Total number of printed pages:5 **Diploma (D)/First/DMA 103**

2022

MATHEMATICS-I

Full Marks: 60

Time: Two hours

The figures in the margin indicate full marks for the questions.

A. Multiple Choice Questions 1 x 20=20

1. For what value $\theta, sin\theta$ is definable
   a. -2
   b. 2
   c. $\frac{1}{2}$
   d. 3
2. Value of $\frac{tan(-\theta)}{sec(-\theta)}$ is
   a. $sin\theta$
   b. $-sin\theta$
   c. $cos\theta$
   d. $-cos\theta$
3. Value of $sin\, sin\, 300^{\circ}$ is
   a. $\frac{\sqrt{3}}{2}$
   b. $-\frac{\sqrt{3}}{2}$
   c. $\frac{1}{2}$
   d. $\frac{1}{\sqrt{2}}$
4. Value of $cos\left(\frac{4\pi}{2}-\theta\right)$ is
   a. $-cos\theta$
   b. $cos\theta$
   c. $sin\theta$
   d. $-sin\theta$
5. Equation $cos\theta = -1$ has a principal solution

a. 0

b. π

c. $-\pi$

d. $\frac{3\pi}{2}$

6. Which of the following is vector quantity

a. Time period

b. speed

c. magnitude

d. force

7. Which of the following is not condition of collinear vectors

a. $\vec{a} = n.\vec{b}$

b. $\vec{a} = -\vec{b}$

c. $\vec{a} \times \vec{b} = 0$

d. $\vec{a} \neq \vec{b}$

8. If $\vec{a}.\vec{b} = -|\vec{a}||b|$, the value of θ is

a. π

b. $-\pi$

c. $\frac{\pi}{2}$

d. $-\frac{\pi}{2}$

9. Formula of unit vector $\vec{a}$.

a. $\frac{1}{|\vec{a}|}$

b. $\frac{|\vec{a}|}{\vec{a}}$

c. $\frac{\vec{a}}{|\vec{a}|}$

d. $\frac{1}{\vec{a}}$

10. Modulus of the vector $\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$

a. $\sqrt{13}$

b. $\sqrt{14}$

c. 13

d. 14

11. The argument of the complex number $0 + i.0$ is:
    a. $\frac{\pi}{2}$
    b. $-\frac{\pi}{2}$
    c. π
    d. 0
12. If the 7^{th} term of an A.P. is 7 and the 11^{th} term is 11, then the common difference of the A.P. is:
    a. 2
    b. $\frac{3}{4}$
    c. 1
    d. $\frac{1}{2}$
13. If x, $x+2$, $x+5$ are consecutive terms of a G.P., then the value of x is:
    a. 1
    b. 2
    c. -2
    d. -1
14. Three geometric means between 1 and 81 are:
    a. 3,8,24
    b. 4,16,24
    c. 3,9,27
    d. 3,9,28
15. The number of permutations of the letters of the word MOZAMBIQUE taken all at a time is:
    a. 10!
    b. $\frac{10!}{(10-10)!}$
    c. $^{10}P_{10}$
    d. None of these
16. The value of $\frac{1}{i}$ is:
    a. i
    b. -i
    c. 1
    d. -1
17. The number of permutations of the letters of the word ENTERTAINMENT taken all at a time is:
    a. $\frac{13!}{(13-13)!}$

b. $\frac{13!}{3!3!3!}$

c. $\frac{13!}{3!3!3!3!}$

d. None of these

18. Three arithmetic means between 1 and 9 are:

a. 2,4,6

b. 3,4,7

c. 3,5,7

d. 2,5,7

19. Tick the correct relationship:

a. ${}^{n+1}C_r = {}^{n}C_r + {}^{n}C_{r-1}$

b. ${}^{n-1}C_{r-1} = {}^{n-1}C_{r-1} + {}^{n}C_{r-1}$

c. ${}^{n}C_{r-1} = {}^{n-1}C_{r-1} + {}^{n}C_{r+1}$

d. ${}^{n+1}C_{r-1} = {}^{n+1}C_{r-1} + {}^{n}C_{r-1}$

20 The relationship between ${}^{n}P_r$ and ${}^{n}C_r$ is:

a. ${}^{n}P_r = {}^{n}C_r$

b. ${}^{n}P_r = \frac{1}{n!}\,{}^{n}C_r$

c. ${}^{n}C_r = \frac{1}{r!}\,{}^{n}P_r$

d. None of these

B. Very Short Question 2*6=12

1. Find the value of $sin(15^\circ)$
2. Find the principal value of $cos^{-1}(-\frac{1}{2})$
3. Find the magnitude of two vectors $\vec{a}$ and $\vec{b}$, having the same magnitude and such that the angle between them is 30° and their scalar product is $2\sqrt{3}$
4. Show that the vectors $2\hat{\imath} - 3\hat{\jmath} + 4\hat{k}$ and $-4\hat{\imath} + 6\hat{\jmath} - 8\hat{k}$ are collinear.
5. Find the term independent of x in the expansion of $(x + \frac{1}{x})^{12}$
6. Simplify: $log\frac{81}{16} - 2log\frac{3}{2} + log\frac{3}{4}$

C Short Question ***(any seven)*** 4*7=28

1. Show that $tan^{-1}\left(\frac{1}{2}\right) + tan^{-1}\left(\frac{1}{3}\right) = \frac{\pi}{4}$
2. Find the value of $sin20^\circ sin40^\circ sin80^\circ$
3. Prove that $cos\frac{\pi}{32} = \frac{1}{2}\sqrt{2 + \sqrt{2 + \sqrt{2 + \sqrt{2}}}}$
4. Find $|\vec{x}|$, if for a unit vector $\vec{a}$, $(\vec{x} - \vec{a}).(\vec{x} + \vec{a}) = 15$
5. Find a unit vector perpendicular to each of the vectors $(\vec{a} - \vec{b})$ and $(\vec{a} + \vec{b})$, where $\vec{a} = 2\hat{\imath} - 7\hat{\jmath} - 3\hat{k}$, $\vec{b} = 2\hat{\imath} - 7\hat{\jmath} + \hat{k}$.
6. Find the complex conjugate of: $\frac{7+2i}{7-2i}$

7. In an A.P., the ratio of the 2nd term to the 6th term is 2/5. If the 8th term is 26, what is the 10th term of the A.P.?
8. Prove that: $\left(1+x+\frac{x^2}{2!}+\frac{x^3}{3!}+\cdots\right)\left(1-x+\frac{x^2}{2!}-\frac{x^3}{3!}+\cdots\right)=1$
9. Using Cramer's Rule, solve the following system of equations:

$$x+y-z=1$$
$$3x-2y+z=2$$
$$6x+y-z=6$$

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