

1) If $\alpha + \beta + \gamma = 2\pi$, Then the system of equations

$$x + (\cos \gamma) y + (\cos \beta) z = 0$$

$$(\cos \gamma) x + y + (\cos \alpha) z = 0$$

$$(\cos \beta) x + (\cos \alpha) y + z = 0$$

has :

a) no solution

b) infinitely many solutions

c) exactly two solutions

d) a unique solution

2) let $\vec{a}, \vec{b}, \vec{c}$ be three vectors mutually perpendicular to each other and have same magnitude. If a vector \vec{r} satisfies

$$\vec{a} \times \{(\vec{r} - \vec{b}) \times \vec{a}\} + \vec{b} \times \{(\vec{r} - \vec{c}) \times \vec{b}\} + \vec{c} \times \{(\vec{r} - \vec{a}) \times \vec{c}\} = \vec{0}$$

Then \vec{r} is equal to :

a) $\frac{1}{3}(\vec{a} + \vec{b} + \vec{c})$

b) $\frac{1}{3}(2\vec{a} + \vec{b} - \vec{c})$

c) $\frac{1}{2}(\vec{a} + \vec{b} + \vec{c})$

d) $\frac{1}{2}(\vec{a} + \vec{b} + 2\vec{c})$

3) The domain of the function

$$f(x) = \sin^{-1}\left(\frac{3x^2 + x - 1}{(x-1)^2}\right) + \cos^{-1}\left(\frac{x-1}{x+1}\right) \text{ is:}$$

a) $\left[0, \frac{1}{4}\right]$

b) $[-2, 0] \cup \left[\frac{1}{4}, \frac{1}{2}\right]$

c) $\left[\frac{1}{4}, \frac{1}{2}\right] \cup \{0\}$

d) $\left[0, \frac{1}{2}\right]$

4) Let $S = \{1, 2, 3, 4, 5, 6\}$. Then the probability that a randomly chosen onto function g from S to S satisfies $g(3) = 2g(1)$ is :

a) $\frac{1}{10}$

b) $\frac{1}{15}$

c) $\frac{1}{5}$

d) $\frac{1}{30}$

5) Let $f: \mathbb{N} \mapsto \mathbb{N}$ be a function such that $f(m+n) = f(m) + f(n)$ for every $m, n \in \mathbb{N}$.

If $f(6) = 18$ then $f(2).f(3)$ is equal to :

- a) 6 b) 54
c) 18 d) 36

6) The distance of the point $(-1, 2, -2)$ from the line of intersection of the planes $2x + 3y + 2z = 0$ and $x - 2y + z = 0$ is:

- a) $\frac{1}{\sqrt{2}}$
- b) $\frac{5}{2}$
- c) $\frac{\sqrt{42}}{2}$
- d) $\frac{\sqrt{34}}{2}$

7) Negation of the statement $(p \vee r) \implies (q \vee r)$ is :

- a) $p \wedge \sim q \wedge \sim r$
b) $\sim p \wedge q \wedge r \sim$
c) $\sim p \wedge q \wedge r$
d) $p \wedge q \wedge r$

8) If $\alpha = \lim_{x \rightarrow \frac{\pi}{4}} \frac{\tan^3 x - \tan x}{\cos(x + \frac{\pi}{4})}$ and $\beta = \lim_{x \rightarrow 0} (\cos x)^{\cot x}$ are the roots of the equation $ax^2 + bx - 4 = 0$, then the ordered pair (a, b) is :

- a) $(1, -3)$
c) $(-1, -3)$
- b) $(-1, 3)$
d) $(1, 3)$

9) The locus of the midpoints of the line segments joining $(-3, -5)$ and the points on the ellipse $\frac{x^2}{4} + \frac{y^2}{4} = 1$ is :

- a) $9x^2 + 4y^2 + 18x + 8y + 145 = 0$
b) $36x^2 + 16y^2 + 90x + 56y + 145 = 0$
c) $36x^2 + 16y^2 + 108x + 80y + 145 = 0$
d) $36x^2 + 16y^2 + 72x + 32y + 145 = 0$

10) If $\frac{dy}{dx} = \frac{2^x y + 2^y \cdot 2^x}{2^x + 2^{x+y} \log_e 2}$, $y(0) = 0$, then for $y = 1$, the value of x lies in the interval

- a) $(1, 2)$
c) $(2, 3)$
- b) $(\frac{1}{2}, 1]$
d) $(0, \frac{1}{2}]$

11) An angle of intersection of the curves $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ and $x^2 + y^2 = ab$, $a > b$ is :

- a) $\tan^{-1}\left(\frac{a+b}{\sqrt{ab}}\right)$ b) $\tan^{-1}\left(\frac{a-b}{2\sqrt{ab}}\right)$
c) $\tan^{-1}\left(\frac{a-b}{\sqrt{ab}}\right)$ d) $\tan^{-1}(2\sqrt{ab})$

12) If $y \frac{dy}{dx} = x \left[\frac{y^2}{x^2} + \frac{\phi\left(\frac{y^2}{x^2}\right)}{\phi'\left(\frac{y^2}{x^2}\right)} \right]$, $x > 0$, $\phi > 0$, and $y(1) = -1$, then $\phi\left(\frac{y^2}{4}\right)$ is equal to :

