

1. If $y = c_1 e^{2x} + c_2 e^x + c_3 e^{-x}$ satisfies the differential equation $\frac{d^3 y}{dx^3} + a \frac{d^2 y}{dx^2} + b \frac{dy}{dx} + cy = 0$, then $\frac{a^3 + b^3 + c^3}{abc}$ is equal to

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

(B) $-\frac{1}{4}$

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

(D) 0

2. The solution of the differential equation $(x \cos x - \sin x)dx = \frac{x}{y} \sin x dy$ is

(A) $\sin x = \ln |xy| + c$

(B) $\ln \left| \frac{\sin x}{x} \right| = y + c$

(C) $\left| \frac{\sin x}{xy} \right| = c$

(D) none of the above.

where c is any arbitrary constant.

3. If $y = f(x)$ passing through $(1, 2)$ satisfies the differential equation $y(1 + xy)dx - xdy = 0$, then

(A) $f(x) = \frac{2x}{2-x^2}$

(B) $f(x) = \frac{x+1}{x^2+1}$

(C) $f(x) = \frac{x-1}{4-x^2}$

(D) $f(x) = \frac{4x}{1-2x^2}$

4. The real value of n for which the substitution $y = z^n$ will transform the differential equation $2x^4 y \frac{dy}{dx} + y^4 = 4x^6$ into a homogeneous equation is

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

(B) 1

(C) $\frac{3}{2}$

(D) 2

5. The integrating factor of the differential equation $\frac{dy}{dx}(x \ln x) + y = 2 \ln x$ is given by

(A) x

(B) e^x

(C) $\ln x$

(D) $\ln(\ln x)$.

6. The total number of linearly independent solutions of a homogeneous n^{th} order first degree differential equation with constant coefficients is

(A) n^2

(B) n

(C) $n - 1$

(D) $n + 1$

7. The general solution of the differential equation $(2x \cos y + y^2 \cos x)dx + (2y \sin x - x^2 \sin y)dy$ is

(A) $x^2 \cos y + y^2 \sin x = C$

(B) $x \cos y - y \sin x = C$

(C) $x^2 \cos^2 y + y^2 \sin^2 x = C$

(D) none of the above.

8. The number of distinct values of a 2×2 determinant whose entries are from the set $\{-1, 0, 1\}$ is

(A) 3

(B) 4

(C) 5

(D) 6

9. If $0 \leq [x] < 2$, $-1 \leq [y] < 1$ and $1 \leq [z] < 3$ where $[.]$ denotes the greatest integer function, then the maximum value of the $\det(A)$ where

$$A = \begin{pmatrix} [x]+1 & [y] & [z] \\ [x] & [y]+1 & [z] \\ [x] & [y] & [z]+1 \end{pmatrix} \text{ is}$$

(A) 2

(B) 4

(C) 6

(D) 8

10. If all the elements of a third order determinant are equal to 1 or -1 , then the determinant itself is

(A) an odd number

(B) an even number

(C) an imaginary number

(D) a real number

11. For the system of equation $x + 2y + 3z = 1$, $2x + y + 3z = 2$, $5x + 5y + 9z = 4$

(A) There is only one solution

(B) There exist infinitely many solutions

(C) There dose not exist any solution

(D) None of the above

12. If $\vec{a} + \vec{b} + \vec{c} = 0$, $|\vec{a}| = 3$, $|\vec{b}| = 5$, and $|\vec{c}| = 7$ then the angle between $\vec{a}$ and $\vec{b}$ is
- (A) $\pi/6$
- (B) $\pi/3$
- (C) $2\pi/3$
- (D) $5\pi/3$
13. Vectors $|\vec{a}|$ and $|\vec{b}|$ are inclined at an angle $\theta = 120^\circ$, if $|\vec{a}| = 1$, $|\vec{b}| = 2$, then $\{(\vec{a} + 3\vec{b}) \times (3\vec{a} - \vec{b})\}^2$ is equal to
- (A) 310
- (B) 290
- (C) 301
- (D) 300
14. The characteristic of an orthogonal matrix A is
- (A) $A^{-1}A = I$
- (B) $A.A^{-1} = I$
- (C) $A'.A^{-1} = I$
- (D) $A.A' = I$
15. The Laplace transform of the function $f(t) = 3 \sin 4t - 2 \cos 5t$ is
- (A) $\frac{12}{s^2+16} - \frac{2s}{s^2+25}$
- (B) $\frac{12}{s^2-16} - \frac{2s}{s^2+25}$
- (C) $\frac{12}{s^2+16} - \frac{2s}{s^2-25}$
- (D) $\frac{12}{s^2+16} + \frac{2s}{s^2+25}$

16. The inverse Laplace transform of $\frac{2s+1}{s^2-4}$ is
- (A) $2 \cos h3t + \frac{1}{2} \sin h3t$
 - (B) $2 \cos h2t - \frac{1}{2} \sin h2t$
 - (C) $2 \cos h2t + \frac{1}{2} \sin h2t$
 - (D) $2 \cos ht + \frac{1}{2} \sin ht$
17. The function $f(x) = \cos 3x$ has period
- (A) $2\pi/3$
 - (B) 2π
 - (C) $3\pi/2$
 - (D) π
18. Let $f(x) = f(-x)$, $\forall x \in (-\pi, \pi)$ and f is periodic with period 2π , then the Fourier series of $f(x)$
- (A) contains only cosine terms
 - (B) contains only sine terms
 - (C) contains both sine and cosine terms
 - (D) Fourier series of the above function does not exist.
19. If A is a skew symmetric matrix, then the trace of A is
- (A) -5
 - (B) -1
 - (C) 0
 - (D) 1

20. The equations $\lambda x - y = 2$, $2x - 3y = -\lambda$, $3x - 2y = -1$ are consistent for

(A) $\lambda = -4$

(B) $\lambda = -1$

(C) $\lambda = -1, 4$

(D) $\lambda = 1, -4$

***** END *****