GATE ALL BRANCHES CRASH COURSE 2025

ENGINEERING MATHEMATICS
Vector Calculus

DPP

Q1 If

$\vec{a} = 2\hat{i} + 3\hat{j} + 4\hat{k}$; $\vec{b} = \hat{i} - 5\hat{j} + 3\hat{k}$; $\vec{c} = 2\hat{i} - \hat{j} + \hat{k}$,

The value of

$\vec{a} \times \left(\vec{b} \times \vec{c}\right) + \left(\vec{b} \times \left(\vec{c} \times \vec{a}\right)\right) + \left(\vec{c} \times \left(\vec{a} \times \vec{b}\right)\right)$

is :

(A) $3\hat{i} - 7\hat{j} + 4\hat{k}$

(B) $3\hat{i} + 7\hat{j} - 4\hat{k}$

(C) $\vec{0}$

(D) $3\hat{i} - 7\hat{j} - 4\hat{k}$

Q2 A Particle moves along a curve whose parametric Equations are $x = e^{-t}; y = 2\cos 3t$; $z = 2 \cdot \sin 3t$. At time t = 0, the acceleration of the particle is _____ units. (Enter in Integer).

Q3 Choose the correct option (s) :

For a scalar function f and vector point function $\vec{A}$.

(A) $\nabla \cdot \left(\vec{A}\right) = \left(\nabla \cdot \vec{A}\right) + \left(\nabla \cdot \vec{A}\right)$

(B) $\nabla \cdot \left(\vec{A}\right) = \left(\nabla \times \vec{A}\right) + \left(\nabla \cdot \vec{A}\right)$

(C) $\nabla \times \left(\vec{A}\right) = (\nabla) \times A + (\nabla \times A)$

(D) $\nabla \times \left(\vec{A}\right) = (\nabla) \times \vec{A} + \left(\nabla \cdot \vec{A}\right)$

Q4 For $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$; $r = |\vec{r}|$, the value of $\nabla . r^n$ is :

(A) $n \cdot (n-1) \cdot r$

(B) $n \cdot r^{n-2} \cdot \vec{r}$

(C) $n \cdot r^{n-1} \cdot \vec{r}$

(D) $(n-1) \cdot r^n$

Q5 The greatest rate of increase of $= x^2 y z^3$ at the point (2, 1, –1) is _____.
(Enter in two decimal places).

Q6 The Angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point of intersection (2, –1, 2) is q. If cos q = $\frac{8\sqrt{k}}{63}$, then value of k is :

(A) 19 (B) 21
(C) 23 (D) 25

Q7 If ϕ (x,y) = $ax^2y - y^3$ and $\nabla^2\phi = 0$ then a = _____.
(Enter in Integer)

Q8 The value of

$\int_c \vec{F} \cdot \vec{dr}$ where $\vec{F} = (2y+3)\vec{i} + xz\,\vec{j} + (yz - x)\hat{k}$,

along the line joining (0,0,1) to (0,1,1) is_____. (Enter in Integer).

Q9 For a closed surface 's' enclosing a volume '$\forall$' and $\vec{F}$ being a smooth vector point function at every point on 's', $\hat{n}$ being the unit outward normal to 's', choose the correct statement.

(A) $\iiint_{\forall} \vec{F} \cdot \hat{n} d\forall = \int_s \left(\nabla \cdot \vec{F}\right) ds$

(B) $\int_s \vec{F} \cdot \hat{n}\, ds = \int_{\forall} \nabla \cdot \left(\nabla \vec{F}\right) d\forall$

(C) $\int_s \vec{F} \cdot \hat{n}\, ds = \int_{\forall} \left(\nabla \cdot \vec{F}\right) d\forall$

(D) $\int_{\forall} \vec{F} \cdot \hat{n} d\forall = \int_s \left(\vec{F} \cdot \nabla s\right)$

Q10 For $\vec{F} = y\hat{i} + (x - 2xz)\hat{j} - xy\hat{k}$, the value of $\int_s \left(\nabla \times \vec{F}\right) \cdot \hat{n}\, ds$ where 's' is the surface of sphere $x^2+y^2+z^2$ = 9 above xy – plane is___. (enter in Integer)

Q11 If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ and $r = \left|\vec{r}\right|$, and $\int_s \frac{\vec{r} \cdot \hat{n}}{r^2} ds = \iiint_{\forall} \frac{d\forall}{r} \alpha$. The value of '$\alpha$' is_____. ('s' is a closed surface enclosing a volume$\forall$)

Q12 The value of $\iint_S \left(\nabla \times \vec{A}\right) \cdot \hat{n}\, ds$ where $\vec{A} = (2x - y)\hat{i} - yz^2\hat{j} - y^2z\hat{k}$ where 's' the upper half of sphere $x^2 + y^2 + z^2 = 1$ with base plane not included is-

(A) $\frac{\pi}{2}$ (B) π

(C) $\frac{3\pi}{2}$ (D) 2π

Answer Key

Q1	C
Q2	18~18
Q3	A, C
Q4	B
Q5	13.2~13.35
Q6	B
Q7	3~3
Q8	0~0
Q9	C
Q10	0~0
Q11	2~2
Q12	B

Hints & Solutions

Note: scan the QR code to watch video solution

Q1 Text Solution:
(C)

Q2 Text Solution:
18

Q3 Text Solution:
(A, C)

Q4 Text Solution:
(B)

Q5 Text Solution:
13.20 to 13.35

Q6 Text Solution:
(B)

Q7 Text Solution:
3

Q8 Text Solution:
0

Q9 Text Solution:
(C)

Q10 Text Solution:
0

Q11 Text Solution:
2

Q12 Text Solution:
(B)