Sub. Code: 0071

MMC-GRADE XI
2081 (2024)
Mathematics

Time: 3 Hours | FM: 75

*Group-A (11*1=11)*

1. A compound statement which is always true is called
a) Contradiction b) Tautology c) Negation d) inverse
2. The inequality $-1 \le x \le 7$ is in absolute value sign as
a) $|x-2| \le 4$ b) $|x-3| \le 4$ c) $|x-1| \le 2$ d) $|x-5| \le 2$
3. Let a function $f : R \to R$ be defined by $f(x) = x^2+7$, $x \in R$ then f^{-1} is
a) $f^{-1}(x) = \sqrt{x-7}$ b) $f^{-1}(x) = \frac{x-7}{2}$ c) $f^{-1}(x) = \frac{\sqrt{x-7}}{2}$ d) $f^{-1}(x) = \sqrt[3]{x-7}$
4. The value of x for $\log_4 X = 1/2$, is
a) -1 b) 0 c) 1 d) 2
5. The vertex of the quadratic function $f(x) = x^2+ 4x+3$ is
a) (-2, -1) b) (-1 , -2) c) (1 ,2) d) (2, 1)
6. The sum of the infinite series 16 + 8 + 4 + …………… is
a) 4 b) 8 c) 16 d) 32
7. If determinant $\begin{vmatrix} 5 & -6 \\ x-2 & 3 \end{vmatrix} = 0$, then the value of x is
a) 2 b) -1/2 c) 1/2 d) 1/4
8. If a line makes 45^0 with positive x-axis and 60^0 with positive y-axis then the angle made by the line with z-axis is
a) 60^0 b) 120^0 c) both a and b d) 180^0
9. If mean = 50, mode = 56 and S.D. = 15, then the karl pearson's coefficient of skewness is
a) – 0.1 b) - 0.2 c) - 0.3 d) - 0.4
10. Two coins are tossed simultaneously , the probability that both are heads is
a) 0 b) 1/2 c) 1/4 d) 1
11. The value of $\int sec^2(ax+b)dx$ is
a) tan(ax+b) + c b) atan(ax+b) +c c) $\frac{\tan(ax+b)}{b}$+c d) $\frac{\tan(ax+b)}{a}$+c

Group-B (5*8 = 40)

12. a) prove that $\overline{(AUB)} = \bar{A} \cap \bar{B}$ [2]
a) solve $x^2 – 2x -3 \ge 0$ [3]
13. a)prove that the $f : R – \{3\} \to R – \{1\}$ defined by $f(x) = \frac{x}{x-3}$ is bijective function[2]
b) sketch the graph of $y = -x^2 +4x -3$. [3]

OR,

prove that the equation of the lines joining the origin and the point of intersection of the line $y = mx+c$ and the circle $x^2 + y^2 = a^2$ will be at right angles if $2c^2 = a^2(1+m^2)$.

14. Prove that : $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix}$ = (a-b) (b-c) (c-a) (a+b+c) [5]

15. a) If A= $\begin{bmatrix} 4 & -5 \\ 3 & 6 \end{bmatrix}$ and B = $\begin{bmatrix} 2 & -3 \\ -1 & -2 \end{bmatrix}$, prove that $(AB)^T = B^T A^T$ [2]

b) find the sum to infinity of the series $1+2x+3x^2+4x^3+ \ldots\ldots\ldots\ldots$ [3]

16. a) find the square roots of $-7 + 24i$. [2]

b) if α and β be the root roots of the equation $px^2 + qx + q = 0$, prove that:

$\sqrt{\frac{\alpha}{\beta}} + \sqrt{\frac{\beta}{\alpha}} + \sqrt{\frac{q}{p}} = 0$ [3]

17. a) find the general solution of $\cos^2 x = 1/2$ [2]

b) If $\tan^{-1}x+\tan^{-1}y+\tan^{-1}z = \pi$, prove that : $x + y + z = xyz$. [3]

18. a) find the ratio in which the xy-plane divides the join of the points (-2,4,7) and (3,-5,-8).

b) Define direction cosines of a line . Find the direction cosine of a line which is equally inclined with the axes of coordinates. [2+3]

19. calculate the coefficient of skewness : [5]

Marks	10-20	20-30	30-40	40-50	50-60	60-70	70-80
F	5	12	15	20	10	4	2

Group- C (8*3 = 24)

20. a) Evaluate: $\lim_{x\to\theta} \frac{x\tan\theta - \theta\tan x}{x-\theta}$ [3+2+3]

b) Find the derivative of $y = \tan(\sin(ax+b))$

c) Prove that the function defined as $f(x) = \begin{cases} 2x+1, for\ x < 1 \\ 3, for\ x = 1 \\ 3x, for\ x > 1 \end{cases}$, is continuous at x=1

21. a) Find the maxima or minima of the function $f(x) = 4x^3-15x^2+12x+7$. [3+2+3]

b) Evaluate $\int \frac{1}{9+x^2} dx$

c) Evaluate $\int x \sin x\, dx$.

22. a) If $f(x)= x^2 + 2$ and $x_0 = 2$, find x_1 & x_2 using Newton-Rapson method. [2+3+3]

b) Prove that the vectors $\vec{i} - 2\vec{j} + \vec{k}$, $\overline{2i} + \vec{j} - \vec{k}$ and $7\vec{i} - 4\vec{j} + \vec{k}$ are linearly dependent.

c) If p and q are the lengths of perpendiculars from the origin upon the straight lines $x\sec\theta + y\,\mathrm{cosec}\theta = a$ and $x\cos\theta - y\sin\theta = a\cos 2\theta$, prove that $4p^2 + q^2 = a^2$.

OR, [5+3]

a) state sine law and use it to prove Lami's theorem.

b) A train moving with a velocity of 360 km/hr has the uniform acceleration $40 m/s^2$. Obtain the distance covered by the train in ½ minute.

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$\frac{d\cos x}{dx} = -\sin x$ $\sec^2 - \tan^2$ $\frac{d\sin x}{dx} = \cos x$

$a^2 - x^2 = a\sin\theta$

$a^2 + x^2 = a\tan\theta$

$x^2 - a^2 = a\sec\theta$