VECTOR CALCULUS AND VECTOR INTEGRATION:

1. If $\varphi = x^2 + y - z - 1$,then $|\nabla \varphi|$at (1,0,0)is

(a) $\sqrt{2}$ (b) $\sqrt{6}$ (c) $\sqrt{5}$ (d) 1

2. The directional derivative of $\varphi = 3x^2 + 2y - 3z$at$(1,1,1)$in the direction of $2\hat{\imath} + 2\hat{\jmath} - \hat{k}$is

(a) $\frac{13}{3}$ (b) 4 (c) $\frac{19}{3}$ (d) none of these

3. The unit normal vector to the surface $x^2 + y^2 - 2z + 3 = 0$at $(1,2,-1)$

(a) $\frac{2\hat{\imath}+4\hat{\jmath}+2\hat{k}}{\sqrt{24}}$ (b) $\frac{2\hat{\imath}+4\hat{\jmath}}{\sqrt{20}}$ (c) $\frac{2\hat{\imath}+2\hat{\jmath}}{\sqrt{20}}$ (d) $\frac{2\hat{\imath}+4\hat{\jmath}-2\hat{k}}{\sqrt{24}}$

4. If $f = \tan^{-1}(\frac{y}{x})$then *div(grad f)* is equal to

(a) 1 (b) -1 (c) 0 (d) 2

5. The value of $curl(grad f)$, where $f = 2x^2 - 3y^2 + 4z^2$is

(a) $4x - 6y + 8z$ (b) $4x\hat{\imath} - 6y\hat{\jmath} + 8z\hat{k}$ (c) 0 (d) 3

6. What is the value of $\nabla\times (xy\hat{\imath} + yz\hat{\jmath} + zx\hat{k})$is

(a) $-y\hat{\imath} + z\hat{\jmath} - x\hat{k}$ (b) $-y\hat{\imath} - z\hat{\jmath} - x\hat{k}$

(c)$-y - z - x$ (d) $-y + z - x$

7. If $\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$, then *div*$\vec{r}$=___________ and $curl\vec{r}$ =_________

(a) $\hat{\imath} + \hat{\jmath} + \hat{k}$ and 0 (b) 3 and $\vec{0}$ (c) 3 and 0 (d)none of these

8. The angle between the vectors $6\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$and $2\hat{\imath} - 9\hat{\jmath} + 6\hat{k}$is

(a) $\theta = 1.4143$ (b) $\theta = 0.897$ (c) $\theta = 0$ (d) $\theta = 0.1558$

9. If $\vec{F} = xyz\hat{\imath} + 3x^2y\hat{\jmath} + (xz^2 - y^2z)\hat{k}$, then at $(2,-1,1)$ $\nabla\bullet \vec{F}$ =________

(a)$-\hat{\imath} + 12\hat{\jmath} + 3\hat{k}$ (b) $-\hat{\imath} + 12\hat{\jmath} + 5\hat{k}$ (c) 16 (d) 14

10. Find $'a'$such that $(-x^2 + yz)\hat{\imath} + (4ay - z^2x)\hat{\jmath} + (2xz - 4z)\hat{k}$is solenoidal

(a) -1 (b) 1 (c) 0 (d) none of these

11. Find $'a'$such that the vector $\vec{F} = (x + y + az)\hat{\imath} + (x + 2y - z)\hat{\jmath} + (-x - y + 2z)\hat{k}$
is irrotational

(a) -1 (b) 1 (c) 0 (d) none of these

12. If $\varphi = xy^3z^2 = 4$,then ∇ φat the point $(1,1,-1)$is

(a) $\hat{\imath} + 3\hat{\jmath} + 2\hat{k}$ (b) $\hat{\imath} + 3\hat{\jmath} - 2\hat{k}$

(c)$\hat{\imath} - 3\hat{\jmath} + 2\hat{k}$ (d) $\hat{\imath} - 3\hat{\jmath} - 2\hat{k}$

13. The unit directional derivative to the curve $x = t, y = t^2, z = t^3$at the point $(-1,1,-1)$is

(a) $\frac{1}{\sqrt{14}}(\hat{\imath} - 2\hat{\jmath} + 3\hat{k})$ (b) $\frac{1}{\sqrt{14}}(\hat{\imath} + 2\hat{\jmath} + 3\hat{k})$

(c) $\frac{1}{\sqrt{3}}(\hat{\imath} + \hat{\jmath} + \hat{k})$ (d) $\frac{1}{\sqrt{3}}(\hat{\imath} - \hat{\jmath} + \hat{k})$

14. A vector field which has a vanishing divergence is called as

(a) Solenoidal field (b)irrotational field (c) roatational field (d) scalar field

15.$\vec{F} = (x + 2y + 4z)\hat{\imath} + (2ax - 3y - z)\hat{\jmath} + (4x - y + 2z)\hat{k}$is

(a) Solenoidal (b) irrotational

(c) rotational (d) both solenoidal and irrotational

16. A unit tangent vector to the surface $x = t, y = e^t, z = -3t^2$at $t = 0$is

(a) $\hat{\imath} + \hat{\jmath}$ (b) $\frac{1}{\sqrt{2}}\hat{\imath} + \frac{1}{\sqrt{2}}\hat{\jmath}$ (c) $\frac{1}{\sqrt{3}}\hat{\imath} + \frac{1}{\sqrt{3}}\hat{\jmath}$ (d) none of these

17. Unit normal vector to the surface $z = 2xy$at the point $(2,1,4)$is

(a) $\frac{1}{\sqrt{20}}(2\hat{\imath} + 4\hat{\jmath})$ (b) $\frac{1}{\sqrt{20}}(2\hat{\imath} - 4\hat{\jmath})$

(c) $\frac{1}{\sqrt{21}}(2\hat{\imath} + 4\hat{\jmath} - \hat{k})$ (d) $\frac{1}{\sqrt{21}}(2\hat{\imath} + 4\hat{\jmath} + \hat{k})$

18. Maximum value of the directional derivative of $\varphi = xyz^2$at the point $(1,0,3)$is

(a) 9 (b) 10 (c) 0 (d) none of these

ANSWERS:

1. b
2. c
3. d
4. c
5. c

6. b
7. b
8. a
9. d
10. b
11. a
12. b
13. a
14. b
15. a
16. b
17. c
18. a