Assignment Previewer

This is a preview of the questions in your assignment, but it does not reflect all assignment settings. Open the student view to interact with the actual assignment.

Show answer key

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EDIT ASSIGNMENT

INSTRUCTOR
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HW1 (Homework)

Current Score: – / 59 POINTS | 0.0 %

Scoring and Assignment Information

QUESTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14
POINTS	– / 2	– / 5	– / 3	– / 2	– / 5	– / 6	– / 3	– / 8	– / 2	– / 4	– / 1	– / 2	– / 2	– / 4

Assignment Submission

For this assignment, you submit answers by question parts. The number of submissions remaining for each question part only changes if you submit or change the answer.

Assignment Scoring

Your best submission for each question part is used for your score.

1. [– / 2 Points]

DETAILS

SCalcET9M 12.1.003.MI.

Use the given points to answer the following questions.

$$A(-3, 0, -8), B(4, 4, -7), C(2, 2, 5)$$

Which of the points is closest to the *yz*-plane?

- A
- B
- C

Which point lies in the *xz*-plane?

- A
- B
- C

Solution or Explanation

The distance from a point to the *yz*-plane is the absolute value of the *x*-coordinate of the point. $C(2, 2, 5)$ has the *x*-coordinate with the smallest absolute value, so C is the point closest to the *yz*-plane. $A(-3, 0, -8)$ must lie in the *xz*-plane since the distance from A to the *xz*-plane, given by the *y*-coordinate of A, is 0.

Resources

Watch It Master It

2. [– / 5 Points]

DETAILS

SCalcET9M 12.1.004.

Consider the point.

(1, 4, 6)

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

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

✕ $\boxed{1, 4, 0}$ $\Big)$

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

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

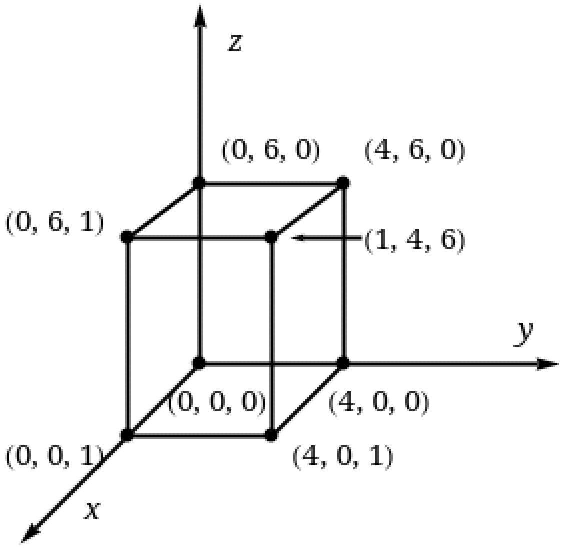
✕ $\boxed{0, 4, 6}$ $\Big)$

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

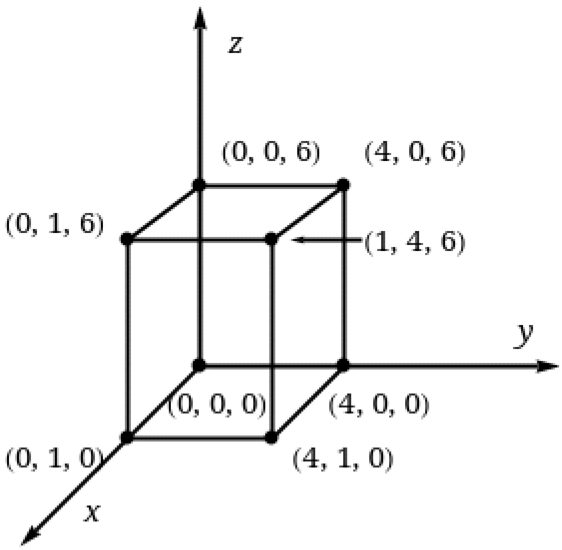
$(x, y, z) = \Big($

✕ $\boxed{1, 0, 6}$ $\Big)$

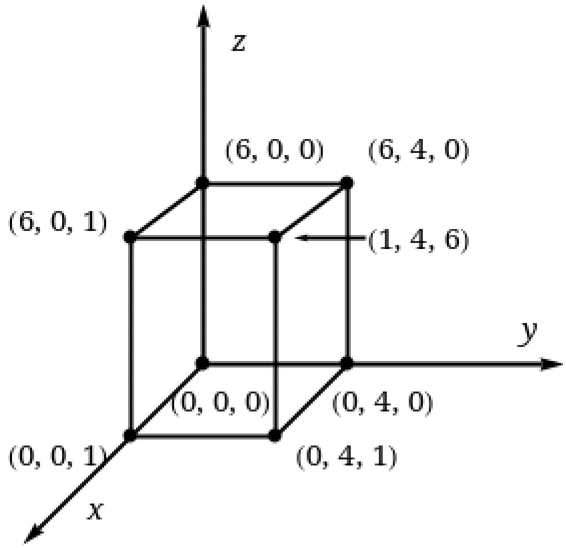
Draw a rectangular box with the origin and (1, 4, 6) as opposite vertices and with its faces parallel to the coordinate planes. Label all vertices of the box.


z
(0, 6, 0)
(4, 6, 0)
(0, 6, 1)
(1, 4, 6)
y
(0, 0, 0)
(4, 0, 0)
(0, 0, 1)
(4, 0, 1)
x

○


z
(0, 0, 6)
(4, 0, 6)
(0, 1, 6)
(1, 4, 6)
y
(0, 0, 0)
(4, 0, 0)
(0, 1, 0)
(4, 1, 0)
x

○



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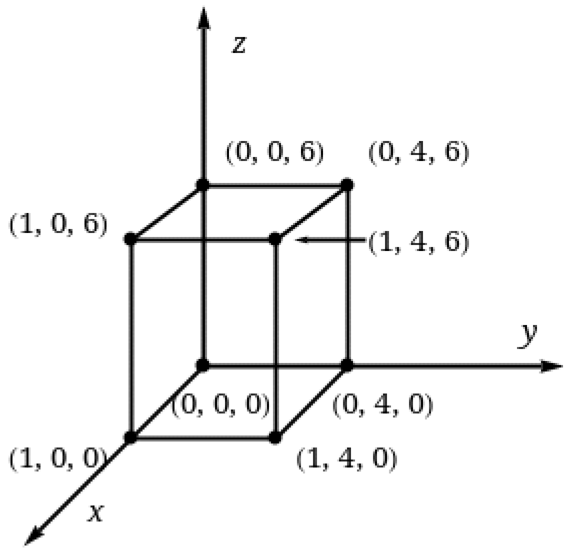


○

✗

Find the length of the diagonal of the box.

✗ $\boxed{\sqrt{53}}$

Solution or Explanation

The projection of (3, 4, 6) onto the xy-plane is (3, 4, 0), onto the yz-plane is (0, 4, 6), and onto the xz-plane is (3, 0, 6).

The length of the diagonal of the box is the distance between the origin and (3, 4, 6), given by

$$\sqrt{(3-0)^2+(4-0)^2+(6-0)^2}=\sqrt{61}\approx 781.$$

Click to View Solution

3. [– / 3 Points] DETAILS

SCalcET9M 12.1.006.

What does the equation $y = 8$ represent in $\mathbb{R}^3$?

- a point
- a line
- a plane
- a circle

What does $z = 9$ represent?

- a point
- a line
- a plane
- a circle

What does the pair of equations $y = 8$, $z = 9$ represent? In other words, describe the set of points (x, y, z) such that $y = 8$ and $z = 9$.

- a point
- a line
- a plane
- a circle

Solution or Explanation

In $\mathbb{R}^3$, the equation $y = 8$ represents a vertical plane that is parallel to the xz-plane and 8 units to the right of it. The equation $z = 9$ represents a horizontal plane parallel to the xy-plane and 9 units above it. The pair of equations $y = 8$, $z = 9$ represents the set of points that are simultaneously on both planes, or in other words, the line of intersection of the planes $y = 8$, $z = 9$. This line can also be described as the set $\{(x, 8, 9) \mid x \in \mathbb{R}\}$, which is the set of all points in $\mathbb{R}^3$ whose x-coordinate may vary but whose y- and z-coordinates are fixed at 8 and 9, respectively. Thus, the line is parallel to the x-axis and intersects the yz-plane in the point $(0, 8, 9)$.

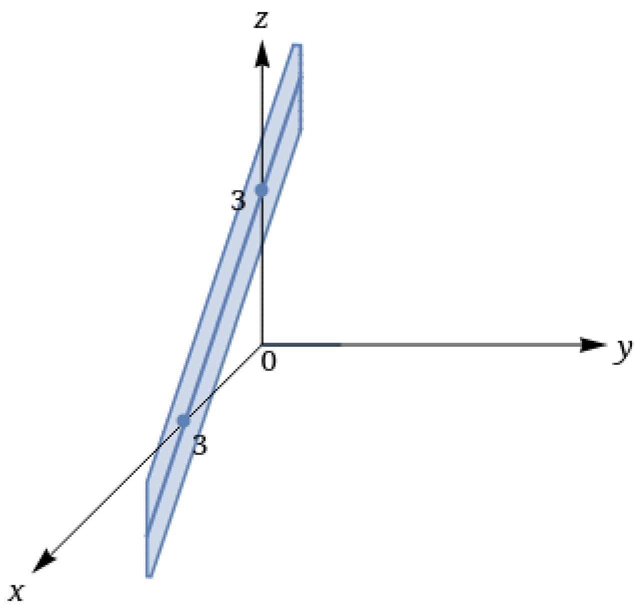
4. [– / 2 Points] DETAILS

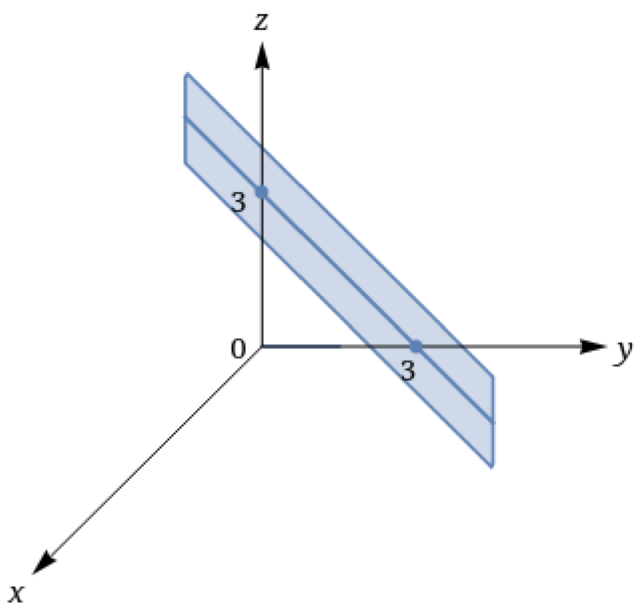
SCalcET9M 12.1.007.

Describe the surface in $\mathbb{R}^3$ represented by the equation $x + y = 3$.

- This is the set $\{(x, 3 - x, z) | x \in \mathbb{R}, z \in \mathbb{R}\}$ which is a horizontal plane that intersects the xy-plane in the line $y = 3 - x$, $z = 0$.
- This is the set $\{(x, 3 - x, z) | x \in \mathbb{R}, z \in \mathbb{R}\}$ which is a horizontal plane that intersects the xz-plane in the line $y = 3 - x$, $z = 0$.
- This is the set $\{(x, y, 3 - x - y) | x \in \mathbb{R}, y \in \mathbb{R}\}$ which is a vertical plane that intersects the xy-plane in the line $y = 3 - x$, $z = 0$.
- This is the set $\{(x, 3 - x, z) | x \in \mathbb{R}, z \in \mathbb{R}\}$ which is a vertical plane that intersects the xy-plane in the line $y = 3 - x$, $z = 0$.
- This is the set $\{(x, 3 - x, z) | x \in \mathbb{R}, z \in \mathbb{R}\}$ which is a vertical plane that intersects the xz-plane in the line $y = 3 - x$, $z = 0$.

Sketch the surface.


z
3
0
y
3
x


z
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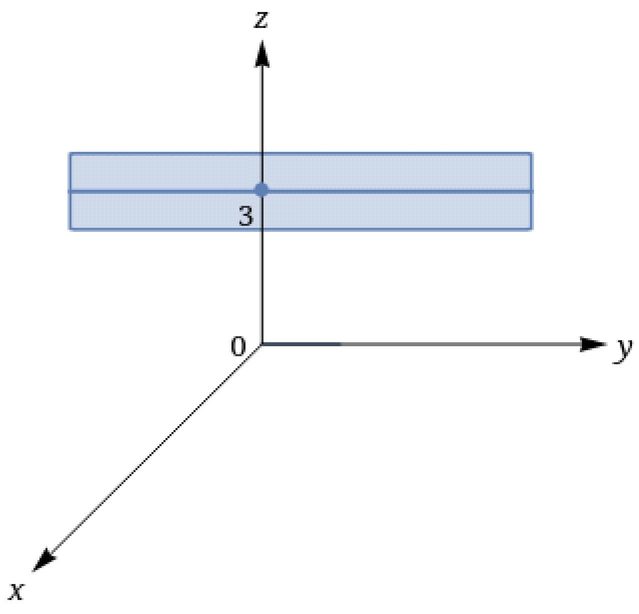
0
y
3
x



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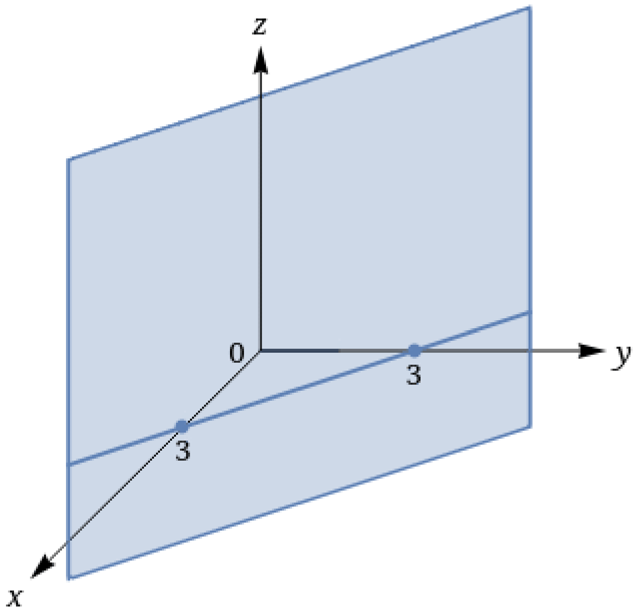

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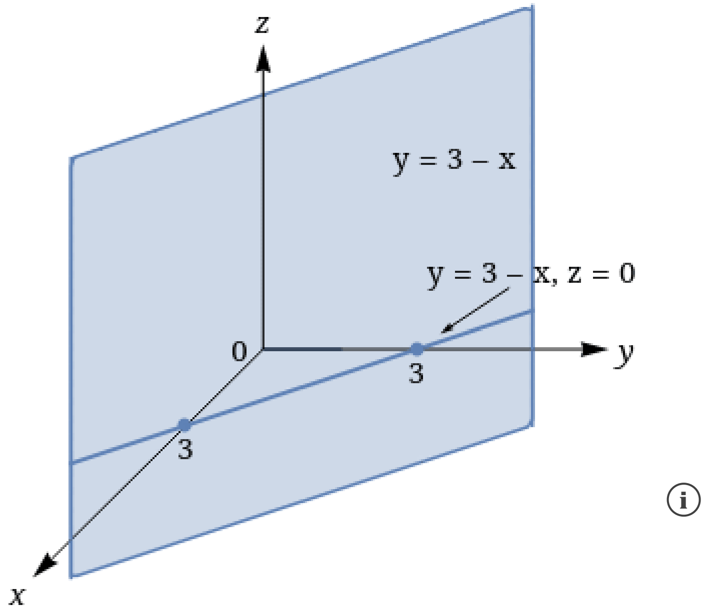
❌

Solution or Explanation

The equation $x + y = 3$ represents the set of all points in $\mathbb{R}^3$ whose x- and y-coordinates have a sum of 3, or equivalently where $y = 3 - x$. This is the set $\{(x, 3 - x, z) \mid x \in \mathbb{R}, z \in \mathbb{R}\}$ which is a vertical plane that intersects the xy-plane in the line $y = 3 - x$, $z = 0$.



Resources

[Watch It]

5. [– / 5 Points] DETAILS

SCalcET9M 12.1.011.

Find the lengths of the sides of the triangle PQR.

$$P(5, -1, -1), \quad Q(7, 0, 1), \quad R(8, -2, -1)$$

$|PQ|$ =

3

$|QR|$ =

3

$|RP|$ =

$\sqrt{10}$

Is it a right triangle?

- Yes
- No

Is it an isosceles triangle?

- Yes
- No

Solution or Explanation

We can find the lengths of the sides of the triangle by using the distance formula between pairs of vertices.

$$|PQ| = \sqrt{(7-5)^2 + [0-(-1)]^2 + [1-(-1)]^2} = \sqrt{4+1+4} = 3$$

$$|QR| = \sqrt{(8-7)^2 + (-2-0)^2 + (-1-1)^2} = \sqrt{1+4+4} = 3$$

$$|RP| = \sqrt{(5-8)^2 + [-1-(-2)]^2 + [-1-(-1)]^2} = \sqrt{9+1+0} = \sqrt{10}$$

The longest side is RP, but the Pythagorean Theorem is not satisfied: $|PQ|^2 + |QR|^2 \neq |RP|^2$. Thus, PQR is not a right triangle. PQR is isosceles as two sides have the same length.

Resources

[Watch It]

6. [– / 6 Points]

DETAILS

SCalcET9M 12.1.014.

Find the distance from $(1, -2, 9)$ to each of the following.

(a) the *xy*-plane

$\boxed{9}$

(b) the *yz*-plane

$\boxed{1}$

(c) the *xz*-plane

$\boxed{2}$

(d) the *x*-axis

$\boxed{\sqrt{85}}$

(e) the *y*-axis

$\boxed{\sqrt{82}}$

(f) the *z*-axis

✖ $\boxed{\sqrt{5}}$

Solution or Explanation

(a) The distance from a point to the *xy*-plane is the absolute value of the *z*-coordinate of the point. Thus, the distance is $|9| = 9$.

(b) Similarly, the distance to the *yz*-plane is the absolute value of the *x*-coordinate of the point: $|1| = 1$.

(c) The distance to the *xz*-plane is the absolute value of the *y*-coordinate of the point: $|-2| = 2$.

(d) The point on the *x*-axis closest to $(1, -2, 9)$ is the point $(1, 0, 0)$. (Approach the *x*-axis perpendicularly.) The distance from $(1, -2, 9)$ to the *x*-axis is the distance between these two points.

$$\sqrt{(1-1)^2+(-2-0)^2+(9-0)^2} = \sqrt{85}.$$

(e) The point on the *y*-axis closest to $(1, -2, 9)$ is $(0, -2, 0)$. The distance between these points is

$$\sqrt{(1-0)^2+[-2-(-2)]^2+(9-0)^2} = \sqrt{82}.$$

(f) The point on the *z*-axis closest to $(1, -2, 9)$ is $(0, 0, 9)$. The distance between these points is

$$\sqrt{(1-0)^2+(-2-0)^2+(9-9)^2} = \sqrt{5}.$$

7. [– / 3 Points] DETAILS

SCalcET9M 12.1.022.

Find equations of the spheres with center (2, −2, 5) that touch the following planes.

(a) *xy*-plane

✗ $(x-2)^2+(y+2)^2+(z-5)^2=25$

(b) *yz*-plane

✗ $(x-2)^2+(y+2)^2+(z-5)^2=4$

(c) *xz*-plane

✗ $(x-2)^2+(y+2)^2+(z-5)^2=4$

Solution or Explanation

(a) Since the sphere touches the *xy*-plane, its radius is the distance from its center, (2, −2, 5), to the *xy*-plane, namely 5. Therefore, $r = 5$ and an equation of the sphere is

$$(x-2)^2+(y+2)^2+(z-5)^2=5^2=25.$$

(b) The radius of this sphere is the distance from its center (2, −2, 5) to the *yz*-plane, which is 2. Therefore, an equation is

$$(x-2)^2+(y+2)^2+(z-5)^2=4.$$

(c) Here the radius is the distance from the center (2, −2, 5) to the *xz*-plane, which is 2. Therefore, an equation is

$$(x-2)^2+(y+2)^2+(z-5)^2=4.$$

8. [– / 8 Points] DETAILS

SCalcET9M 12.2.001.

Are the following quantities vectors or scalars? Explain.

(a) the cost of a theater ticket

The cost of a theater ticket is a ---Select--- ✗ scalar because it has ---Select--- ✗ only magnitude .

(b) the current in a river

The current in a river is a ---Select--- ✗ vector because it has ---Select--- ✗ both magnitude and direction .

(c) the initial flight path from Houston to Dallas

The initial flight path from Houston to Dallas is a ---Select--- ✗ vector because it has ---Select--- ✗ both magnitude and direction .

(d) the population of the world

The population of the world is a ---Select--- ✗ scalar because it has ---Select--- ✗ only magnitude .

Solution or Explanation

(a) The cost of a theater ticket is a scalar, because it has only magnitude.

(b) The current in a river is a vector, because it has both magnitude (the speed of the current) and direction at any given location.

(c) If we assume that the initial path is linear, the initial flight path from Houston to Dallas is a vector, because it has both magnitude (distance) and direction.

(d) The population of the world is a scalar, because it has only magnitude.

Resources

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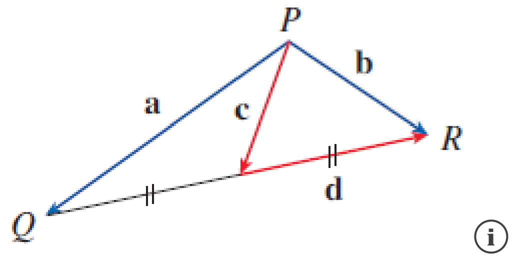
9. [– / 2 Points]

DETAILS

SCalcET9M 12.2.007.

In the figure, the tip of **c** and the tail of **d** are both the midpoint of QR. Express **c** and **d** in terms of **a** and **b**.



c =

$\boxed{\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}}$

d =

$\boxed{\frac{1}{2}\mathbf{b} - \frac{1}{2}\mathbf{a}}$

Solution or Explanation

Because the tail of **d** is the midpoint of QR we have $\overrightarrow{QR} = 2\mathbf{d}$, and by the Triangle Law,

$\mathbf{a} + 2\mathbf{d} = \mathbf{b} \quad \Rightarrow \quad 2\mathbf{d} = \mathbf{b} - \mathbf{a} \quad \Rightarrow \quad \mathbf{d} = \frac{1}{2}(\mathbf{b} - \mathbf{a}) = \frac{1}{2}\mathbf{b} - \frac{1}{2}\mathbf{a}$. Again by the Triangle Law, we have

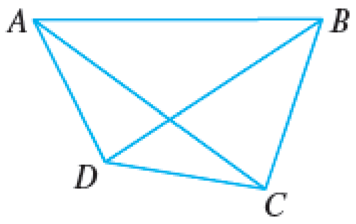
$\mathbf{c} + \mathbf{d} = \mathbf{b}$ so $\mathbf{c} = \mathbf{b} - \mathbf{d} = \mathbf{b} - \left(\frac{1}{2}\mathbf{b} - \frac{1}{2}\mathbf{a}\right) = \frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$.

10. [– / 4 Points]

DETAILS

SCalcET9M 12.2.004.

Write each combination of vectors as a single vector.



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

✕ $\boxed{\overrightarrow{AC}}$

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

✕ $\boxed{\overrightarrow{CB}}$

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

✕ $\boxed{\overrightarrow{DA}}$

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

✕ $\boxed{\overrightarrow{DB}}$

Solution or Explanation

(a) The initial point of $\overrightarrow{BC}$ is positioned at the terminal point of $\overrightarrow{AB}$, so by the Triangle Law the sum $\overrightarrow{AB} + \overrightarrow{BC}$ is the vector with initial point A and terminal point C, namely $\overrightarrow{AC}$.

(b) By the Triangle Law, $\overrightarrow{CD} + \overrightarrow{DB}$ is the vector with initial point C and terminal point B, namely $\overrightarrow{CB}$.

(c) First we consider $\overrightarrow{DB} - \overrightarrow{AB}$ as $\overrightarrow{DB} + \left(-\overrightarrow{AB}\right)$. Then, since $-\overrightarrow{AB}$ has the same length as $\overrightarrow{AB}$ but points in the opposite direction, we have $-\overrightarrow{AB} = \overrightarrow{BA}$ and so $\overrightarrow{DB} - \overrightarrow{AB} = \overrightarrow{DB} + \overrightarrow{BA} = \overrightarrow{DA}$.

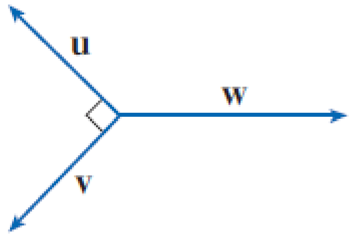
(d) We use the Triangle Law twice: $\overrightarrow{DC} + \overrightarrow{CA} + \overrightarrow{AB} = \left(\overrightarrow{DC} + \overrightarrow{CA}\right) + \overrightarrow{AB} = \overrightarrow{DA} + \overrightarrow{AB} = \overrightarrow{DB}$.

---

11. [–/1 Points] DETAILS

SCalcET9M 12.2.008.

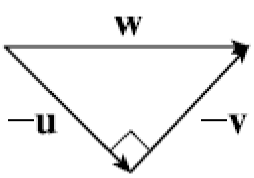
If the vectors in the figure satisfy $|\mathbf{u}| = |\mathbf{v}| = 1$ and $\mathbf{u} + \mathbf{v} + \mathbf{w} = \mathbf{0}$, what is $|\mathbf{w}|$?



$|\mathbf{w}| =$

✕ $\sqrt{2}$

Solution or Explanation



We are given $\mathbf{u} + \mathbf{v} + \mathbf{w} = \mathbf{0}$, so $\mathbf{w} = (-\mathbf{u}) + (-\mathbf{v})$. (See the figure above.)

Vectors $-\mathbf{u}$, $-\mathbf{v}$, and $\mathbf{w}$ form a right triangle, so from the Pythagorean Theorem we have $|-\mathbf{u}|^2 + |-\mathbf{v}|^2 = |\mathbf{w}|^2$. But $|-\mathbf{u}| = |\mathbf{u}| = 1$ and $|-\mathbf{v}| = |\mathbf{v}| = 1$, so $|\mathbf{w}| = \sqrt{|-\mathbf{u}|^2 + |-\mathbf{v}|^2} = \sqrt{2}$.

12. [– / 2 Points] DETAILS

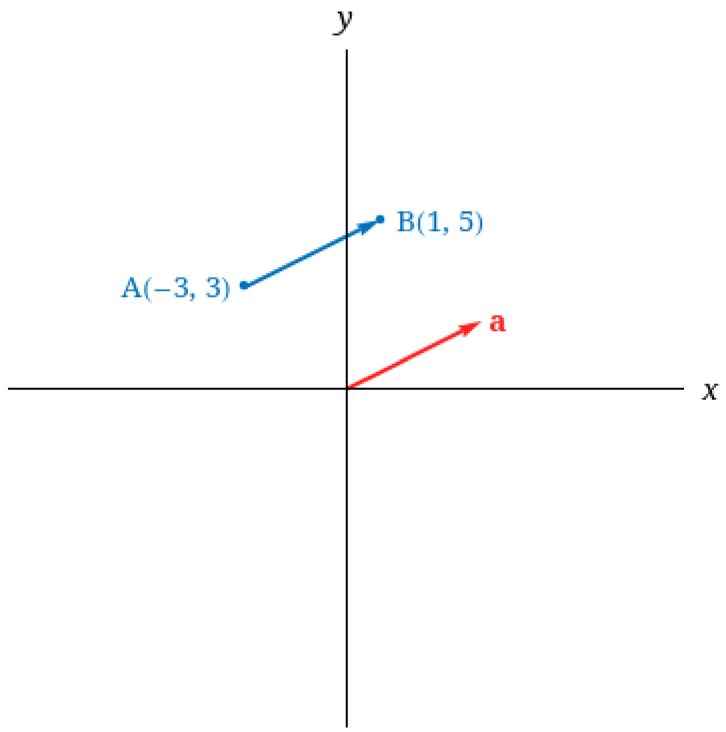
SCalcET9M 12.2.009.

Find a vector **a** with representation given by the directed line segment $\overrightarrow{AB}$.

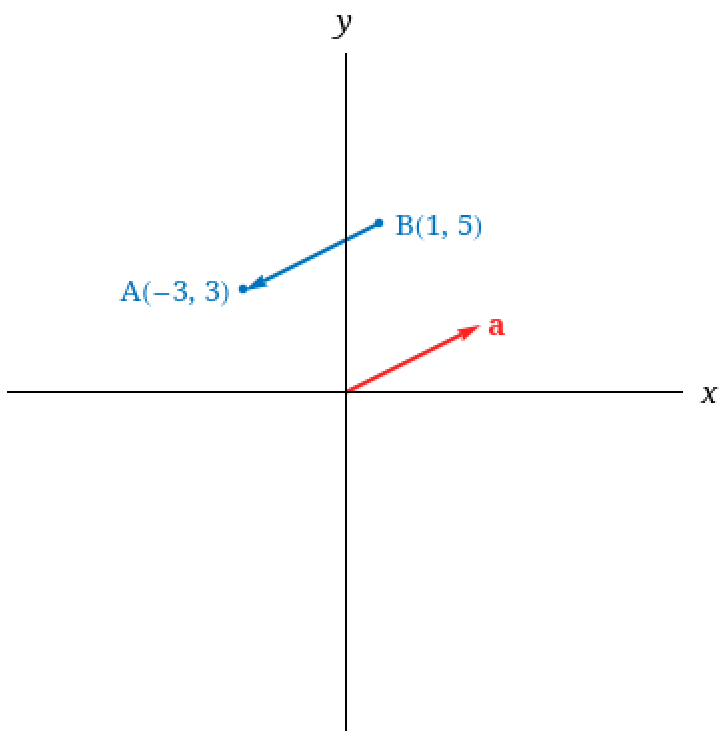
$A(-3, 3), \quad B(1, 5)$

✖ $\langle 4, 2 \rangle$

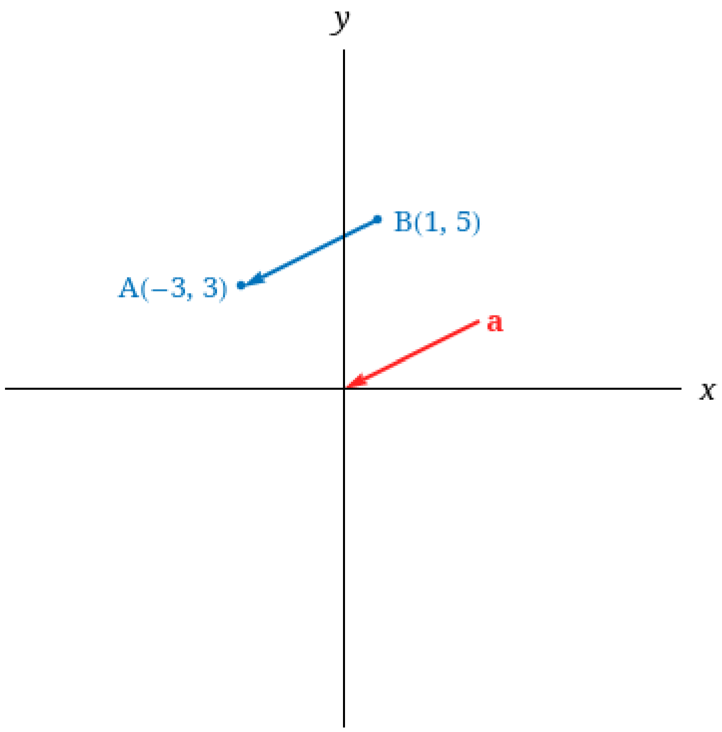
Draw $\overrightarrow{AB}$ and the equivalent representation starting at the origin.

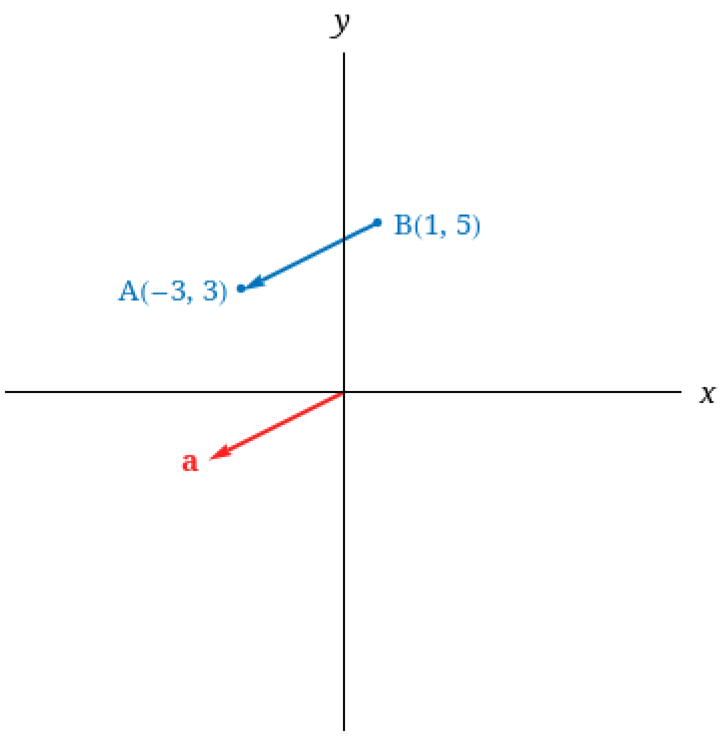


y
B(1, 5)
A(−3, 3)
a
x



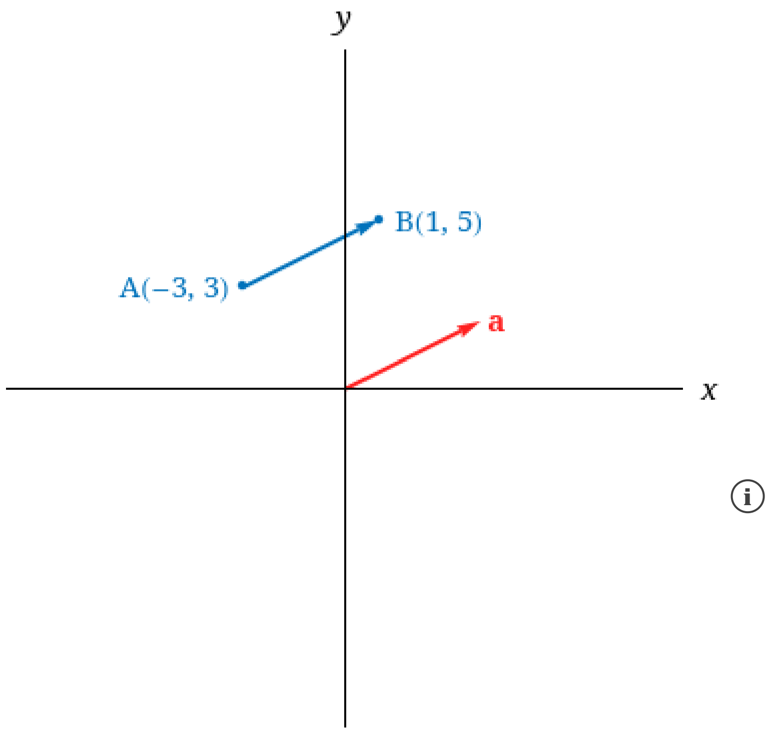
y
B(1, 5)
A(−3, 3)
a
x





Solution or Explanation

a = $\langle 1 - (-3), 5 - 3 \rangle = \langle 4, 2 \rangle$


y
B(1, 5)
A(−3, 3)
a
x

13. [– / 2 Points]

DETAILS

SCalcET9M 12.2.015.

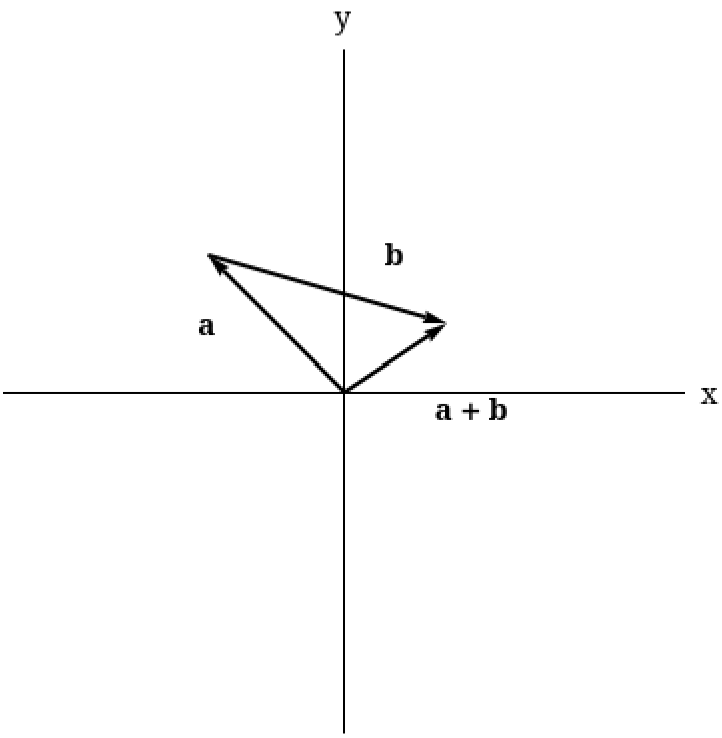
Find the sum of the given vectors.

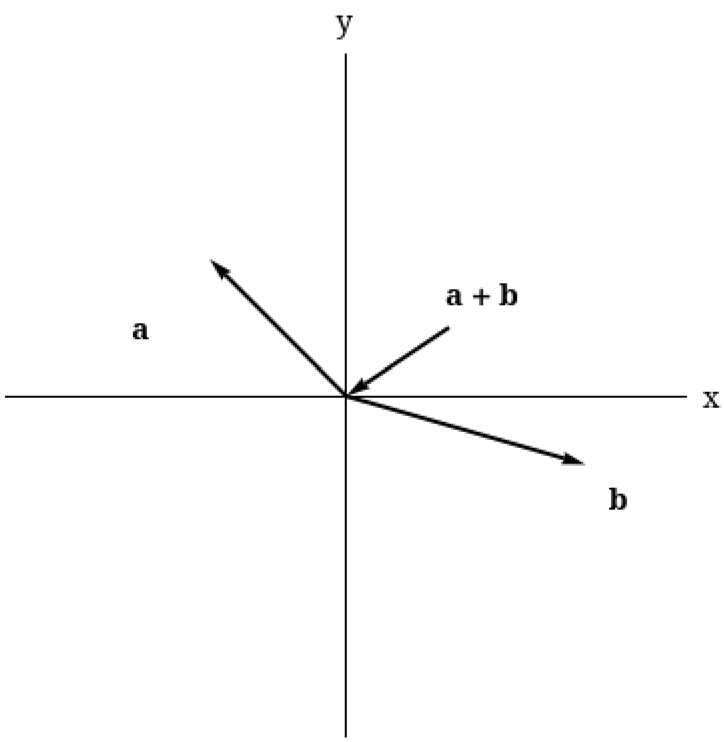
$$\mathbf{a} = \langle -4, 4 \rangle, \quad \mathbf{b} = \langle 7, -2 \rangle$$

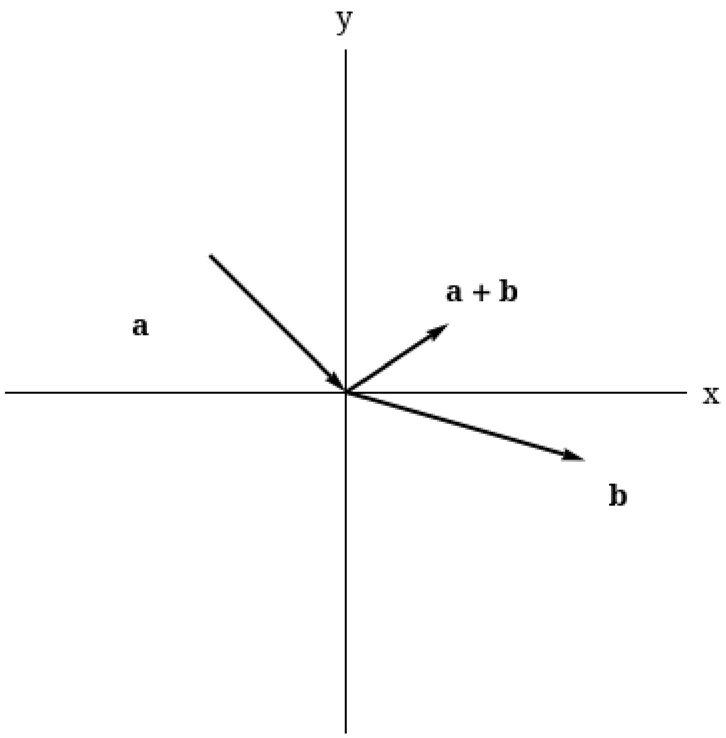
$\mathbf{a} + \mathbf{b} =$

✕ $\boxed{\langle 3, 2 \rangle}$

Illustrate geometrically.


y
b
a
x
a + b


y
a + b
a
x
b



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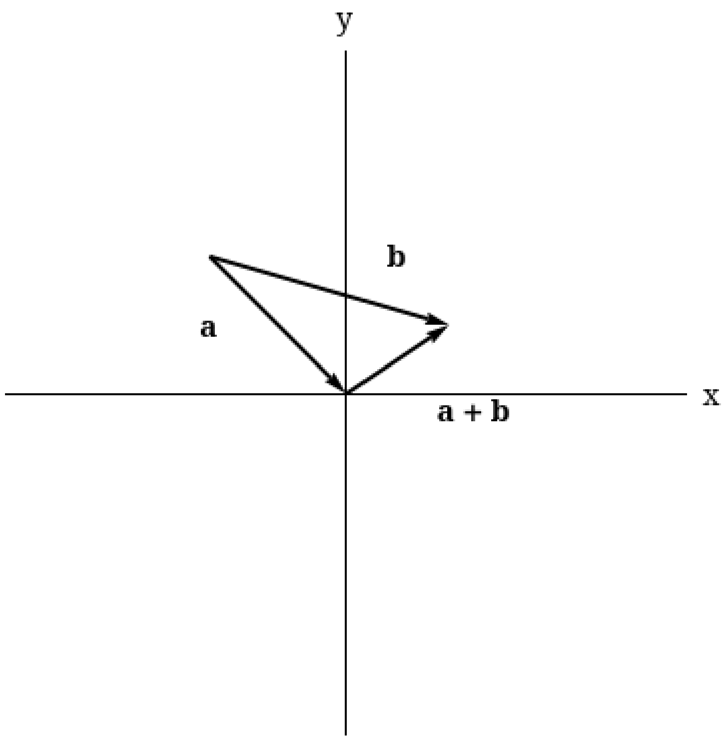
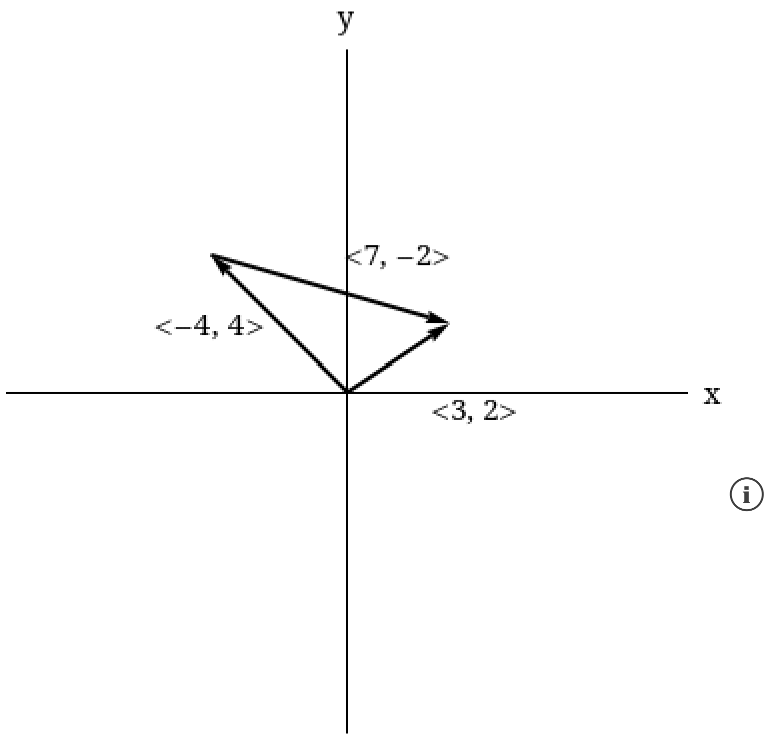


○

✕

Solution or Explanation

$\langle -4, 4\rangle + \langle 7, -2\rangle = \langle -4 + 7, 4 + (-2)\rangle = \langle 3, 2\rangle$



Resources

Watch It

14. [– / 4 Points]

DETAILS

SCalcET9M 12.2.019.

Find **a** + **b**, 7**a** + 9**b**, |**a**|, and |**a** − **b**|. (Simplify your answer completely.)

$\mathbf{a} = \langle -3, 4 \rangle, \quad \mathbf{b} = \langle 9, -1 \rangle$

$\mathbf{a} + \mathbf{b} =$

✗ $\langle 6, 3 \rangle$

$7\mathbf{a} + 9\mathbf{b} =$

✗ $\langle 60, 19 \rangle$

$|\mathbf{a}| =$

✗ 5

$|\mathbf{a} - \mathbf{b}| =$

✗ 13

Solution or Explanation

$\mathbf{a} + \mathbf{b} = \langle -3, 4 \rangle + \langle 9, -1 \rangle = \langle -3 + 9, 4 + (-1) \rangle = \langle 6, 3 \rangle$

$7\mathbf{a} + 9\mathbf{b} = 7\langle -3, 4 \rangle + 9\langle 9, -1 \rangle = \langle -21, 28 \rangle + \langle 81, -9 \rangle = \langle 60, 19 \rangle$

$|\mathbf{a}| = \sqrt{(-3)^2 + 4^2} = \sqrt{25} = 5$

$|\mathbf{a} - \mathbf{b}| = \left|\langle -3 - 9, 4 - (-1) \rangle\right| = \left|\langle -12, 5 \rangle\right| = \sqrt{(-12)^2 + 5^2} = \sqrt{169} = 13$

15. [– / 1 Points]

DETAILS

SCalcET9M 12.2.026.

Find the vector that has the same direction as $\langle 6, 9, -2 \rangle$ but has length 3.

✕ $\boxed{\left\langle \frac{18}{11}, \frac{27}{11}, -\frac{6}{11} \right\rangle}$

Solution or Explanation

$\left| \langle 6, 9, -2 \rangle \right| = \sqrt{6^2 + 9^2 + (-2)^2} = \sqrt{121} = 11$, so a unit vector in the direction of $\langle 6, 9, -2 \rangle$ is

$\mathbf{u} = \frac{1}{11}\langle 6, 9, -2 \rangle$. A vector in the same direction but with length 3 is

$3\mathbf{u} = 3 \cdot \frac{1}{11}\langle 6, 9, -2 \rangle = \left\langle \frac{18}{11}, \frac{27}{11}, -\frac{6}{11} \right\rangle.$

16. [– / 1 Points] DETAILS

SCalcET9M 12.2.027.

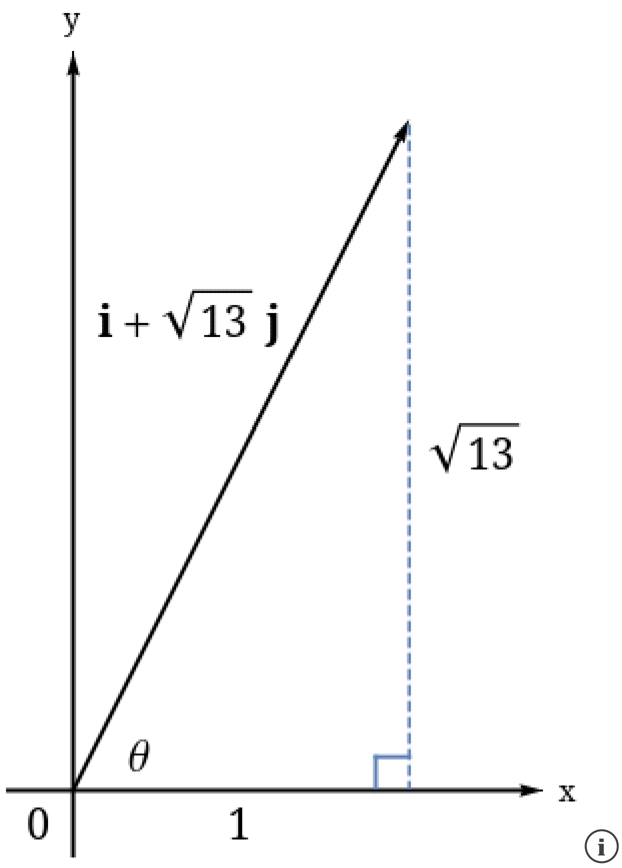
What is the angle between the given vector and the positive direction of the *x*-axis? (Round your answer to the nearest degree.)

$\mathbf{i} + \sqrt{13}\,\mathbf{j}$

[ ] ✕ 74 °

Solution or Explanation

From the figure, we see that $\tan(\theta) = \dfrac{\sqrt{13}}{1} = \sqrt{13} \Rightarrow \theta = \tan^{-1}\left(\sqrt{13}\right) \approx 74°$.



Resources

Watch It

17. [– / 1 Points]

DETAILS

SCalcET9M 12.2.029.

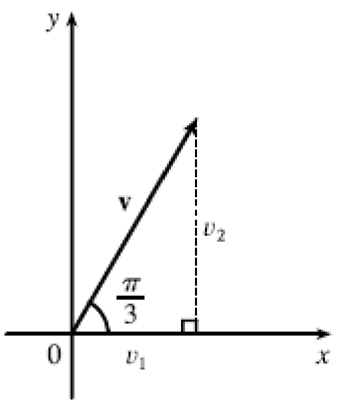
If **v** lies in the first quadrant and makes an angle $\frac{\pi}{3}$ with the positive x-axis and $|\mathbf{v}| = 6$, find **v** in component form.

v =

$\langle 3, 3\sqrt{3} \rangle$

Solution or Explanation

From the figure, we see that the x-component of **v** is $v_1 = |\mathbf{v}| \cos\left(\frac{\pi}{3}\right) = 6 \cdot \frac{1}{2} = 3$, and the y-component is $v_2 = |\mathbf{v}| \sin\left(\frac{\pi}{3}\right) = 6 \cdot \frac{\sqrt{3}}{2} = 3\sqrt{3}$. Thus, $\mathbf{v} = \langle v_1, v_2 \rangle = \langle 3, 3\sqrt{3} \rangle$.



Resources

Watch It

18. [– / 2 Points]

DETAILS

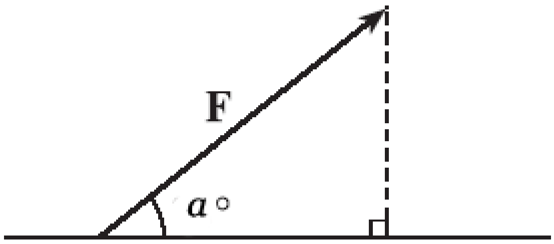
SCalcET9M 12.2.030.MI.

If a child pulls a sled through the snow on a level path with a force of 70 N exerted at an angle of 36° above the horizontal, find the horizontal and vertical components of the force. (Round your answers to one decimal place.)

horizontal	✗	56.6	N
vertical	✗	41.1	N

Solution or Explanation

From the figure, we see that the horizontal component of the force **F** is
$|\mathbf{F}|\cos(36°) = 70\cos(36°) \approx 56.6$ N, and the vertical component is $|\mathbf{F}|\sin(36°) = 70\sin(36°) \approx 41.1$ N.



Resources

Master It

19. [– / 5 Points]

DETAILS

SCalcET9M 12.2.030.MI.SA.

This question has several parts that must be completed sequentially. If you skip a part of the question, you will not receive any points for the skipped part, and you will not be able to come back to the skipped part.

Tutorial Exercise

If a child pulls a sled through the snow on a level path with a force of 40 N exerted at an angle of 43° above the horizontal, find the horizontal and vertical components of the force.

Click here to begin!