ASSIGNMENT 1

EE24BTECH11011 - PRANAY

1) If the boolean expression $(p \land q) \odot (p \oplus q)$ is a tautology, then \odot and \oplus are respectively given by:

a) \land, \rightarrow b) \rightarrow, \rightarrow	c) \vee, \rightarrow d) \vee, \wedge		
2) Let the tangent to the circle $x^2 + y^2 = 25$ at the point $\mathbf{R}(3,4)$ meet x – axis and y – axis at per \mathbf{P} and \mathbf{Q} , respectively. If r is the radius of the circle passing through the origin \mathbf{O} and having centre at the incentre of triangle OPQ , then r^2 is equal to:			
a) $\frac{625}{72}$	c) $\frac{125}{72}$		
b) $\frac{585}{66}$	d) $\frac{529}{64}$		
3) Let a computer program generate only the digits 0 and 1 to form a string of numbers with probabili of occurence of 0 at even places be $\frac{1}{2}$ and probability of occurence of 0 at the odd place be $\frac{1}{3}$. The the probability that '10' is followed by '01' is equal to:			
a) $\frac{1}{6}$	c) $\frac{1}{9}$		
b) $\frac{1}{18}$	d) $\frac{1}{3}$		
4) The number of solutions of the equation $x + 2 \tan x = \frac{\pi}{2}$ in the interval $[0, 2\pi]$			
a) 5 b) 2	c) 4 d) 3		
5) If the equation of plane passing through the mirror image of point $(2,3,1)$ with respect to the lin $\frac{x+1}{2} = \frac{y-3}{2} = \frac{z+2}{-1}$ and containing the line $\frac{x-2}{3} = \frac{1-y}{3} = \frac{z+1}{2}$ is $\alpha x + \beta y + \gamma z = 24$ then $\alpha + \beta + \gamma$ is equato:			
a) 21b) 19	c) 18 d) 20		
6) Consider the function $f : \mathbf{R} \to \mathbf{R}$ a) monotonic on $(0,\infty)$ only	defined by $f(x) = \begin{cases} \left(2 - \sin\left(\frac{1}{x}\right)\right) x & ,x \neq 0\\ 0 & ,x = 0 \end{cases}$. Then f is		

7) Let **O** be the origin . Let $\mathbf{OP} = x\hat{i} + y\hat{j} - \hat{k}$ and $\mathbf{OQ} = -\hat{i} + 2\hat{j} + 3x\hat{k}, x, y \in \mathbf{R}, x > 0$ be such that $|\mathbf{PQ}| = \sqrt{20}$ and the vector \mathbf{OP} is perpendicular to \mathbf{OQ} . If $\mathbf{OR} = 3\hat{i} + z\hat{j} - 7\hat{k}, z \in \mathbf{R}$, is coplanar with \mathbf{OP} and \mathbf{OQ} , then the value of $x^2 + y^2 + z^2$ is equal to :

b) Non monotonic on $(-\infty, 0)$ and $(0, \infty)$

c) monotonic on $(-\infty, 0)$

d) monotonic on $(-\infty, 0) \cup (0, \infty)$

8) Let L be a tangent line to the parabola $y^2 = 4x - 20$ at $(6,2)$ If L is also a tangent to the ellipse $\frac{t^2}{2} + \frac{t^2}{b} = 1$, then the value of b is equal to: a) 20 b) 14 c) 16 9) Let $f: \mathbf{R} \to \mathbf{R}$ be defined as $f(x) = e^{-x} \sin x$. If $F: [0,1] \to \mathbf{R}$ is a differentiable function such that $F(x) = \int_0^x f(t) dt$, Then the value of $\int_0^1 (F(x) + f(x)) e^{t} dx$ lies in the interval: a) $\left[\frac{30}{360}, \frac{321}{360}\right]$ c) $\left[\frac{327}{360}, \frac{320}{360}\right]$ b) $\left[\frac{31}{360}, \frac{324}{360}\right]$ c) $\left[\frac{327}{360}, \frac{320}{360}\right]$ d) $\left[\frac{1}{350}, \frac{340}{360}\right]$ 10) If x, y, z are in arithmetic progression with the common difference $d, x \neq 3d$ and the determinent of the matrix $\begin{pmatrix} 3 & 4\sqrt{2} & x \\ 4 & 5\sqrt{2} & y \\ 5 & k & z \end{pmatrix}$ is zero, then the value of k^2 is: a) 6 b) 36 c) 72 b) 36 d) 12 11) If the integral $\int_0^{10} \frac{[\sin 2\pi x]}{e^{x}} dx = \alpha e^{-1} + \beta e^{-\frac{1}{2}} + \gamma$, where α, β, γ are integers and $[x]$ denotes the greatest integer less than or equal to x , then the value of $\alpha + \beta + \gamma$ is equal to: a) 20 c) 25 b) 0 d) 10 12) Let $y = y(x)$ be the solution of the differential equation (cos $3\sin x + \cos x + 3) dy = (1 + y \sin x (3\sin x + \cos x + 3)) dx$, $0 \le x \le \frac{\pi}{2}, y(0) = 0$. Then $y\left(\frac{\pi}{3}\right)$ is equal to: a) $3\log_x\left(\frac{2\sqrt{3}+10}{11}\right)$ c) $2\log_x\left(\frac{\sqrt{3}+1}{4}\right)$ b) $2\log_x\left(\frac{\sqrt{3}+2}{2}\right)$ d) $3\log_x\left(\frac{2\sqrt{3}+10}{6}\right)$ is equal to: a) $\frac{-1}{2}$ c) 0 b) $\frac{-1}{4}$ d) $\frac{1}{4}$		a) 2 b) 9	c) 1 d) 7		
b) 14 c) 16 9) Let $f: \mathbf{R} \to \mathbf{R}$ be defined as $f(x) = e^{-x} \sin x$. If $F: [0,1] \to \mathbf{R}$ is a differentiable function such that $F(x) = \int_0^x f(t) dt$, Then the value of $\int_0^1 (F(x) + f(x)) e^x dx$ lies in the interval: a) $\left[\frac{330}{360}, \frac{331}{360}\right]$ b) $\left[\frac{331}{360}, \frac{336}{360}\right]$ c) $\left[\frac{325}{360}, \frac{336}{360}\right]$ d) $\left[\frac{335}{360}, \frac{336}{360}\right]$ 10) If x, y, z are in arithmetic progression with the common difference $d, x \neq 3d$ and the determinent of the matrix $\begin{bmatrix} 3 & 4\sqrt{2} & x \\ 4 & 5\sqrt{2} & y \\ 5 & k & z \end{bmatrix}$ is zero, then the value of k^2 is: a) 6 c) 72 a) 6 d) 12 11) If the integral $\int_0^{10} \frac{ \sin 2\pi x }{e^{x}} dx = \alpha e^{-1} + \beta e^{\frac{x}{2}} + \gamma$, where α, β, γ are integers and $[x]$ denotes the greatest integer less than or equal to x , then the value of $\alpha + \beta + \gamma$ is equal to: a) 20 c) 25 b) 0 d) 10 12) Let $y = y(x)$ be the solution of the differential equation $(\cos 3 \sin x + \cos x + 3) dy = (1 + y \sin x (3 \sin x + \cos x + 3)) dx$, $0 \le x \le \frac{\pi}{2}, y(0) = 0$. Then $y(\frac{\pi}{3})$ is equal to: a) $3 \log_x \left(\frac{2\sqrt{3}+10}{11}\right)$ c) $2 \log_x \left(\frac{3\sqrt{3}-8}{6}\right)$ 13) The value of the limit $\lim_{x\to 0} \frac{\tan(\pi\cos^2\theta)}{\sin(2\pi\sin^2\theta)}$ is equal to: a) $\frac{-1}{2}$ c) 0 b) $\frac{-1}{4}$ d) $\frac{1}{4}$	8)	8) Let L be a tangent line to the parabola $y^2 = 4x - 20$ at $(6,2)$ If L is also a tangent to the ellipse $\frac{x^2}{2} + \frac{y^2}{b} = 1$, then the value of <i>b</i> is equal to :			
$F(x) = \int_{0}^{x} f(t) dt \text{ , Then the value of } \int_{0}^{x} (F(x) + f(x)) e^{x} dx \text{ lies in the interval :}$ a) $\left[\frac{330}{360}, \frac{331}{360}\right]$ b) $\left[\frac{331}{360}, \frac{334}{360}\right]$ d) $\left[\frac{327}{360}, \frac{326}{360}\right]$ d) $\left[\frac{327}{360}, \frac{326}{360}\right]$ 10) If x, y, z are in arithmetic progression with the common difference $d, x \neq 3d$ and the determinent of the matrix $\begin{pmatrix} 3 & 4\sqrt{2} & x \\ 4 & 5\sqrt{2} & y \\ 5 & k & z \end{pmatrix}$ is zero, then the value of k^2 is: a) 6 b) 36 c) 72 b) 36 c) 72 b) 36 c) 72 c) 72 b) 36 c) 72 c) 72 c) 72 c) 73 c) 74 c) 75 c)		b) 14	d) 11		
b) $\left[\frac{331}{360}, \frac{334}{360}\right]$ d) $\left[\frac{335}{360}, \frac{336}{360}\right]$ 10) If x, y, z are in arithmetic progression with the common difference $d, x \neq 3d$ and the determinent of the matrix $\begin{pmatrix} 3 & 4\sqrt{2} & x \\ 4 & 5\sqrt{2} & y \\ 5 & k & z \end{pmatrix}$ is zero, then the value of k^2 is: a) 6 b) 36 c) 72 b) 36 c) 72 b) 36 c) 72 c) 12 11) If the integral $\int_0^{10} \frac{\left \sin 2\pi x\right }{e^{2\pi d}} dx = \alpha e^{-1} + \beta e^{\frac{-1}{2}} + \gamma$, where α, β, γ are integers and $[x]$ denotes the greatest integer less than or equal to x , then the value of $\alpha + \beta + \gamma$ is equal to: a) 20 c) 25 b) 0 c) 25 d) 10 12) Let $y = y(x)$ be the solution of the differential equation (cos $3 \sin x + \cos x + 3$) $dy = (1 + y \sin x (3 \sin x + \cos x + 3)) dx$, $0 \le x \le \frac{\pi}{2}, y(0) = 0$. Then $y(\frac{\pi}{3})$ is equal to: a) $3 \log_e \left(\frac{2\sqrt{3}+0}{11}\right)$ c) $2 \log_e \left(\frac{3\sqrt{3}-8}{6}\right)$ 13) The value of the limit $\lim_{x\to 0} \frac{\tan(\pi\cos^2\theta)}{\sin(2\pi\sin^2\theta)}$ is equal to: a) $\frac{-1}{2}$ c) 0 b) $\frac{-1}{4}$ d) $\frac{1}{4}$ 14) If the curve $y = y(x)$ is the solution of the differential equation $2(x^2 + x^{\frac{4}{3}})dy - y(x + x^{\frac{1}{4}})dx = 2x^{\frac{2}{3}}$, where $x = x$ is the solution of the differential equation $y = y(x)$ is the solution of the differential equation $y = y(x)$ is the solution of the differential equation $y = y(x)$ is the solution of the differential equation $y = y(x)$ is the solution of the differential equation $y = y(x)$ is the solution of the differential equation $y = y(x)$ is the solution of the differential equation $y = y(x)$ is the solution of the differential equation $y = y(x)$ is the solution of the differential equation $y = y(x)$ is the solution of the differential equation $y = y(x)$ is the solution of the differential equation $y = y(x)$ is the solution of the differential equation $y = y(x)$ is the solution of the differential equation $y = y(x)$ is the solution of the differential equation $y = y(x)$ is the solution of the differential equation $y = y(x)$ is the solution of the differential equation $y = y(x)$ is the solution of the diffe	9)	9) Let $f: \mathbf{R} \to \mathbf{R}$ be defined as $f(x) = e^{-x} \sin x$. If $F: [0,1] \to \mathbf{R}$ is a differentiable function such that $F(x) = \int_0^x f(t) dt$, Then the value of $\int_0^1 (F(x) + f(x)) e^x dx$ lies in the interval:			
10) If x, y, z are in arithmetic progression with the common difference $d, x \neq 3d$ and the determinent of the matrix $\begin{pmatrix} 3 & 4\sqrt{2} & x \\ 4 & 5\sqrt{2} & y \\ 5 & k & z \end{pmatrix}$ is zero, then the value of k^2 is: a) 6 b) 36 c) 72 b) 36 c) 72 d) 12 11) If the integral $\int_0^{10} \frac{[\sin 2\pi x]}{e^{ x }} dx = \alpha e^{-1} + \beta e^{\frac{-1}{2}} + \gamma$, where α, β, γ are integers and $[x]$ denotes the greatest integer less than or equal to x , then the value of $\alpha + \beta + \gamma$ is equal to: a) 20 c) 25 b) 0 d) 10 12) Let $y = y(x)$ be the solution of the differential equation ($\cos 3 \sin x + \cos x + 3$) $dy = (1 + y \sin x (3 \sin x + \cos x + 3)) dx$, $0 \le x \le \frac{\pi}{2}, y(0) = 0$. Then $y(\frac{\pi}{3})$ is equal to: a) $3 \log_e(\frac{2\sqrt{3}+10}{11})$ c) $2 \log_e(\frac{3\sqrt{3}-8}{4})$ b) $2 \log_e(\frac{\sqrt{3}+7}{2})$ d) $3 \log_e(\frac{2\sqrt{3}+9}{6})$ 13) The value of the limit $\lim_{x\to 0} \frac{\tan(\pi \cos^2 \theta)}{\sin(2\pi \sin^2 \theta)}$ is equal to: a) $\frac{-1}{2}$ c) 0 b) $\frac{-1}{4}$ d) $\frac{1}{4}$		a) $\left[\frac{330}{360}, \frac{331}{360}\right]$	c) $\left[\frac{327}{360}, \frac{329}{360}\right]$		
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$(\cos 3 \sin x + \cos x + 3) dy = (1 + y \sin x (3 \sin x + \cos x + 3)) dx , 0 \le x \le \frac{\pi}{2}, y(0) = 0. \text{ Then } y\left(\frac{\pi}{3}\right) \text{ is equal to:}$ a) $3 \log_e\left(\frac{2\sqrt{3}+10}{11}\right)$ c) $2 \log_e\left(\frac{3\sqrt{3}-8}{4}\right)$ b) $2 \log_e\left(\frac{\sqrt{3}+7}{2}\right)$ d) $3 \log_e\left(\frac{2\sqrt{3}+9}{6}\right)$ 13) The value of the limit $\lim_{x\to 0} \frac{\tan\left(\pi\cos^2\theta\right)}{\sin(2\pi\sin^2\theta)}$ is equal to: a) $\frac{-1}{2}$ c) 0 b) $\frac{-1}{4}$ d) $\frac{1}{4}$ 14) If the curve $y = y(x)$ is the solution of the differential equation $2(x^2 + x^{\frac{5}{4}})dy - y(x + x^{\frac{1}{4}})dx = 2x^{\frac{9}{4}}$,			*		
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14) If the curve $y = y(x)$ is the solution of the differential equation $2(x^2 + x^{\frac{5}{4}})dy - y(x + x^{\frac{1}{4}})dx = 2x^{\frac{9}{4}}$,		a) $\frac{-1}{2}$	c) 0		
		b) $\frac{-1}{4}$	d) $\frac{1}{4}$		
$x > 0$ which passes through the point $\left(1, 1 - \frac{4}{3} \log_e 2\right)$ then the value of $y(16)$ is equal to :	14)				

a)
$$\left(\frac{31}{3} - \frac{8}{3}\log_e 3\right)$$
 c) $\left(\frac{31}{3} + \frac{8}{3}\log_e 3\right)$

b)
$$4\left(\frac{31}{3} + \frac{8}{3}\log_e 3\right)$$
 d) $4\left(\frac{31}{3} - \frac{8}{3}\log_e 3\right)$

15) Let S_1 , S_2 and S_3 be three sets defined as

$$S_1 = \left\{ z \in \mathbb{C} : |z - 1| \le \sqrt{2} \right\}$$

$$S_2 = \left\{ z \in \mathbb{C} : \operatorname{Re} \left((1 - i) z \right) \ge 1 \right\}$$

$$S_3 = \left\{ z \in \mathbb{C} : \operatorname{Im} (z) \le 1 \right\}$$

Then the set $S_1 \cap S_2 \cap S_3$

- a) Has infinitely many elements
- b) Has exactly 2 elements
- c) has exactly 3 elements
- d) is singleton