

1. A, because it is bounded for x and z while moving along y in a negative direction.
2. A, because the x and y components create a circle of radius 3 and the z component is bounded below by 0 and above by 1.

$$3. \left\langle 0, -9, \frac{3\pi}{2} \right\rangle$$

$$4. \langle 1, 0, 0 \rangle$$

$$5. \text{Domain is } \{t \mid 0 \leq t \leq 3\}$$

$$6. \left(\frac{7\sqrt{2}}{2}, \frac{7\sqrt{2}}{2}, \frac{\pi}{4} \right), \left(-\frac{7\sqrt{2}}{2}, -\frac{7\sqrt{2}}{2}, \frac{5\pi}{4} \right), \left(\frac{7\sqrt{2}}{2}, \frac{7\sqrt{2}}{2}, \frac{9\pi}{4} \right), \left(-\frac{7\sqrt{2}}{2}, -\frac{7\sqrt{2}}{2}, \frac{13\pi}{4} \right)$$

$$7. \langle 7, 0, 0 \rangle$$

$$8. \left\langle \frac{e^{2t}}{\sqrt{5e^{4t} + 64e^{16t}}}, \frac{2e^{2t}}{\sqrt{5e^{4t} + 64e^{16t}}}, \frac{8e^{8t}}{\sqrt{5e^{4t} + 64e^{16t}}} \right\rangle$$

$$9. 24t^2 e^t + 14te^{-t} + 8t^3 e^t - 7t^2 e^{-t} + 42e^{-7} + 56e^{7t}$$

$$10. \langle 0, -6, 3 \rangle$$

$$11. \left\langle 20, -\frac{6}{\sqrt{t}}, 0 \right\rangle$$

$$12. \left\langle (t-1)e^t, -\frac{\cos t^4}{4}, 2\sqrt{t^2+2} \right\rangle + C$$

$$13. \langle e^t + 1, \cos t + 1, \tan t + 2 \rangle$$

$$14. \langle -3(e^2 + 1), -5(e^2 + 1), 9(e^2 + 1) \rangle$$

$$15. \left\langle -t + 10, 8t + 2, 3t + \frac{3\pi}{2} \right\rangle$$

$$16. \langle 1, 0, 0 \rangle$$

17. $\mathbf{v}(t) = \langle 3\cos t - \sqrt{7}\sin t, \sqrt{7}\cos t + 3\sin t \rangle$. The dot product is 0 because the velocity vector is orthogonal to the position vector.

$$18. \mathbf{v} = \left\langle \frac{5}{3}t^2, -e^{-t} + 1, 3t + 1 \right\rangle \quad \mathbf{r} = \left\langle \frac{5}{6}t^3 + 4, e^{-t} + t - 1, \frac{3}{2}t^2 + t \right\rangle$$

19. a) $\mathbf{v} = \langle 300, 3t + 450, -9.8t + 550 \rangle$ b) $\mathbf{r} = \left\langle 300t, \frac{3}{2}t^2 + 450t, -4.9t^2 + 550t + 15 \right\rangle$
 c) 112.27 seconds d) 77,168.54 m e) 15,448.67 m

20. an angle of 11.25° or 78.75°

21. $\frac{9}{8}\pi^2$

22. Speed $4\sqrt{3}e^t$ length $4\sqrt{3}$

23. $\mathbf{T} = \left\langle -\frac{\sqrt{195}}{14}\sin t, -\frac{1}{14}\sin t, \cos t \right\rangle$ $\kappa = \frac{1}{14}$

24. $\mathbf{T} = \langle \cos t, -\sin t \rangle$ $\mathbf{N} = \langle -\sin t, -\cos t \rangle$

25. $a_N = 18, a_T = 0$

26. $\mathbf{B} = \left\langle \frac{16}{\sqrt{481}}\cos t, -\frac{16}{\sqrt{481}}\sin t, -\frac{15}{\sqrt{481}} \right\rangle$ $\tau = -\frac{16}{481}$

27. a) $\{(x, y) \mid x^2 + y^2 \leq 1\}$ b) $\{(x, y) \mid -1 \leq 2y - 4x^2 \leq 1\}$

28. B

29. C

30. $\frac{1}{6}$

31. Use path $x = 0$ and limit is -1 , using path $y = 0$ the limit is 1 .

32. Continuous on \mathbb{R}^2 .

33. $\frac{\partial f}{\partial x} = 20xye^{x^2y}$ $\frac{\partial f}{\partial y} = 10x^2e^{x^2y}$

34. $f_x = -45x^8y^5 \cos^4(x^9y^5) \sin(x^9y^5)$ $f_y = -25x^9y^4 \cos^4(x^9y^5) \sin(x^9y^5)$

35. $z_{xx} = 567ye^{9x}$ $z_{xy} = 63e^{9x}$ $z_{yy} = 0$ $z_{yx} = 63e^{9x}$

36. $f_{xy} = 162x^5y^2 - 140x^4y^3$