 3, 4)$ from the plane $3x - 6y + 2z + 11 = 0$ is
   a) 0 b) 1 c) 2 d) 3
7. The mean of binomial distribution is 12 and the standard deviation is 3 then the no of trials are
   a) 12 b) 24 c) 36 d) 48
8. The degree of the differential equation $\frac{d^3y}{dx^3} + 5\frac{d^2y}{dx^2} + 4\left(\frac{dy}{dx}\right)^2 + 6 = 0$
   a) 1 b) 2 c) 3 d) 4
9. According to the L- Hospital Rule the value of $\lim_{x\to 0}\frac{x - \sin x}{x^3}$ is equal to
   a) $\frac{1}{3}$ b) $\frac{1}{4}$ c) $\frac{1}{6}$ d) $\frac{1}{2}$
10. When Gauss forward elimination method is used for solving the equations
    $3x + 4y = 18 \ldots (i)$ and $3y - x = 7 \ldots . (ii)$ we apply the operation like
    a) equation (i) +4 equation (ii) b) equation (i) +3 equation (ii)
    c) equation (i) + equation (ii) d) equation (ii) +3 equation (i)
11. If P and Q be two like parallel forces acting at A and B whose resultant R acts at C then
    a) $P.AC = Q.BC$ b) $Q.AC = P.BC$ c) $\frac{P}{AC} = \frac{Q}{BC}$ d) none

    OR

    If the demand and supply intersect at a point under the pure competition the it is called
    a) economic point b) equilibrium point c) turning point d) point of intersection

Group B[5x8=40]

12. The binomial expression for two algebraic terms a and x is given as $(a + x)^n$.
    a) Write the binomial theorem for any positive integer n in the expansion form
    b) Write any one property of binomial coefficients.
    c) Write the general term of the expansion
    d) Write the single term for $C(n, r) + C(n, r - 1)$.
    e) How many terms are there in the expansion?
13. Using the principle of mathematical induction for every natural number n, prove that
    $$\frac{1}{1\cdot 3} + \frac{1}{3\cdot 5} + \frac{1}{5\cdot 7} + \cdots + \frac{1}{(2n-1)(2n+1)} = \frac{n}{2n+1}$$
14. a) Evaluate : $\cos\left(\sin^{-1}\frac{3}{5} + \sin^{-1}\frac{5}{12}\right)$
    b) In any triangle ABC prove by vector method $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
15. The following table gives the normal weight of a baby during first six months

Age in month	1	2	3	5	6
Weight	5	7	8	10	12

    Estimate the weight of baby at the age of 4 month
16. Find from the first principle the derivative of $\log\left(\sin\frac{x}{a}\right)$
17. a) Integrate $\int\frac{dx}{1 + \sin x + \cos x}$
    b) Write the difference between the derivative and antiderivative.
18. Solve the LP problem by the Simplex Method
    Maximize: $Z = 40x + 88y$ Subject to : $2x + 8y \le 60; 5x + 2y \le 60, \quad x, y \ge 0$
19. If R is the horizontal range of a projectile and H is the greatest height, prove that its initial velocity is $\sqrt{2g\left(H + +\frac{R^2}{16H}\right)}$

    OR

    If the demand function is $P = 85 - 4Q - Q^2$, find the consumer surplus at the demand 4 units and the price 64 units. Also make a revenue function for the demand equation $P = 20 + 5Q - Q^2$. Obtain the standard quadratic equation for marginal revenue, where Q represents the number of units demand and P represents the price.

Group C[8x3=24]

20. A mixture is to be made of three A, B, C which contains nutrients P, Q and R as shown in table below. The quantity of P, Q and R are 45 units, 54 units and 45 units resp.

Food	Units of nutrients per kg of the food		
	P	Q	R
A	2	2	4
B	3	5	0
C	4	3	5

    a) Express the information in equation form.
    b) Solve the equation using matrix method
    c) If the cost per kg of food A, B, C are Rs. 300, Rs. 240, Rs 180 respectively, find the total cost of mixture by matrix method.
21. a) Find the angle between the lines whose direction cosines are given by the equations
    $$l + m + n = 0, 2lm - mn + 2nl = 0$$
    b) Find the center, vertices, foci, eccentricity and length of latus rectum of the ellipse
    $$9x^2 + 4y^2 + 18x - 16y + 11 = 0$$
22. a) Solve : $x\frac{dy}{dx} + 2y = x^2\log x$
    b) Show that the set of positive rational numbers form an abelian group under the composition defined by $a * b = \frac{ab}{4}$.

Group A[11x1=11]

Rewrite the correct option in your answer sheet.

1. From 10 person, in how many ways can a selection of 4 be made so that one particular person is always included.
   a) 21 b) 84 c) 30 d) 504
2. If $z = \cos\theta + i\sin\theta$, then the value of $z^n + \frac{1}{z^n}$ is
   a) $2n\sin\theta$ b) $2ni\sin\theta$ c) $2n\cos\theta$ d) $2ni\cos\theta$
3. Which of the following relation is correct
   a) $\sin^{-1}x + \cos^{-1}x = \frac{\pi}{2}$ b) $\cos^{-1}(-x) = \pi - \cos^{-1}x$
   c) $\sin^{-1}x = \cos^{-1}\sqrt{1-x^2}$ d) all of the above
4. A particle moves in a curved path having equation $\tan px = \cot qx$. The general solution for x is
   a) $px = n\pi + qx$ b) $px = n\pi + \left(\frac{\pi}{2} + qx\right)$
   c) $px = n\pi + \left(\frac{\pi}{2} - qx\right)$ d) none of the above
5. If α, β and γ represent the angle made by a line segment with $x-, y-, z-$ axes respectively then which of the following relation is correct:
   a) $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = -1$ b) $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$
   b) $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 0$ d) $\cos^2\alpha + \cos^2\beta = \cos^2\gamma$
6. If $\vec{a}$ and $\vec{b}$ represents the two adjacent sides of a parallelogram, then the area of the parallelogram is
   a) $\vec{a}\cdot\vec{b}$ b) $\vec{a}\times\vec{b}$ c) $|\vec{a}\cdot\vec{b}|$ d) $|\vec{a}\times\vec{b}|$
7. If r is the correlation coefficient between two variables x and y then
   a) $|r| \le 1$ b) r is independent of change of both origin and scale
   c) r is geometric mean between two regression coefficients d) all of the above
8. If $y = f(x)$ be the function
   Statement 1: The differentiability of the function at a point implies that the continuity of the function at that point.
   Statement 2: The continuity of a function at a point is the necessary but not sufficient condition for the existence of the derivative of the function at that point.
   a) statement1 is true and statement 2 is false. b)statement2 is true and statement 1 is false
   c) both statements are true d) both statements are false.
9. A general second order differential equation is written in the form $\frac{d^2y}{dx^2} + P\frac{dy}{dx} + Qy = R$, then
   a) P and Q are function of x but R is constant b) Only R is function of x
   c) Only Q is function of x d) P, Q, and R are function of x.
10. An inequality is given by $ax + by \le c$ and r is a non-negative variable such that $ax + by + r = c$ then
    a) x and y are basic variable but r is surplus variable.
    b) x and y are decision variable but r is surplus variable.
    c) x and y are basic variable but r is slack variable.
    d) x and y are decision variable but r is slack variable.
11. α and β are the angle of projection of a projectile with the same velocity such that horizontal range remains the same then
    a) $\alpha + \beta = 90°$ b) $\alpha - \beta = 90°$ c) $\alpha = 45°, \beta > 45°$ d) $\alpha < 45°; \beta = 45°$

Group B[8x5=40]

12. a) In the study of elementary group theory, Mr. A says that "every element in group (G, o) has unique inverses." Do you agree with him? Justify
    b) In binomial expansion of $(a+b)^n$ write the general term to find the given expansion.
    c) Show that $\sum_{n=1}^{\infty}\frac{n^2}{(n+1)!} = e - 1$
13. a) Using the principle of induction prove that $x^n - y^n$ is divisible by $x - y$
    b) Form the quadratic equation with rational coefficient whose one root is $3 - \sqrt{2}$
14. a) Solve $\sin^2\theta - 2\cos\theta + \frac{1}{4} = 0$
    b) If $\vec{a} + \vec{b} + \vec{c} = 0$ prove that $\vec{a}\times\vec{b} = \vec{b}\times\vec{c}$.
15. a) The regression coefficient of x on y and y on x are 0.84 and 0.32 respectively. If arithmetic mean of x and y series are 42 and 26 respectively. Find two equations of lines of regression.
    b) In an observation of 200 students it is found that the average pass students is 60%. Find the mean and variance of the observation if the observation follow binomial distribution
16. a) A circular copper plate is heated so that its radius increases from 5 cm to 5.06 cm. Find the approximate increase in area.
    b) Write geometrical meaning of mean value theorem in a sentence.
    c) Write the expression of the standard integral $\int\sqrt{a^2 - x^2}\,dx$
    d) In a function $y = f(x)$ how can we find the derivative of $f(x)$ as stated by definition?
    e) Write the condition to use the L-Hospital Rule to find the limit of real valued function.
17. Integrate $\int\frac{x^2}{(x^2+a^2)(x^2+b^2)}dx$ by using the concept of partial fraction. Write the concept of fundamental theorem of integral calculus.
18. Use the simplex method to maximize the function $z = 15x + 12y$ subject to the constraints $2x + 3y \le 21, 3x + 2y \le 24\ x \ge 0, y \ge 0$
19. a) How can you determine the force applied on a moving body with varying mass and constant velocity? Two men, one stronger than the other have to remove a block of stone weighing 270N with a light plank whose length is 6m if the stronger men is able to carry 180N , how must the block be placed so as to allow him that share of the weight.

Group C[3x8=24]

20. a) Use the row equivalent matrices to solve the equations:
    $$x + y + z = 1, x + 2y + 3z = 4, x + 3y + 7z = 13$$
    b) State the De Moivre's theorem. Use Euler's formula to prove De Moivre's theorem . Write any one use of De Moivre's theorem
21. a) The earth is supposed to move around the sun in an elliptical orbit. If p and q are the farthest and nearest distance of the earth from the sun in an elliptical orbit find the equation of locus of the Earth in the standard form
    b) Find the direction cosines of two lines which satisfy the relation $2l + 2m - n = 0$ and $lm + mn + nl = 0$. Also find the angle between these lines.
22. a) Solve the differential equation $\sin x\frac{dy}{dx} + y\cos x = x\sin x$
    b) Use the concept of differential equation to find the equation of the curve passing through the point (2, 1) if the slope of the tangent to the curve at any point (x, y) is $\frac{x^2 - y^2}{2xy}$