1. [-/1 Points] DETAILS SCALC8 12.1.017.

Write the equation of the sphere in standard form.

$x^2 + y^2 + z^2 + 2x - 4y - 2z = 10$

Find its center and radius.

center $(x, y, z) = ($ $)$

radius

2. [-/5 Points] DETAILS SCALC8 12.1.004.

Consider the point.

$(3, 5, 6)$

What is the projection of the point on the xy-plane?

$(x, y, z) = ($ $)$

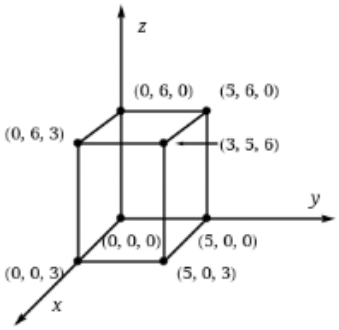
What is the projection of the point on the yz-plane?

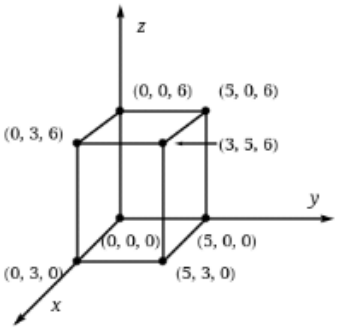
$(x, y, z) = ($ $)$

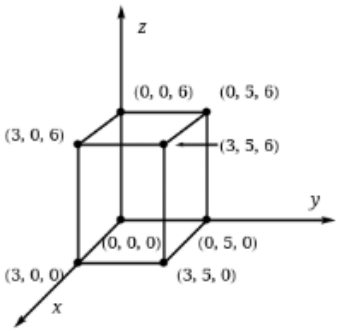
What is the projection of the point on the xz-plane?

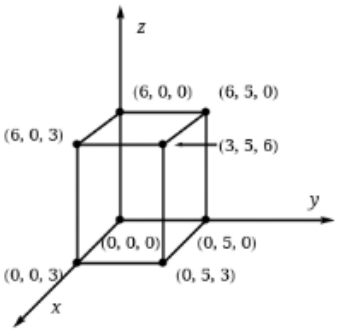
$(x, y, z) = ($ $)$

Draw a rectangular box with the origin and $(3, 5, 6)$ as opposite vertices and with its faces parallel to the coordinate planes. La





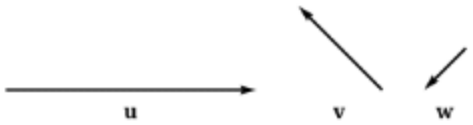




Find the length of the diagonal of the box.

3. [-/6 Points] DETAILS SCALC8 12.2.005.

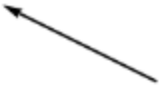
Copy the vectors in the figure and use them to draw the following vectors.



(a) **u + v**

○

○



○

○

(b) **u + w**

○

○

○

○

(c) $\mathbf{v} + \mathbf{w}$

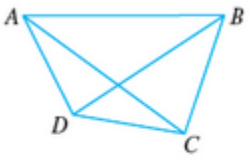
(d) $\mathbf{u} - \mathbf{v}$

(e) $\mathbf{v} + \mathbf{u} + \mathbf{w}$

(f) $\mathbf{u} - \mathbf{w} - \mathbf{v}$

4. [–/4 Points] DETAILS **SCALC8 12.2.004.**

Write each combination of vectors as a single vector.



(a) $\overrightarrow{AB} + \overrightarrow{BC}$

(b) $\overrightarrow{CD} + \overrightarrow{DB}$

(c) $\overrightarrow{DB} - \overrightarrow{AB}$

(d) $\overrightarrow{DC} + \overrightarrow{CA} + \overrightarrow{AB}$

5. [–/2 Points] DETAILS **SCALC8 12.2.031.**

A quarterback throws a football with an angle of elevation 50° and speed 80 ft/s. Find the horizontal and vertical components of the velocity vector. (Round your answers to one decimal place.)

horizontal ft/s

vertical ft/s

6. [–/1 Points] DETAILS SCALC8 12.2.509.XP.

Find $\mathbf{a} + \mathbf{b}$, $2\mathbf{a} + 3\mathbf{b}$, $|\mathbf{a}|$, and $|\mathbf{a} - \mathbf{b}|$.

$\mathbf{a} = 5\mathbf{i} - 6\mathbf{j} + 4\mathbf{k}, \quad \mathbf{b} = 2\mathbf{j} - \mathbf{k}$

$\mathbf{a} + \mathbf{b} =$ ☐

$2\mathbf{a} + 3\mathbf{b} =$ ☐

$|\mathbf{a}| =$ ☐

$|\mathbf{a} - \mathbf{b}| =$ ☐

7. [–/1 Points] DETAILS SCALC8 12.3.507.XP.

Find the angle between the vectors. (First find an exact expression and then approximate to the nearest degree.)

$\mathbf{a} = \mathbf{i} + 2\mathbf{j} - 2\mathbf{k}, \quad \mathbf{b} = 6\mathbf{i} - 8\mathbf{k}$

exact ☐

approximate ☐ °

8. [–/1 Points] DETAILS SCALC8 12.3.008.

Find $\mathbf{a} \cdot \mathbf{b}$.

$\mathbf{a} = 5\mathbf{i} + 5\mathbf{j} - \mathbf{k}, \quad \mathbf{b} = -4\mathbf{i} + 6\mathbf{k}$

☐

9. [–/2 Points] DETAILS SCALC8 12.3.039.

Find the scalar and vector projections of $\mathbf{b}$ onto $\mathbf{a}$.

$\mathbf{a} = \langle -3, 4 \rangle, \quad \mathbf{b} = \langle 6, 7 \rangle$

scalar projection of $\mathbf{b}$ onto $\mathbf{a}$ ☐

vector projection of $\mathbf{b}$ onto $\mathbf{a}$ ☐

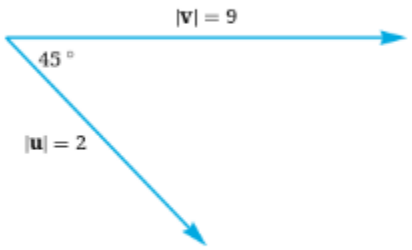
10. [–/1 Points] DETAILS SCALC8 12.4.507.XP.

Find the area of the parallelogram with vertices $K(2, 2, 2)$, $L(2, 3, 3)$, $M(5, 7, 3)$, and $N(5, 6, 2)$.

☐

11. [–/2 Points] DETAILS SCALC8 12.4.014.

Find $|\mathbf{u} \times \mathbf{v}|$ and determine whether $\mathbf{u} \times \mathbf{v}$ is directed into the screen or out of the screen.



$|\mathbf{u} \times \mathbf{v}| =$ ☐

- ○ $\mathbf{u} \times \mathbf{v}$ is directed into the screen.
- ○ $\mathbf{u} \times \mathbf{v}$ is directed out of the screen.

12. [–/3 Points] DETAILS SCALC8 12.4.007.

Find the cross product $\mathbf{a} \times \mathbf{b}$.

$\mathbf{a} = \langle t, 1, 1/t \rangle, \quad \mathbf{b} = \langle t^2, t^2, 1 \rangle$

Verify that it is orthogonal to both $\mathbf{a}$ and $\mathbf{b}$.

$(\mathbf{a} \times \mathbf{b}) \cdot \mathbf{a} =$

$(\mathbf{a} \times \mathbf{b}) \cdot \mathbf{b} =$

13. [–/2 Points] DETAILS SCALC8 12.4.019.

Find two unit vectors orthogonal to both $\langle 2, 8, 1 \rangle$ and $\langle -1, 1, 0 \rangle$.

(smaller **i**-value)

(larger **i**-value)

14. [–/1 Points] DETAILS SCALC8 12.4.053.

Suppose that $\mathbf{a} \neq \mathbf{0}$.

(a) If $\mathbf{a} \cdot \mathbf{b} = \mathbf{a} \cdot \mathbf{c}$, does it follow that $\mathbf{b} = \mathbf{c}$?

- Yes
- No

(b) If $\mathbf{a} \times \mathbf{b} = \mathbf{a} \times \mathbf{c}$, does it follow that $\mathbf{b} = \mathbf{c}$?

- Yes
- No

(c) If $\mathbf{a} \cdot \mathbf{b} = \mathbf{a} \cdot \mathbf{c}$, and $\mathbf{a} \times \mathbf{b} = \mathbf{a} \times \mathbf{c}$, does it follow that $\mathbf{b} = \mathbf{c}$?

- Yes
- No

15. [–/11 Points] DETAILS SCALC8 12.5.058.

Consider the following planes.

$4x - 3y + z = 1, \quad 3x + y - 4z = 4$

(a) Find parametric equations for the line of intersection of the planes. (Use the parameter t.)

$(x(t), y(t), z(t)) = (\quad)$

(b) Find the angle between the planes. (Round your answer to one decimal place.)

°

Need Help? Read It

Show My Work (Required)

What steps or reasoning did you use? Your work counts towards your score.

16. [-/11 Points] DETAILS **SCALC8 12.5.001.**

Determine whether each statement is true or false in $\mathbb{R}^3$.

(a) Two lines parallel to a third line are parallel.
- ○ True
- ○ False

(b) Two lines perpendicular to a third line are parallel.
- ○ True
- ○ False

(c) Two planes parallel to a third plane are parallel.
- ○ True
- ○ False

(d) Two planes perpendicular to a third plane are parallel.
- ○ True
- ○ False

(e) Two lines parallel to a plane are parallel.
- ○ True
- ○ False

(f) Two lines perpendicular to a plane are parallel.
- ○ True
- ○ False

(g) Two planes parallel to a line are parallel.
- ○ True
- ○ False

(h) Two planes perpendicular to a line are parallel.
- ○ True
- ○ False

(i) Two planes either intersect or are parallel.
- ○ True
- ○ False

(j) Two lines either intersect or are parallel.
- ○ True
- ○ False

(k) A plane and a line either intersect or are parallel.
- ○ True
- ○ False

17. [-/2 Points] DETAILS **SCALC8 12.5.004.**

Find a vector equation and parametric equations for the line. (Use the parameter t.)

The line through the point $(0, 13, -6)$ and parallel to the line $x = -1 + 4t$, $y = 6 - 3t$, $z = 3 + 9t$

$\mathbf{r}(t) =$ ☐

$(x(t), y(t), z(t)) =$ (☐)

18. [-/14 Points] DETAILS SCALC8 12.5.015.

(a) Find symmetric equations for the line that passes through the point $(1, -3, 6)$ and is parallel to the vector $\langle -1, 4, -4 \rangle$.

- $x + 1 = \frac{y + 3}{4} = \frac{z - 6}{-4}$.
- $-(x - 1) = 4(y + 3) = -4(z - 6)$.
- $\frac{x + 1}{-1} = \frac{y - 3}{4} = \frac{z + 6}{-4}$.
- $\frac{x - 1}{-1} = \frac{y + 3}{4} = \frac{z - 6}{-4}$.
- $-(x + 1) = 4(y - 3) = -4(z + 6)$.

(b) Find the points in which the required line in part (a) intersects the coordinate planes.

point of intersection with xy-plane ( )

point of intersection with yz-plane ( )

point of intersection with xz-plane ( )

Need Help? Read It Watch It

Show My Work (Required)

What steps or reasoning did you use? Your work counts towards your score.

19. [-/1 Points] DETAILS SCALC8 12.5.072.

Find the distance from the point to the given plane.

$(-2, 8, 3)$, $x - 2y - 4z = 8$

20. [-/1 Points] DETAILS SCALC8 12.6.001.

(a) What does the equation $y = x^2$ represent as a curve in $\mathbb{R}^2$?

- line
- parabola
- circle
- ellipse
- hyperbola

(b) What does it represent as a surface in $\mathbb{R}^3$?

- parabolic cylinder
- elliptic paraboloid
- ellipsoid
- cone
- hyperboloid

(c) What does the equation $z = y^2$ represent?

- cone
- hyperboloid
- parabolic cylinder
- elliptic paraboloid
- ellipsoid

21. [-/1 Points] DETAILS SCALC8 12.6.515.XP.

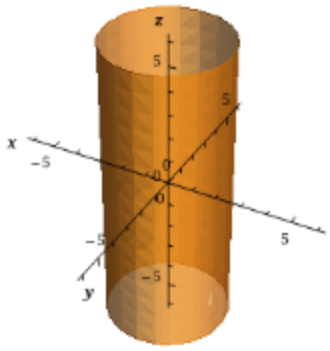
Describe the surface.

$x^2 - y^2 = 6$

- ○ sphere
- ○ ellipsoid
- ○ hyperboloid
- ○ circular cylinder
- ○ elliptic cylinder
- ○ hyperbolic cylinder
- ○ parabolic cylinder
- ○ elliptic paraboloid

Sketch the surface.

○



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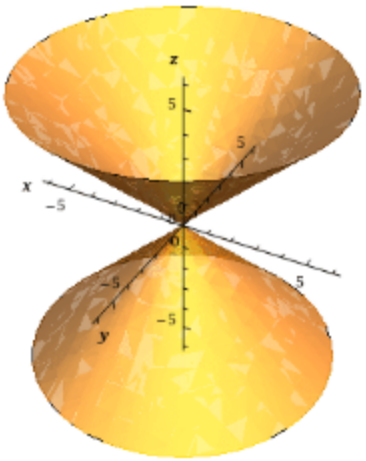

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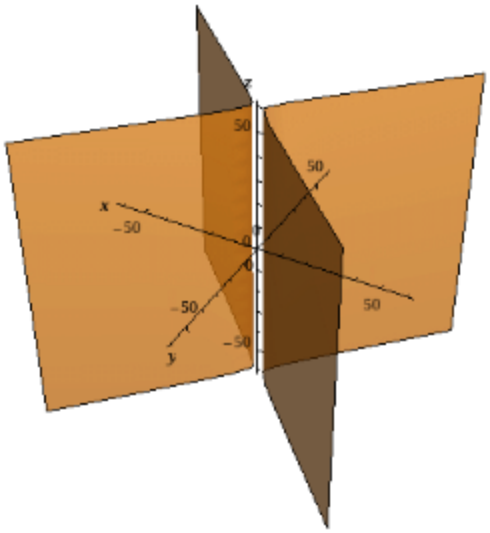

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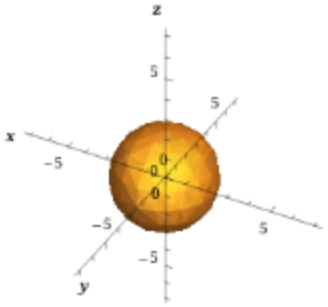


22. [-/1 Points] DETAILS SCALC8 12.6.519.XP.

Consider the equation below.

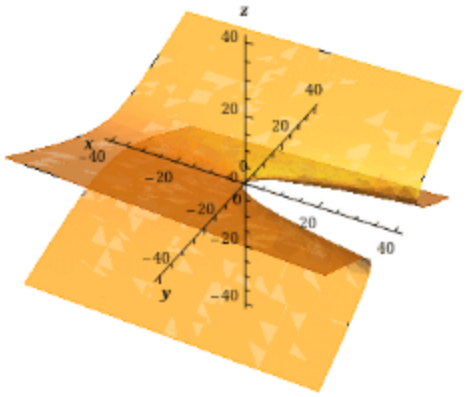
$5x - y^2 + 5z^2 = 0$

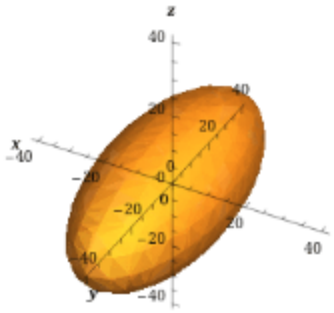
Reduce the equation to one of the standard forms.

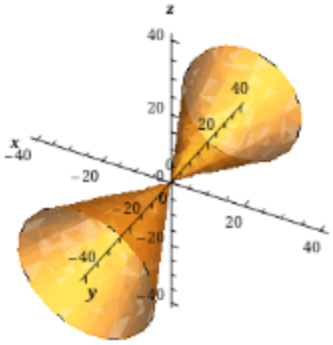
Classify the surface.

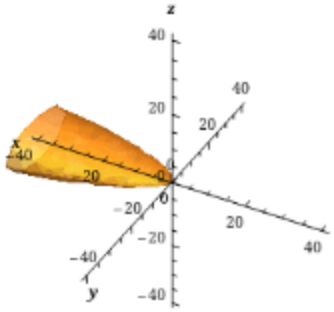
- ellipsoid
- elliptic paraboloid
- hyperbolic paraboloid
- cone
- hyperboloid of one sheet
- hyperboloid of two sheets

Sketch the surface.









23. [-/9 Points] DETAILS SCALC8 12.6.009.

(a) Find and identify the traces of the quadric surface $x^2 + y^2 - z^2 = 81$ given the plane.

$x = k$

Find the trace.

Identify the trace.
- circle
- ellipse
- hyperbola
- parabola

$y = k$

Find the trace.

Identify the trace.
- circle
- ellipse
- hyperbola
- parabola

$z = k$

Find the trace.

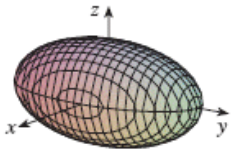
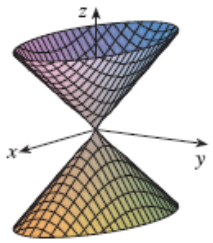
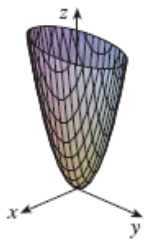
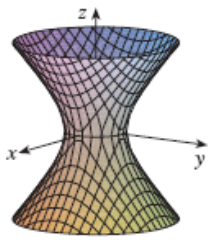
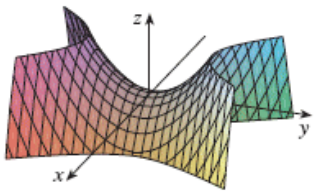
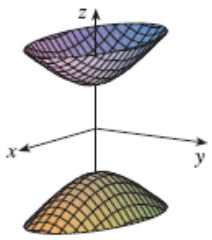
Identify the trace.
- circle
- ellipse
- hyperbola
- parabola

Describe the surface from one of the graphs in the table.
- ellipsoid
- elliptic paraboloid
- hyperbolic paraboloid
- cone
- hyperboloid of one sheet
- hyperboloid of two sheets

(b) If we change the equation in part (a) to $x^2 - y^2 + z^2 = 81$, how is the graph affected?
- The graph is rotated so that its axis is the x-axis.
- The graph is rotated so that its axis is the y-axis.
- The graph is rotated so that its axis is the z-axis
- The graph is shifted one unit in the negative y-direction.
- The graph is shifted one unit in the positive y-direction.

(c) What if we change the equation in part (a) to $x^2 + y^2 + 2y - z^2 = 80$?
- The graph is rotated so that its axis is the x-axis.
- The graph is rotated so that its axis is the y-axis.
- The graph is rotated so that its axis is the z-axis
- The graph is shifted one unit in the negative y-direction.
- The graph is shifted one unit in the positive y-direction.

Graphs of quadric surfaces

Surface	Equation	Surface	Equation
Ellipsoid 	$\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$ All traces are ellipses. If $a=b=c$, the ellipsoid is a sphere.	**Cone** 	$\frac{z^2}{c^2}=\frac{x^2}{a^2}+\frac{y^2}{b^2}$ Horizontal traces are ellipses. Vertical traces in the planes $x=k$ and $y=k$ are hyperbolas if $k\neq 0$ but are pairs of lines if $k=0$.
Elliptic Paraboloid 	$\frac{z}{c}=\frac{x^2}{a^2}+\frac{y^2}{b^2}$ Horizontal traces are ellipses. Vertical traces are parabolas. The variable raised to the first power indicates the axis of the paraboloid.	**Hyperboloid of One Sheet** 	$\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z^2}{c^2}=1$ Horizontal traces are ellipses. Vertical traces are hyperbolas. The axis of symmetry corresponds to the variable whose coefficient is negative.
Hyperbolic Paraboloid 	$\frac{z}{c}=\frac{x^2}{a^2}-\frac{y^2}{b^2}$ Horizontal traces are hyperbolas. Vertical traces are parabolas. The case where $c<0$ is illustrated.	**Hyperboloid of Two Sheets** 	$-\frac{x^2}{a^2}-\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$ Horizontal traces in $z=k$ are ellipses if $k>c$ or $k<-c$. Vertical traces are hyperbolas. The two minus signs indicate two sheets.