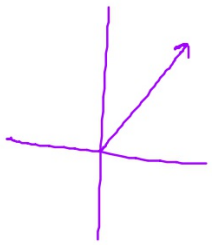
Given the following coordinates, find the component form, magnitude, and direction angle of each vector.

A(-3, -5) B(5, 1) C(-3, 11)

1. Vector AB

$\langle 5-(-3), 1-(-5) \rangle$

$\langle 8, 6 \rangle$



$\theta = \tan^{-1}\left(\frac{6}{8}\right)$

$\theta = 36.869°$

$|AB| = \sqrt{8^2+6^2} = \sqrt{100} = 10$

Given the following coordinates, find the component form, magnitude, and direction angle of each vector.

A(-3, -5) B(5, 1) C(-3, 11)

2. Vector BC

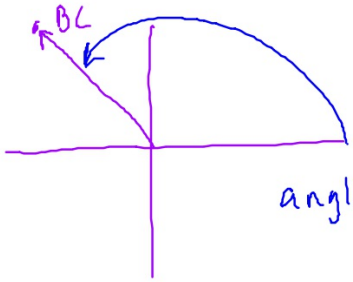
$\langle -3-5, 11-1 \rangle$

$\langle -8, 10 \rangle$

$|BC| = \sqrt{8^2 + 10^2} = \sqrt{164} \approx 12.806$

$\theta = \tan^{-1}\left(\frac{10}{-8}\right)$

$\theta = -51.340$

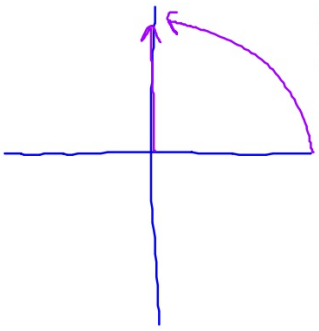


angle $= 180 - 51.340$

$= 128.659$

Given the following coordinates, find the component form, magnitude, and direction angle of each vector.

A(-3, -5) B(5, 1) C(-3, 11)



$|AC| = 16$

$\theta = 90^\circ$

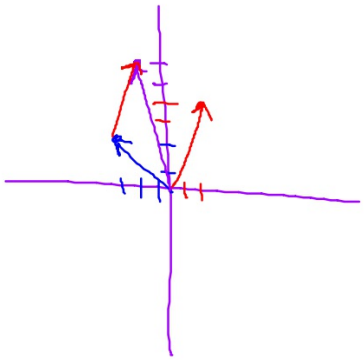
3. Vector AC

$\langle -3-(-3), 11-(-5) \rangle$

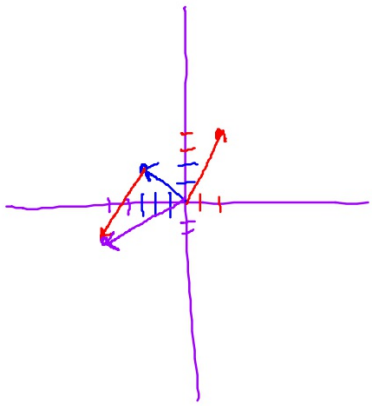
$\langle 0, 16 \rangle$

- Given $u = \langle -3,2 \rangle$ and $v = \langle 2,4 \rangle$
- Find the following and sketch the resultant vector

4. u + v = ⟨-1, 6⟩



5. u – v = ⟨-5, -2⟩



- Given $u = \langle -3,2 \rangle$ and $v = \langle 2,4 \rangle$

- Find the following.

6. 2u – 3v

$2u = \langle -6, 4 \rangle$

$3v = \langle 6, 12 \rangle$

$2u - 3v = \langle -12, -8 \rangle$

7. v + 4u

$v = \langle 2, 4 \rangle$

$4u = \langle -12, 8 \rangle$

$v + 4u = \langle -10, 12 \rangle$

Write the following in component form.

8. $8i + 6j$

$\langle 8, 6 \rangle$

9. $5i - 2j$

$\langle 5, -2 \rangle$

Write the following as a standard linear combination of **i** and **j**.

10. $u = \langle -3,2 \rangle$

$-3i + 2j$

11. $v = \langle 2,4 \rangle$

$2i + 4j$

Find a unit vector in the direction of the given vector. Write the result in component form and as a standard linear combination of **i** and **j**.

12. $u = \langle -3,2 \rangle$

$|u| = \sqrt{9+4} = \sqrt{13}$

$\left\langle \frac{-3}{\sqrt{13}}, \frac{2}{\sqrt{13}} \right\rangle$

$\frac{-3}{\sqrt{13}} i + \frac{2}{\sqrt{13}} j$

13. $v = \langle 2,4 \rangle$ $|v| = \sqrt{20}$

$\left\langle \frac{2}{\sqrt{20}}, \frac{4}{\sqrt{20}} \right\rangle$

$\frac{2}{\sqrt{20}} i + \frac{4}{\sqrt{20}} j$

Find the component form of v given its magnitude and the direction angle.

14. $|v| = 5 \quad \theta = 42^\circ$

$\langle 5\cos 42^\circ, 5\sin 42^\circ \rangle$

$\langle 3.715, 3.345 \rangle$

15. $|v| = 7 \quad \theta = 142^\circ$

$\langle 7\cos 142, 7\sin 142 \rangle$

$\langle -5.516, 4.309 \rangle$

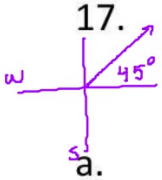
16. Forces with magnitudes of 2000 newtons and 900 newtons act on a machine part at angle of $\theta = 30^\circ$ and $\theta = -45^\circ$ respectively with the positive x-axis. Find the direction and magnitude of the resultant of these forces.

$\langle 2000\cos 30 + 900\cos(-45^\circ),\ 2000\sin 30 + 900\sin(-45)\rangle = F$

$2396.194 = |F|$

$8.727^\circ = \theta$

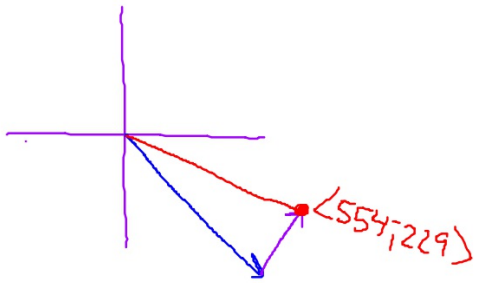
17. An airplane is flying in the direction 332° with an airspeed of 580 mph. The wind at the altitude of the plane, is blowing from the southwest with a velocity of 60 mph.



a. Draw a picture that gives a visual representation of the problem.

b. Fine the speed of the jet and the direction it is flying in.

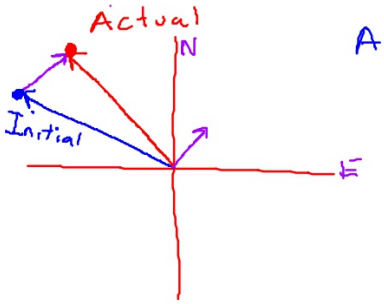
wind + plane = $\langle 580\cos 332 + 60\cos 45^\circ,\ 580\sin 332 + 60\sin 45^\circ \rangle$



mag ≈ 600.290 mph

angle ≈ 337.484

18. An airplane is flying in the direction 148° with an airspeed of 860 kmh. Because of the wind, its groundspeed and direction are, respectively, 800 kmh and 140°. Find the direction and speed of the wind.



Actual − Initial $= \langle 800\cos 140 - 860\cos 148,\ 800\sin 140 - 860\sin 148 \rangle$

130.35 km h

$\theta = 26.6^\circ$ from the Southwest

OR

$\theta = 26.6^\circ$ North East

Find the dot product of u and v and then find the angle between the 2 vectors u and v.

$u = \langle -3,2 \rangle \qquad v = \langle 2,4 \rangle$

$u \cdot v = (-3)(2) + (2)(4)$

$u \cdot v = -6 + 8$

$u \cdot v = 2$

$|u| = \sqrt{13}$

$|v| = \sqrt{20}$

$\theta = \cos^{-1}\left(\frac{u \cdot v}{|u|\,|v|}\right)$

$\theta = \cos^{-1}\left(\frac{2}{\sqrt{13}\sqrt{20}}\right)$

$\theta = 82.874^\circ$

Determine whether u and v are orthogonal, parallel or neither.

$$u = \langle 2,-2 \rangle \qquad v = \langle -1,-1 \rangle$$

$u \cdot v = (2)(-1) + (-2)(-1)$

$= -2 + 2$

$= 0$

orthogonal

Determine whether u and v are orthogonal, parallel or neither.

$u = \langle 2,4 \rangle \qquad v = \langle -3,-6 \rangle$ parallel

$u \cdot v = 2(-3) + 4(-6) \neq 0$

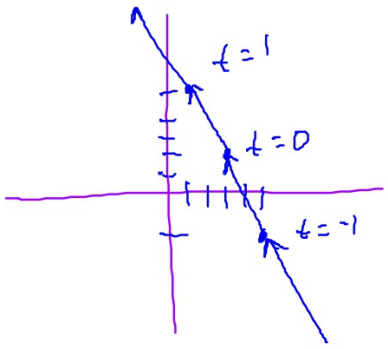
not orthogonal

slope of $u = \frac{4}{2}$ slope of $v = \frac{-6}{-3}$

Sketch the curve represented by the parametric equations. Then eliminate the parameter and write the corresponding rectangular equation whose graph represents the curve.

22. $x = 3 - 2t$ $y = 2 + 3t$

t	x	y
-1	5	-1
0	3	2
1	1	5



23. ~~$x = t + 2$ $y = t^2$~~

$x = 3 - 2t$

$\frac{x-3}{-2} = \frac{-2t}{-2}$

$\frac{x-3}{-2} = t$

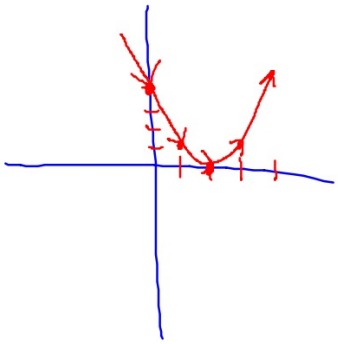
$y = 2 + 3t$

$y = 2 + 3\left(\frac{x-3}{-2}\right)$

Sketch the curve represented by the parametric equations. Then eliminate the parameter and write the corresponding rectangular equation whose graph represents the curve.

23. $x = t + 2 \quad y = t^2$

t	x	y
-2	0	4
-1	1	1
0	2	0
1	3	1
2	4	4



$x = t + 2 \quad y = t^2$

$x - 2 = t$

$y = (x-2)^2$

Find a set of parametric equation for the line

24. Passes through (2, -1) and (5, -2)

$t = 0$

$x = 2 + 3t \qquad y = -1 - t$

Find a set of parametric equation for the line segment

$t=0$ $t=1$

25. Endpoints (1, 4) and (5, -2)

$x = 1 + 4t \quad y = 4 - 6t \quad 0 \leq t \leq 1$

26. **Hitting a baseball**: Trevor Story, rookie shortstop of the Colorado Rockies, hits a baseball at 3 feet above the ground with an initial speed of 126ft/sec at angle of 29 degrees with the horizontal. Will the ball clear a 10 foot wall that is 375 feet away?

$x = 126t\cos 29$

$\frac{375}{126\cos 29} = \frac{126t\cos 29}{126\cos 29}$

$3.402 = t$

$y = -16t^2 + 126t\sin 29 + 3$

$y = 25.596$ ft

yes it will

HR

27. The men's horseshoe pitching court has metal stakes 45 feet apart. The stakes stand 18 inches out of the ground.

a. Alan pitches a horseshoe at 50 feet per second, at a 15 degree angle to the ground. He releases the horseshoe at about 2.5 feet above the ground and 1.75 feet in front of the stake at one end. Write parametric equations modeling a typical throw.

$x = 50t\cos 15 + 1.75\ ft$ $\quad y = -16t^2 + 50t\sin 15 + 2.5$

27. The men's horseshoe pitching court has metal stakes 45 feet apart. The stakes stand 18 inches out of the ground.

Alan pitches a horseshoe at 50 feet per second, at a 15 degree angle to the ground. He releases the horseshoe at about 2.5 feet above the ground and 1.75 feet in front of the stake at one end.

b. How long is the thrown horseshoe in the air?

$0 = -16t^2 + 50t \sin 15 + 2.5$

$t = .969 \text{ sec}$

27. The men's horseshoe pitching court has metal stakes 45 feet apart. The stakes stand 18 inches out of the ground.

Alan pitches a horseshoe at 50 feet per second, at a 15 degree angle to the ground. He releases the horseshoe at about 2.5 feet above the ground and 1.75 feet in front of the stake at one end.

c. How close to 45 ft is the horizontal component when the horseshoe hits the ground?

$x = 50t \cos 15 + 1.75$

$x = 48.59$

3 1/2 ft away

27. The men's horseshoe pitching court has metal stakes 45 feet apart. The stakes stand 18 inches out of the ground.

Alan pitches a horseshoe at 50 feet per second, at a 15 degree angle to the ground. He releases the horseshoe at about 2.5 feet above the ground and 1.75 feet in front of the stake at one end.

d. How far in the horizontal direction is the horseshoe when the horseshoe is 1.5 feet above the ground?

$t = .879$

$1.5 = -16t^2 + 50t\sin 15 + 2.5$

$-1.5 \qquad -1.5$

$0 = -16t^2 + 50t\sin 15 + 1$

$X = 44.24$ ft