General Instructions :

Read the following instructions very carefully and strictly follow them :

(i) *This question paper contains **38** questions. **All** questions are **compulsory**.*

(ii) *This question paper is divided into **five** Sections – **A, B, C, D** and **E**.*

(iii) *In **Section A,** Questions no. **1** to **18** are multiple choice questions (MCQs) and questions number **19** and **20** are Assertion-Reason based questions of **1** mark each.*

(iv) *In **Section B,** Questions no. **21** to **25** are very short answer (VSA) type questions, carrying **2** marks each.*

(v) *In **Section C,** Questions no. **26** to **31** are short answer (SA) type questions, carrying **3** marks each.*

(vi) *In **Section D,** Questions no. **32** to **35** are long answer (LA) type questions carrying **5** marks each.*

(vii) *In **Section E,** Questions no. **36** to **38** are case study based questions carrying **4** marks each.*

(viii) *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 3 questions in Section E.*

(ix) *Use of calculator is **not** allowed.*

SECTION A

This section comprises multiple choice questions (MCQs) of 1 mark each.

1. The domain of $f(x) = \cos^{-1}(2x - 5)$ is :

(A) $[-1, 1]$ (B) $[4, 6]$

(C) $[-7, -3]$ (D) $[2, 3]$

2. If $A^2 = 4A + 3I$ and $A^{-1} = xA + yI$, then the value of $(x + y)$ is :

(A) -1 (B) 1

(C) $\frac{5}{3}$ (D) 7

3. If A and B are skew-symmetric matrices of same order, then $AB' + BA'$ is a/an :

(A) symmetric matrix

(B) skew-symmetric matrix

(C) null matrix

(D) identity matrix

4. If $\begin{bmatrix} 4 \\ 1 \\ 3 \end{bmatrix} A = \begin{bmatrix} -4 & 8 & 4 \\ -1 & 2 & 1 \\ -3 & 6 & 3 \end{bmatrix}$, then order of A must be :

(A) 3×1 (B) 1×3

(C) 1×1 (D) 3×3

5. If a square matrix A is such that $A^2 = A$ and $(I - A)^3 = xA + I$, then value of x must be :

(A) 7 (B) 5

(C) -7 (D) -1

6. If $B(\text{adj } B) = \begin{bmatrix} \frac{1}{3} & 0 & 0 \\ 0 & \frac{1}{3} & 0 \\ 0 & 0 & \frac{1}{3} \end{bmatrix}$, then the value of $\det(B^{-1}) =$

(A) $\frac{1}{3}$ (B) $\frac{1}{9}$

(C) 3 (D) 9

7. The value of k for which the function $f(x) = \begin{cases} x^2 \sin \frac{1}{x}, & x \neq 0 \\ k(x+1), & x = 0 \end{cases}$ is a continuous function, is :

(A) $\frac{1}{4}$ (B) 2

(C) $\frac{1}{2}$ (D) 0

8. If $\sin^{-1} x = y$, then $\frac{dy}{dx}$ is :

(A) $\cos^{-1} x$ (B) $\cos y$

(C) $\frac{1}{1 - x^2}$ (D) $\sec y$

9. The rate of change of volume of a sphere with respect to its diameter, when its radius is 5 cm, is :

(A) $400\pi \text{ cm}^3/\text{cm}$ (B) $100\pi \text{ cm}^3/\text{cm}$

(C) $50\pi \text{ cm}^3/\text{cm}$ (D) $25\pi \text{ cm}^3/\text{cm}$

(C) $\int_{0}^{3} \sqrt{9 - x^2}\ dx$

(D) $2\int_{0}^{3} \sqrt{9 - x^2}\ dx$

10. $\int \frac{dx}{2^x + 2^{-x}}$ is equal to :

(A) $\tan^{-1}(2^x) + C$

(B) $\tan^{-1}(2^{-x}) + C$

(C) $\frac{\tan^{-1}(2^x)}{\log 2} + C$

(D) $(\log 2)\tan^{-1}(2^x) + C$

11. $\int_{-1}^{1} (1 - |x|)\, dx$ is equal to :

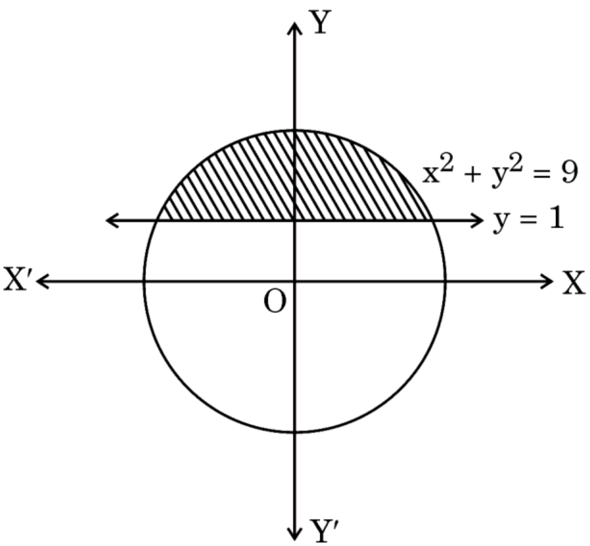
(A) $2\int_{0}^{1} (1 + x)\ dx$

(B) $2\int_{-1}^{0} (1 + x)\ dx$

(C) 0

(D) $2\int_{-1}^{0} (1 - x)\ dx$

12. The area of the shaded region of the circle given below is equal to :



(A) $\int_{1}^{3} \sqrt{9 - y^2}\ dy$

(B) $2\int_{1}^{3} \sqrt{9 - y^2}\ dy$

(A) $\frac{2}{7}$ (B) $\frac{3}{35}$

(C) $\frac{1}{70}$ (D) $\frac{1}{7}$

13. $\frac{dy}{dx} = F(x, y)$ will be a homogeneous differential equation for which of the following functions ?

(i) $F(x, y) = 3x + 2y$ (ii) $F(x, y) = \sin \frac{y}{x} + \log y - \log x$

(iii) $F(x, y) = e^{y/x} + 1$ (iv) $F(x, y) = \sqrt{x^2 + y^2} - y$

(A) (i) and (ii) (B) (i), (ii) and (iii)

(C) (ii), (iii) and (iv) (D) (ii) and (iii)

14. For any two vectors $\vec{a}$ and $\vec{b}$, which of the following statements is always true ?

(A) $\vec{a} \cdot \vec{b} \leq |\vec{a}| \, |\vec{b}|$ (B) $|\vec{a} + \vec{b}| \geq |\vec{a}| + |\vec{b}|$

(C) $|\vec{a} - \vec{b}| = |\vec{a}| - |\vec{b}|$ (D) $|\vec{a} \times \vec{b}| \geq |\vec{a}| \, |\vec{b}|$

15. If $(\vec{a} + \vec{b}) \cdot (\vec{a} - \vec{b}) = 198$ and $|\vec{a}| = 10|\vec{b}|$, then :

(A) $|\vec{a}| = \sqrt{2}$ (B) $|\vec{b}| = \sqrt{2}$

(C) $|\vec{b}| = 10\sqrt{2}$ (D) $|\vec{a}| = \frac{10}{\sqrt{2}}$

16. If l_1, m_1, n_1 and l_2, m_2, n_2 are direction cosines of lines L_1 and L_2 respectively and θ is the acute angle between them, then :

(A) $\cos \theta = l_1 l_2 + m_1 m_2 + n_1 n_2$ (B) $\sin \theta = l_1 l_2 + m_1 m_2 + n_1 n_2$

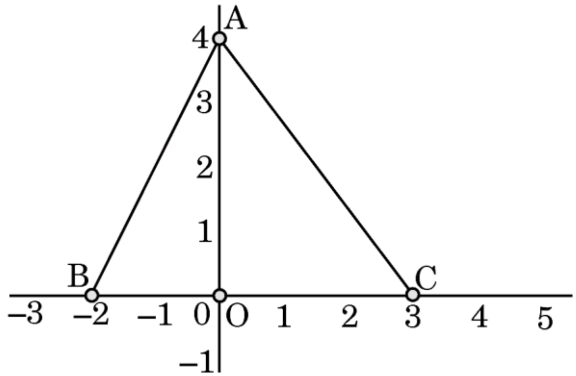
(C) $\tan \theta = \frac{l_1}{l_2} + \frac{m_1}{m_2} + \frac{n_1}{n_2}$ (D) $\cos \theta = | l_1 l_2 + m_1 m_2 + n_1 n_2 |$

17. Direction ratios of lines l_1 and l_2 are $<12, -3, 9>$ and $<4, q, -p>$ respectively. The values of p and q for which l_1 and l_2 are parallel are respectively :

(A) $-1, 3$ (B) $3, 1$

(C) $-3, -1$ (D) $-1, -3$

18. If E and F are two independent events such that $P(E) = \frac{3}{10}$, $P(E \cup F) = \frac{1}{2}$, then $P(E | F) - P(F | E)$ is equal to :



In the region OAC, children are allowed to play games like cricket, football, while in the region AOB, activities which involve running are not allowed.

The vertices of the triangular park ABC are A(0, 4), B(– 2, 0) and C(3, 0).

Based on the above information, answer the following questions :

(i) Write the equation of the boundary line AB of the park. *1*

(ii) Write the equation of the boundary line AC of the park. *1*

(iii) (a) Using integration, find the area of region OAC, in which children are allowed to play cricket, football. *2*

OR

(iii) (b) Using integration, find the area of region AOB. *2*