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 questio[ns] carrying **3** marks each.*

(vi) *In **Section D,** Questions no. **32** to **35** are long answer (LA) type que[stions] 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 2 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. Sum of two skew-symmetric matrices of same order is always a/an :

(A) skew-symmetric matrix

(B) symmetric matrix

(C) null matrix

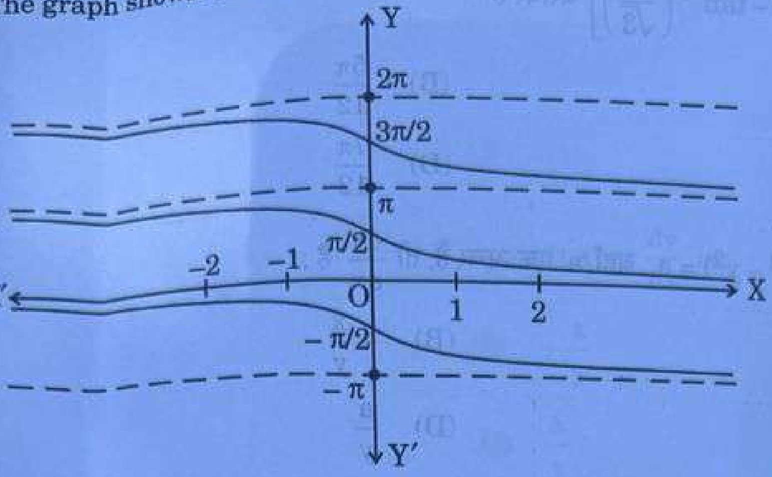
(D) identity matrix

2. If $A = \begin{bmatrix} 0 & -3 & 8 \\ 3 & 0 & 5 \\ -8 & -5 & 0 \end{bmatrix}$, then A is a :

(A) null matrix (B) symmetric matrix

(C) skew-symmetric matrix (D) diagonal matrix

3. The graph shown below depicts :



(A) $y = \cot x$

(B) $y = \cot^{-1} x$

(C) $y = \tan x$

(D) $y = \tan^{-1} x$

4. Let both AB' and $B'A$ be defined for matrices A and B. If order of A is $n \times m$, then the order of B is :

(A) $n \times n$

(B) $n \times m$

(C) $m \times m$

(D) $m \times n$

5. If $f(x) = \begin{cases} \dfrac{\log(1 + ax) + \log(1 - bx)}{x}, & \text{for } x \neq 0 \\ k, & \text{for } x = 0 \end{cases}$

is continuous at $x = 0$, then the value of k is :

(A) a

(B) a + b

(C) a − b

(D) b

6. If $y = a \cos(\log x) + b \sin(\log x)$, then $x^2y_2 + xy_1$ is :

(A) $\cot(\log x)$

(B) y

(C) − y

(D) $\tan(\log x)$

P.T.O.

#

7. $\left[\sec^{-1}(-\sqrt{2}) - \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)\right]$ is equal to :

(A) $\frac{11\pi}{12}$ (B) $\frac{5\pi}{12}$

(C) $-\frac{5\pi}{12}$ (D) $\frac{7\pi}{12}$

8. If $\tan^{-1}(x^2 - y^2) = a$, where 'a' is a constant, then $\frac{dy}{dx}$ is :

(A) $\frac{x}{y}$ (B) $-\frac{x}{y}$

(C) $\frac{a}{x}$ (D) $\frac{a}{y}$

9. Let $f(x) = x^2$, $x \in R$. Then, which of the following statements is ***incorrect*** ?

(A) Minimum value of f does not exist.

(B) There is no point of maximum value of f in R.

(C) f is continuous at $x = 0$.

(D) f is differentiable at $x = 0$.

10. $\int \frac{x+5}{(x+6)^2} e^x \, dx$ is equal to :

(A) $\log(x+6) + C$ (B) $e^x + C$

(C) $\frac{e^x}{x+6} + C$ (D) $\frac{-1}{(x+6)^2} + C$

11. Let $f'(x) = 3(x^2 + 2x) - \frac{4}{x^3} + 5$, $f(1) = 0$. Then, $f(x)$ is :

(A) $x^3 + 3x^2 + \frac{2}{x^2} + 5x + 11$ (B) $x^3 + 3x^2 + \frac{2}{x^2} + 5x - 11$

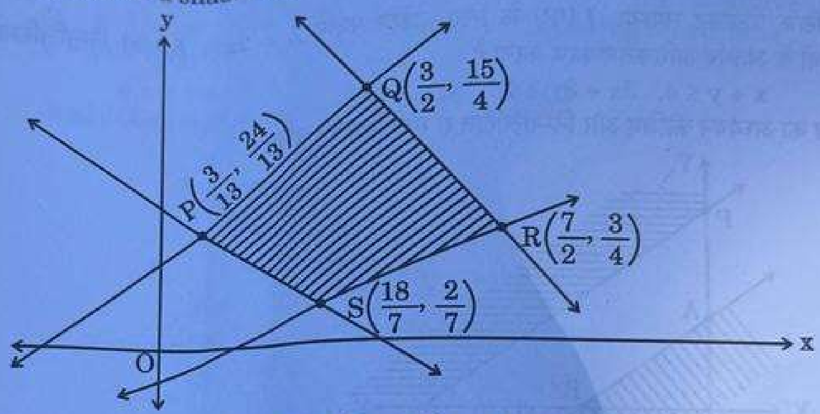
(C) $x^3 + 3x^2 - \frac{2}{x^2} + 5x - 11$ (D) $x^3 - 3x^2 - \frac{2}{x^2} + 5x - 11$

12. The order and degree of the differential equation

$$\frac{d^2y}{dx^2} + 4\left(\frac{dy}{dx}\right) = x \log\left(\frac{d^2y}{dx^2}\right)$$ are respectively :

(A) 0, 3
(B) 2, 1
(C) 2, not defined
(D) 1, not defined

13. For a Linear Programming Problem (LPP), the given objective function is $Z = x + 2y$. The feasible region PQRS determined by the set of constraints is shown as a shaded region in the graph.



(Note : The figure is not to scale)

$$P \equiv \left(\frac{3}{13}, \frac{24}{13}\right), Q \equiv \left(\frac{3}{2}, \frac{15}{4}\right), R \equiv \left(\frac{7}{2}, \frac{3}{4}\right), S \equiv \left(\frac{18}{7}, \frac{2}{7}\right)$$

Which of the following statements is correct ?

(A) Z is minimum at $S\left(\frac{18}{7}, \frac{2}{7}\right)$

(B) Z is maximum at $R\left(\frac{7}{2}, \frac{3}{4}\right)$

(C) (Value of Z at P) > (Value of Z at Q)

(D) (Value of Z at Q) < (Value of Z at R)

14. The area of the region bounded by the curve $y^2 = x$ between $x = 0$ and $x = 1$ is :

(A) $\frac{3}{2}$ sq units
(B) $\frac{2}{3}$ sq units
(C) 3 sq units
(D) $\frac{4}{3}$ sq units

15. Let $|\vec{a}| = 5$ and $-2 \le \lambda \le 1$. Then, the range of $|\lambda \vec{a}|$ is :

(A) $[5, 10]$ (B) $[-2, 5]$

(C) $[-2, 1]$ (D) $[-10, 5]$

16. The solution for the differential equation $\log\left(\frac{dy}{dx}\right) = 3x + 4y$ is :

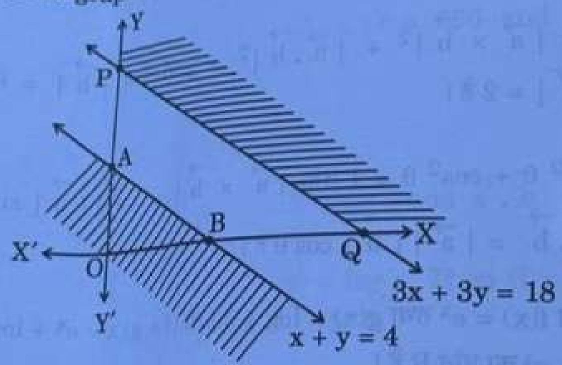
(A) $3e^{4y} + 4e^{-3x} + C = 0$ (B) $e^{3x+4y} + C = 0$

(C) $3e^{-3y} + 4e^{4x} + 12C = 0$ (D) $3e^{-4y} + 4e^{3x} + 12C = 0$

17. In a Linear Programming Problem (LPP), the objective function $Z = 2x + 5y$ is to be maximised under the following constraints :

$x + y \le 4,\ 3x + 3y \ge 18,\ x, y \ge 0$

Study the graph and select the correct option.



(Note : The figure is not to scale)

The solution of the given LPP :

(A) lies in the shaded unbounded region.

(B) lies in Δ AOB.

(C) does not exist.

(D) lies in the combined region of Δ AOB and unbounded shaded region.

18. Chances that three persons A, B, and C go to the market are 30%, 60% and 50% respectively. The probability that at least one will go to the market is :

(A) $\frac{14}{10}$ (B) $\frac{43}{50}$

(C) $\frac{9}{100}$ (D) $\frac{7}{50}$