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. 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) $|\vec{a}| = \frac{10}{\sqrt{2}}$

2. 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) $\cos\theta = l_1l_2 + m_1m_2 + n_1n_2$ (B) $\sin\theta = l_1l_2 + m_1m_2 + n_1n_2$

(C) $\tan\theta = \frac{l_1}{l_2} + \frac{m_1}{m_2} + \frac{n_1}{n_2}$ (D) $\cos\theta = |\, l_1l_2 + m_1m_2 + n_1n_2 \,|$

3. Direction ratios of lines l_1 and l_2 respectively are <1, 0, 0> and <0, –1, 0>. The direction ratios of the line perpendicular to both l_1 and l_2 are :

(A) <1, 1, 0> (B) <0, 0, –1>

(C) <1, 1, 1> (D) <1, 0, –1>

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

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

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

5. The domain of $\cos^{-1}(4x + 1)$ is :

(A) $[-1, 1]$ (B) $[-3, 5]$

(C) $[-4, 4]$ (D) $[-\frac{1}{2}, 0]$

6. 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

7. 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

8. If a matrix X is such that $[2 \quad 1]\, X = [3 \quad 4 \quad 5]$, then the order of matrix X is :

(A) 3×1 (B) 2×3

(C) 1×2 (D) 1×3

9. 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

10. If $A(\text{adj } A) = \begin{bmatrix} 3 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 3 \end{bmatrix}$, then the value of $|2A|$ is :

(A) 6 (B) 54

(C) 12 (D) 24

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

11. 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

12. If $2\cos^{-1} x = y$, then $\frac{dy}{dx}$ is :

(A) $-2\sin^{-1} x$ (B) $-\frac{1}{2}\sin\frac{y}{2}$

(C) $\frac{-1}{\sqrt{1-2x^2}}$ (D) $-2\,\text{cosec}\,\frac{y}{2}$

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

(A) 400π cm^3/cm (B) 100π cm^3/cm

(C) 50π cm^3/cm (D) 25π cm^3/cm

14. $\int \frac{\cos x}{\sqrt{\sin^2 x + 1}}\,dx$ is equal to :

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

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

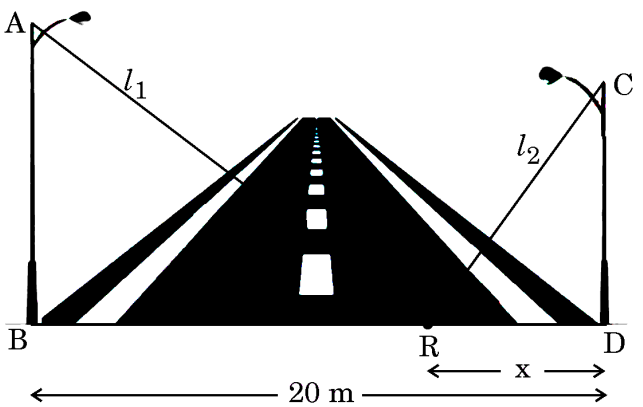
(C) $\log|\sin x + \sqrt{1+\sin^2 x}| + C$

(D) $\log|\sin x - \sqrt{\sin^2 x + 1}| + C$

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

Case Study – 2

37. Two vertical light poles of height 22 m and 16 m stand on the opposite sides of a 20 m wide road as shown below in the figure.



Two ladders of length l_1 and l_2 are placed from a common point R on the road at a distance of x m from the smaller pole.

Based on the above information, answer the following questions :

(i) Express p(x) = $l_1 + l_2$ in terms of x. *1*

(ii) Find p′(x). *1*

(iii) (a) Find the value of x for which $l_1^2 + l_2^2$ is minimum. *2*

OR

(iii) (b) If the 22 m long pole is also replaced by a 16 m long pole, at what distance from either pole should the ladders be kept so that the sum of squares of lengths of ladders needed to reach the top of the pole is minimum ? *2*

Case Study – 3

38. A survey was conducted to find out the success rate of students who qualified the entrance examination by dropping a year after class XII.

As per the data collected, 40% students appearing in the examination were dropouts and the remaining students were regular students of class XII.

Of the dropouts, 5% qualify the examination while 10% of the regular students qualify the examination.

Based on the above information, answer the following questions.

(i) Find the probability that a student selected at random is a regular student. *1*

(ii) A student is selected at random from a group of dropout students. What is the probability that the student will not qualify the examination ? *1*

(iii) (a) A student selected at random qualified the examination. Find the probability that student is not a dropout. *2*

OR

(iii) (b) A student selected at random did not qualify the examination. Find the probability that the student was a regular student. *2*