VNR11M

Virudhunagar District

Common Half Yearly Examination - December 2024

Standard 11

MATHEMATICS

Time Allowed: 3.00 Hours Maximum Marks: 90

PART-A

i) Answer all the questions. **20×1=20**

ii) Choose the correct answer.

1) If $n(A) = 2$ and $n(B \cup C) = 3$ then $n[(A \times B) \cup (A \times C)]$ is

a) 2^3 b) 3^2 c) 6 d) 5

2) Let $f : R \to R$ be defined by $f(x) = 1 - |x|$. Then the range of f is _____.

a) R b) $(1, \infty)$ c) $(-1, \infty)$ d) $(-\infty, 1)$

3) The value of $\log_{\sqrt{2}} 512$ is _____.

a) 16 b) 9 c) 18 d) 12

4) If $\frac{kx}{(x+2)(x-1)} = \frac{2}{x+2} + \frac{1}{x-1}$ then the value of k is _____.

a) 1 b) 3 c) 2 d) 4

5) $\sin 765^\circ$ = _____.

a) $\frac{1}{2}$ b) $\frac{\sqrt{3}}{2}$ c) $\frac{1}{\sqrt{2}}$ d) 1

6) $\cos 1^\circ + \cos 2^\circ + \cos 3^\circ + \cos 4^\circ + \ldots + \cos 179^\circ$ = _____.

a) 0 b) 1 c) −1 d) 89

7) $\overset{15}{C}_{13}$ = _____.

a) 1005 b) 105 c) 15 d) 51

8) The value of $1 + 3 + 5 + 7 + \ldots + 17$ = _____.

a) 101 b) 81 c) 71 d) 61

9) The remainder when 38^{15} is divided by 13 is _____.

a) 12 b) 1 c) 5 d) 11

10) Which of the following equation is the locus of $(at^2, 2at)$ _____.

a) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ b) $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ c) $x^2 + y^2 = a^2$ d) $y^2 = 4ax$

11) The area of the triangle formed by the lines $x^2 - 4y^2 = 0$ and $x = a$ is _____.

a) $2a^2$ b) $\frac{\sqrt{3}}{2}a^2$ c) $\frac{1}{2}a^2$ d) $\frac{2}{\sqrt{3}}a^2$

12) If the points $(x,-2)$, $(5,2)$, $(8,8)$ are collinear, then x is equal to _____.

a) 3 b) −3 c) $\frac{1}{3}$ d) 1

13) If $|\vec{a}| = 13$, $|\vec{b}| = 5$ and $\vec{a} \cdot \vec{b} = 60^\circ$ then $|\vec{a} \times \vec{b}|$ is

a) 15 b) 35 c) 45 d) 25

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14) If ABCD is a parallelogram, then $\overrightarrow{AB}+\overrightarrow{AD}+\overrightarrow{CB}+\overrightarrow{CD}$ is equal to

a) $2(\overrightarrow{AB}+\overrightarrow{AD})$ b) $4\overrightarrow{AC}$ c) $4\overrightarrow{BD}$ d) $\vec{O}$

15) The value of $\lim_{n\to\infty}\left[\frac{1}{n^2}+\frac{2}{n^2}+\frac{3}{n^2}+.....+\frac{n}{n^2}\right]$ is _____.

a) $\frac{1}{2}$ b) 0 c) 1 d) ∞

16) If $Y = \sin^2 x$ $\frac{dy}{dx}$ = _____.

a) 2 sin x b) sin 2x c) sin x d) 2 cos x

17) If pv = 81 then $\frac{dp}{dv}$ at V = 9 is _____.

a) 1 b) −1 c) 2 d) −2

18) It is given that the events A and B are such that $P(A) = \frac{1}{4}$; $P(A/B) = \frac{1}{2}$ and $P(B/A) = \frac{2}{3}$ then P(B) is _____.

a) $\frac{1}{6}$ b) $\frac{1}{3}$ c) $\frac{2}{3}$ d) $\frac{1}{2}$

19) If A is a square matrix, then which of the following is not symmetric?

a) $A + A^T$ b) AA^T c) A^TA d) $A-A^T$

$g(x) = \begin{cases} x^2 - b^2 & ; x<4 \\ bx+20 & ; x\geq 4 \end{cases}$

20) Eight coins are tossed once, the probability of getting exactly two tails _____.

a) $8C_2$ b) $\frac{81}{256}$ c) 2^8 d) $\frac{7}{64}$

PART-B

Answer any 7 questions only. Q.No.30 is compulsary. **7×2=14**

21) If A = {1,2,3,4} and B = {3,4,5,6}, find $n[(A\cup B)\times(A\cap B)\times(A\Delta B)$.

22) Find the real roots $x^4 = 16$.

23) Prove that $\tan(45°+A) = \frac{1+\tan A}{1-\tan A}$.

24) Find the number of ways of arranging the letters of the word "BANANA".

25) Find the equation of the line through the intersection of the lines 3x + 2y + 5 = 0 and 3x − 4y + 6 = 0 and the point (1,1).

26) Show that $\vec{a}\times(\vec{b}+\vec{c})+\vec{b}\times(\vec{c}+\vec{a})+\vec{c}\times(\vec{a}+\vec{b})=0$.

27) Evaluate $\lim_{x\to\infty}\frac{1+x-3x^3}{1+x^2+3x^2}$.

28) If $y = \left(x-\frac{1}{x}\right)^2$ find $\frac{dy}{dx}$.

29) If $P(A) = 0.52$; $P(B) = 0.43$; and $P(A \cap B) = 0.24$ find the value of $P(A \cap \bar{B})$ and $P(\bar{A} \cup \bar{B})$.

30) If $\begin{bmatrix} 2 & -3 & 5 \\ 6 & 0 & 4 \\ 1 & 5 & -7 \end{bmatrix}$ identify the singular and non-singular matrix.

Part-C

Answer any seven questions only. Q.No.40 is compulsary. **7×3=21**

31) A salesperson whose annual earnings can be represented by the function $A(x) = 30000 + 0.04x$, where x is the rupee values of he sells. His son is also in sales and his earnings are represented by the function $S(X) = 25000 + 0.05x$. Find (A+S) (X) and determine the total family income if they each sell rupees in 1,50,00,000 worth of merchandise.

32) Resolve into partial fractions $\frac{x}{(x+3)(x+4)}$.

33) In ΔABC, Prove that $(b+c)\cos A + (c+a)\cos B + (a+b)\cos C = a+b+c$.

34) How many ways a committee of six persons from 10 persons can be choosen along with a chair person and a secretary?

35) Find the co-efficient of x^{15} in $\left(x^2 + \frac{1}{x^3}\right)^{10}$.

36) Prove that $\begin{vmatrix} 0 & c & b \\ c & 0 & a \\ b & a & 0 \end{vmatrix}^2 = \begin{vmatrix} b^2+c^2 & ab & ac \\ ab & c^2+a^2 & bc \\ ab & bc & a^2+b^2 \end{vmatrix}$.

37) Show that the vectors $(2\vec{i} - \vec{j} + \vec{k})$; $(3\vec{i} - 4\vec{j} - 4\vec{k})$; $(\vec{i} - 3\vec{j} - 5\vec{k})$ form a right angled triangle?

38) Find Y′, Y″ and Y‴ if $y = x^3 - 6x^2 - 5x + 3$.

39) Show that the points (1,3) (2,1) and $\left(\frac{1}{2}, 4\right)$ are collinear by straight line method.

40) X speaks truth in 70% of causes, and Y in 90% percent of causes what is the probability that they likely to contradict each other in stating the same fact?

Part-D

Answer all the questions. **7×5=35**

41) Write the values of f at −3,5,2,−1,0 if

$$f(x) = \begin{cases} x^2 + x - 5 & \text{if } x \in (-\infty, 0) \\ x^2 + 3x - 2 & \text{if } x \in (3, \infty) \\ x^2 & \text{if } x \in (0, 2) \\ x^2 - 3 & \text{otherwise} \end{cases}$$

(OR)

Find the constant b that makes g continuous on $(-\infty, \infty)$

$$g(x) = \begin{cases} x^2 - b^2 & \text{if } x < 4 \\ bx + 20 & \text{if } x \geq 4 \end{cases}$$

42) i) Find the radius of the spherical tank whose volume is $32\frac{\pi}{3}$ units.

ii) Prove that $\log\frac{a^2}{bc} + \log\frac{b^2}{ca} + \log\frac{c^2}{ab} = 0$.

(OR)

Prove that $\sqrt[3]{x^3+7} - \sqrt[3]{x^3+4}$ is approximately equal to $\frac{1}{x^2}$ when x is large.

43) If A+B+C = 180° Prove that $\sin^2 A + \sin^2 B + \sin^2 C = 2 + 2\cos A \cos B \cos C$.

(OR)

Show that $\begin{vmatrix} (q+r)^2 & p^2 & p^2 \\ q^2 & (r+p)^2 & q^2 \\ r^2 & r^2 & (p+q)^2 \end{vmatrix} = 2pqr(p+q+r)^3$.

44) Prove by mathematical induction if $n \geq 1$.

$$1^2 + 2^2 + 3^2 + \ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

(OR)

If $y = \sin^{-1}\left(\frac{1-x^2}{1+x^2}\right)$ find $\frac{dy}{dx}$.

45) If the equation $2x^2 - 10xy + 12y^2 + 5x - 16y - 3 = 0$ represents a pair of straight lines. (i) Seperate equations of the lines (ii) Find the angle between the lines.

(OR)

If $y = e^{\tan^{-1}x}$ prove that $(1+x^2)\,y^{11} + (2x-1)\,y^1 = 0$.

46) Prove by vector method, the medians of the triangle are concurrent.

(OR)

Use the method of undetermined co-efficients to find the sum of

$1 + 2 + 3 + \ldots + (n-1)$; $n \in N$.

47) The chances of A, B and C becoming the manager of a certain company are 5:3:2. The probabilities that the office canteen will be improved if A, B and C become managers are 0.4, 0.5 and 0.3 respectively. If the office canteen has been improved. What is the probability that B was appointed as the manager?

(OR)

Show that the points whose position vectors $4\vec{i}+5\vec{j}+\vec{k}$; $-\vec{j}-\vec{k}$; $3\vec{i}+9\vec{j}+4\vec{k}$ and $-4\vec{i}+4\vec{j}+4\vec{k}$ are co-planar.
