

1. What does the pair of equations $x = 2$, $y = 7$ represent in \mathbb{R}^3 ?

- A. a point.
- B. a line.
- C. a plane.
- D. a cone.
- E. two planes.

2. Find the radius of the sphere

$$x^2 + y^2 + z^2 - 2x + 4y - 6z = 7.$$

- A. 1
- B. $\sqrt{5}$
- C. $\sqrt{11}$
- D. $\sqrt{21}$
- E. $\sqrt{23}$

3. Let $\mathbf{a} = 2\mathbf{i} + 5\mathbf{j} - \mathbf{k}$ and $\mathbf{b} = 4\mathbf{i} + 2\mathbf{j}$. Find $|\mathbf{a} - \mathbf{b}|$.

- A. $\sqrt{10}$
- B. $\sqrt{14}$
- C. $\sqrt{17}$
- D. $\sqrt{20}$
- E. $\sqrt{30}$

4. Find a unit vector with direction opposite that of $\langle 2, 4, -4 \rangle$.

- A. $\langle 2, 4, -4 \rangle$
- B. $\left\langle \frac{2}{\sqrt{10}}, \frac{4}{\sqrt{10}}, \frac{-4}{\sqrt{10}} \right\rangle$
- C. $\left\langle \frac{-2}{\sqrt{10}}, \frac{-4}{\sqrt{10}}, \frac{4}{\sqrt{10}} \right\rangle$
- D. $\left\langle \frac{1}{3}, \frac{2}{3}, \frac{-2}{3} \right\rangle$
- E. $\left\langle \frac{-1}{3}, \frac{-2}{3}, \frac{2}{3} \right\rangle$

5. Let $\mathbf{a} = \langle 1, 2, 3 \rangle$ and $\mathbf{b} = \langle 2, -1, 1 \rangle$. Find $\mathbf{a} \times \mathbf{b}$.

- A. $\langle -5, -5, 5 \rangle$
- B. $\langle 1, 1, -1 \rangle$
- C. $\langle 5, 5, -5 \rangle$
- D. $\langle -1, -1, 1 \rangle$
- E. $\langle -1, -7, 3 \rangle$

6. Let $\mathbf{a} = \mathbf{i} + 2\mathbf{j} + \mathbf{k}$ and $\mathbf{b} = \mathbf{j} + \mathbf{k}$. Find $\text{proj}_{\mathbf{a}}\mathbf{b}$,

- A. $\frac{3}{2}\mathbf{j} + \frac{3}{2}\mathbf{k}$
- B. $\frac{1}{2}\mathbf{j} + \frac{1}{2}\mathbf{k}$
- C. $\frac{1}{2}\mathbf{i} + \mathbf{j} + \frac{1}{2}\mathbf{k}$
- D. $\frac{1}{3}\mathbf{i} + \frac{2}{3}\mathbf{j} + \frac{1}{3}\mathbf{k}$
- E. $\frac{1}{4}\mathbf{i} + \frac{1}{2}\mathbf{j} + \frac{1}{4}\mathbf{k}$

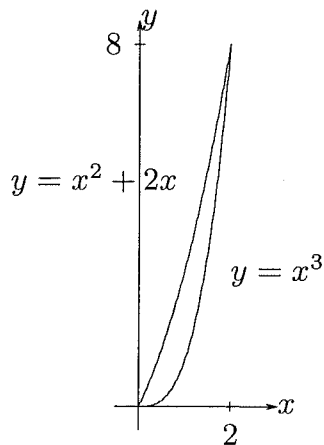
7. Let $\mathbf{a} = \langle 4, 2, 3 \rangle$ and $\mathbf{b} = \langle -2, 1, 2 \rangle$. Find $\mathbf{a} \cdot \mathbf{b}$.

- A. 11
- B. $\langle 2, 3, 5 \rangle$
- C. 0
- D. 8
- E. $\frac{3}{2}$

8. Let $\mathbf{a} = \mathbf{i} + 2\mathbf{j} + \mathbf{k}$ and $\mathbf{b} = 2\mathbf{i} - 2\mathbf{j} + \mathbf{k}$. Find $\cos \theta$, where θ is the angle between \mathbf{a} and \mathbf{b} .

- A. $\frac{-1}{2\sqrt{5}}$
- B. $\frac{-7}{3\sqrt{6}}$
- C. $\frac{\sqrt{53}}{3\sqrt{6}}$
- D. $\frac{7}{3\sqrt{6}}$
- E. $\frac{-1}{3\sqrt{6}}$

9. The area between the curves $y = x^2 + 2x$ and $y = x^3$ and between $x = 0$ and $x = 2$ is



- A. $\frac{2}{3}$
- B. $\frac{4}{3}$
- C. $\frac{5}{3}$
- D. $\frac{8}{3}$
- E. $\frac{10}{3}$

10. The area between the curves $y^2 = x - 1$ and $y = x - 3$ is

- A. $\int_{-1}^2 ((y + 3) - (y^2 + 1)) dy$
- B. $\int_{-1}^2 ((y^2 + 1) - (y + 3)) dy$
- C. $\int_1^5 (\sqrt{x - 1} - (x - 3)) dx$
- D. $\int_1^5 ((x - 3) - \sqrt{x - 1}) dx$
- E. $\int_{-1}^2 ((x - 3) - (x - 1)) dy$

11. What is the distance between the points (x, x^2) and $(x, x + 1)$ for $x > 2$?

- A. $x^2 - x - 1$
- B. $x + 1 - x^2$
- C. Cannot be determined.

12. The region bounded by $y = 1 - x^2$ and $y = 0$ is rotated about the x -axis. Find the volume of the solid generated.

- A. $\frac{3}{5}\pi$
- B. $\frac{7}{15}\pi$
- C. $\frac{11}{15}\pi$
- D. $\frac{16}{15}\pi$
- E. $\frac{21}{15}\pi$

13. The region bounded by $x = y^2$ and $x = 2$ is rotated about the line $x = 3$. Using the method of cylindrical shells, the volume of the solid generated is

A. $\int_0^2 2\pi (3x^{1/2} - x^{3/2}) dx$

B. $\int_0^2 2\pi (6x^{1/2} - 2x^{3/2}) dx$

C. $\int_0^2 2\pi (3 - x) dx$

D. $\int_0^2 2\pi (6x - 2x^2) dx$

E. $\int_0^2 2\pi (3x - x^2) dx$

14. A person slides a block of ice 20 feet along a horizontal floor by pulling with a force of 10 lbs at an angle of 45° to the floor. How much work is done by the person?

A. $\frac{200}{\sqrt{2}}$ ft-lbs

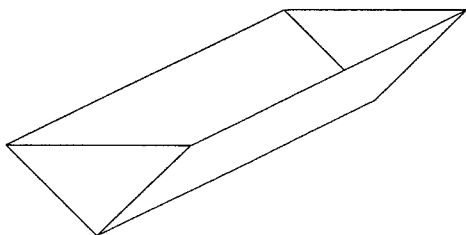
B. 200 ft-lbs

C. 100 ft-lbs

D. $\frac{400}{\sqrt{3}}$ ft-lbs

E. $\frac{400}{\sqrt{2}}$ ft-lbs

15. A water trough with triangular cross-section (see figure) is 2 feet high, 4 feet wide at the top and 10 feet long, and is full of water (62.5 lbs/ft^3). Find the work done pumping all the water to the top of the tank.



A. $(62.5)(30)$ ft-lbs

B. $(62.5)(25)$ ft-lbs

C. $(62.5) \left(\frac{40}{3}\right)$ ft-lbs

D. $(62.5) \left(\frac{70}{3}\right)$ ft-lbs

E. $(62.5) \left(\frac{80}{3}\right)$ ft-lbs

16. $\int_0^{\pi/6} x \sin x \, dx =$

A. $\frac{1}{2} - \frac{\sqrt{3}}{12}\pi$

B. $\frac{1}{2} - \frac{\sqrt{3}}{2}\pi$

C. $\frac{\sqrt{3}}{2} - \frac{\pi}{12}$

D. $\frac{\sqrt{3}}{2} + \frac{\pi}{12}$

E. $\frac{1}{2} + \frac{\sqrt{3}}{6}\pi$

17. $\int_0^{\pi/2} \sin^3 x \cos^2 x \, dx =$

A. $\frac{4}{15}$

B. $\frac{2}{15}$

C. $\frac{-2}{15}$

D. $\frac{-4}{15}$

E. $\frac{1}{3}$

