2011
XE : Engineering Sciences

AI24BTECH11022 - Pabbuleti Venkata Charan Teja

14) The integral $\oint_C \frac{z^3 e^z}{(z-1)^3} dz$ the curve $C : |z| = \frac{\pi}{2}$, oriented counter-clockwise, equals

a) 0
b) $2\pi i$
c) $13e\pi i$
d) $20e\pi i$

15) Consider the function $f(x, y, z) = x^3 e^y \sin z$ and the point $P = \left(1, 0, \frac{\pi}{2}\right)$. The value of f DOES NOT change due to a small displacement of P along the direction of

a) $\left[1, 0, \frac{\pi}{2}\right]$
b) $[1, -1, 1]$
c) $[1, -3, 0]$
d) $[2, 0, -1]$

16) A solution of the differential equation $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 36x$ is

a) $e^{2x} + e^{3x} + 6x + 5$
b) $e^{-3x} + 6x + 5$
c) $e^{2x} + e^{-3x} + 6x + \frac{5}{6}$
d) $e^{2x} + e^{3x} + x + \frac{5}{6}$

17) For any positive numbers a and b, the matrix

$$P = \begin{bmatrix} 1 \\ a \\ b \end{bmatrix} \begin{bmatrix} 4 & 5 & 6 \end{bmatrix}$$

is

a) orthogonal
b) diagonalizable
c) nonsingular
d) of rank 2

18) Suppose x_n is the $n-th$ iterated value while finding the positive square root of 7 by the Newton-Raphson method with a positive initial guess $x_0 \left(\neq \sqrt{7}\right)$. If $e_n = \sqrt{7} - x_n$ for $n \geq 1$, then

a) $e_{n+1} = \frac{e_n}{2x_n^2}$
b) $e_{n+1} = \frac{-\sqrt{7}e_n^2}{2x_n}$
c) $e_{n+1} = \frac{e_n^2}{\sqrt{7}}$
d) $e_{n+1} = \frac{-e_n^2}{2x_n}$

19) The solution of the initial boundary value problem partial

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}, 0 < x < \pi, t > 0, \text{with boundary and initial conditions}$$

$\frac{\partial u}{\partial x}(0,t) = 0 = u(\pi,t), t > 0$ and $u(x,0) = f(x), 0 < x < \pi$ is

a) $u(x,t) = \sum_{n=0}^{\infty} A_n exp\left(-\left(\frac{2n+1}{2}\right)^2 t\right)\cos\left(\frac{2n+1}{2}x\right)$, with $A_n = \frac{2}{\pi}\int_0^{\pi} f(x)\cos\left(\frac{2n+1}{2}x\right)dx$

b) $u(x,t) = \sum_{n=0}^{\infty} A_n exp\left(-n^2 t\right)\cos(nx)$, with $A_n = \frac{2}{\pi}\int_0^{\pi} f(x)\cos(nx)dx$

c) $u(x,t) = \sum_{n=1}^{\infty} A_n exp\left(-\left(\frac{2n+1}{2}\right)^2 t\right)\sin\left(\frac{2n+1}{2}x\right)$, with $A_n = \frac{2}{\pi}\int_0^{\pi} f(x)\sin\left(\frac{2n+1}{2}x\right)dx$

d) $u(x,t) = \sum_{n=1}^{\infty} A_n exp\left(-n^2 t\right)\sin(nx)$, with $A_n = \frac{2}{\pi}\int_0^{\pi} f(x)\sin(nx)dx$

20) The function $f(x)$ defined by $f(x) = \begin{cases} 3 - x^2, & x \le 1, \\ 3 - x, & 1 < x \le 2, \\ x - 1, & x > 2. \end{cases}$ has

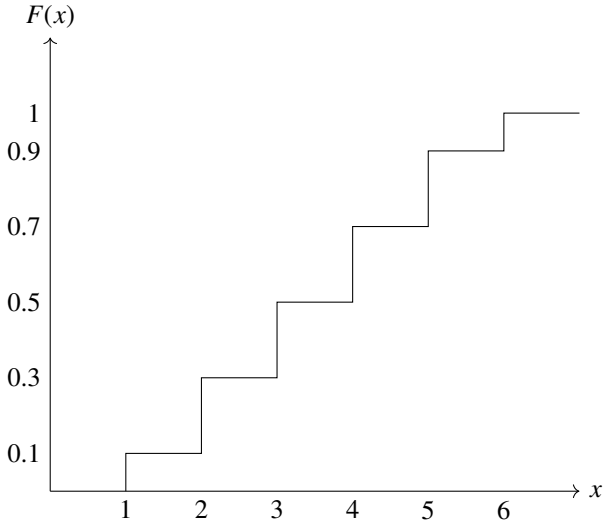
a) a local maxima at $x = 3$ and a local minima at $x = 0$

b) a local maxima at $x = 0$ and no local minima

c) a local maxima at $x = 0$ and a local minima at $x = 2$

d) no local maxima and a local minima at $x = 1$

21) In a biased die experiment, the random variable x of the outcome has the (cumulative) distribution function $F(x)$ shown below.



The variance of x is

a) 1.5

b) 2.25

c) 3.5

d) 4.25

22) For a boundary layer on a flat plate _____ forces and _____ forces are of the same order of magnitude

a) body, inertia
b) viscous, body
c) inertia, viscous
d) viscous, pressure

23) The temperature field in a fluid flow is given by $(60-0.2xy)°C$. The velocity field is $\overrightarrow{V} = 2xy\hat{i}+ty\hat{j}m/s$. The rate of change of the temperature measured by a thermometer moving along with the flow at $(2,-4)\,m$ at $t = 4s$ is

a) $-12.8°C/s$
b) $-10.6°C/s$
c) $-6.4°C/s$
d) $-4.8°C/s$

24) Two tanks A and B, with the same height are filled with water till the top. The volume of tank A is 10 times the volume of tank B. What can you say about the pressures p_A and p_B at the bottom of the tanks A and B respectively?

a) $p_A = 10p_B$
b) $p_B = 10p_A$
c) $p_A = p_B$
d) Additional data is required to compare the two pressures

25) A velocity field in a plane flow is given by $\overrightarrow{V} = 2xy\hat{i}+3y\hat{j}$. The vorticity at the point $(2,4)\,m$ is

a) $-4\hat{k}rad/s$
b) $-3\hat{j}rad/s$
c) $-2\hat{k}rad/s$
d) $-3\hat{i}rad/s$

26) Separation is said to occur at a wall when _____ at the wall becomes zero.

a) internal energy
b) pressure
c) shear stress
d) density