

The Distance from a Point to a Line

The distance from the point (x_1, y_1) and the line whose equation is $Ax + By + C = 0$ is

$$\frac{|Ax_1 + By_1 + C|}{\sqrt{A^2 + B^2}}$$

Directions: Determine the distance in each problem below.

1. From $(2,1)$ to the line $3x + 4y + 8 = 0$
2. From $(-2,3)$ to the line $5x + 12y + 2 = 0$
3. From $(4,-1)$ to the line $x - 2y + 8 = 0$
4. From $(0,5)$ to the line $2x - 3y - 7 = 0$
5. From $(-3,-4)$ to the line $4x - y + 6 = 0$
6. From $(0,0)$ to the line $5x + 4y - 10 = 0$

Parametric Modeling Problems

Use the parametric equations $x = (v_o \cos \theta)t$
 $y = -16t^2 + (v_o \sin \theta)t + y_o$ to solve the following problems.

1. The left-field fence at a baseball park is 400 feet from home plate and 8 feet high. A baseball is hit from 2 feet high with an initial velocity of 150 feet per second at an angle of 25 degrees with the horizontal.
 - a. Write a set of parametric equations that model the path of the baseball.
 - b. Is the hit a home run? Justify your answer.

2. An arrow is shot from a bow 4 feet above the ground at an angle of 10 degrees with the horizontal with an initial velocity of 250 feet per second.
 - a. Write a set of parametric equations that model the path of the arrow.
 - b. Find the amount of time that the arrow is in the air.
 - c. Find the horizontal distance that the arrow travels before it hits the ground.
 - d. What is the maximum height of the arrow?

3. A golfer hits a ball with an initial velocity of 150 feet per second at an angle of 31 degrees with the horizontal.
 - a. Write a set of parametric equations that model the path of the golf ball.
 - b. If the ball travels between 200 and 220 yards, it will land on the green. Does the ball land on the green? Justify your answer.

4. Another golfer needs to hit over a tree that is 30 feet high and 100 yards away. He hits the ball with an initial velocity of 120 feet per second at an angle of 28 degrees with the horizontal. Does the ball go over the tree? Justify your answer.

5. Jack throws a ball off of the roof of a building 300 feet high with an initial speed of 100 feet per second at an angle of 45 degrees with the horizontal.
 - a. Write a set of parametric equations that model the path of the ball.
 - b. How long is the ball in the air?
 - c. Determine the horizontal distance that the ball has traveled when it hits the ground.
 - d. Determine the maximum height of the ball.

Name _____

Systems of Polar Equations

Graph each system of polar equations. Solve the system using algebra and trigonometry.
Assume $0 \leq \theta < 2\pi$.

1. $r = 3$
 $r = 2 + \cos \theta$

2. $r = 1 + \cos \theta$
 $r = 1 - \cos \theta$

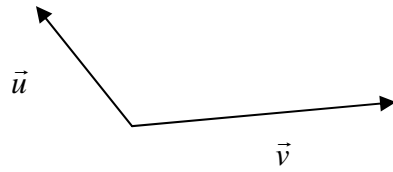
3. $r = 2 \sin \theta$
 $r = 2 \sin 2\theta$

Name _____

Cross-Products

Complete:

1. The cross product of two vectors \vec{u} and \vec{v} is a _____ that is _____ to both \vec{u} and \vec{v} .
2. The magnitude of the cross product of \vec{u} and \vec{v} is equal to the _____ of the parallelogram with vectors \vec{u} and \vec{v} as adjacent sides.
3. Explain the right-hand rule as it relates to the cross-product of two vectors.
4. Look at the two vectors below.



Lay the paper flat on your desk. Does the vector $\vec{u} \times \vec{v}$ point towards the ceiling, or towards the floor? Explain your answer.

Determine the cross products of the following vectors:

5. $(2\vec{i} + 3\vec{j} + \vec{k}) \times (\vec{i} + \vec{j} + 4\vec{k})$
6. $(3\vec{i} + \vec{j} - \vec{k}) \times (2\vec{i} + 2\vec{j} + 5\vec{k})$
7. $(\vec{i} - \vec{j} - \vec{k}) \times (2\vec{i} - 3\vec{j} - 4\vec{k})$

Determine the area of each triangle with the following sets of vertices.

8. $(3, 7, 5)$, $(4, 9, 7)$, and $(2, 4, 9)$
9. $(0, 2, 4)$, $(3, 2, 5)$, and $(2, 1, 1)$

Name _____

Vectors

In exercises # 1 – 3, determine whether \overrightarrow{AB} and \overrightarrow{CD} are equivalent vectors. Justify your answer.

1. $A(2,5), B(4,8), C(-1,3), D(1,6)$

2. $A(5,1), B(4,-4), C(0,3), D(-1,-2)$

3. $A(-2,2), B(-6,-7), C(3,-1), D(-12,-5)$

In exercises 4 – 8, let $A(1,5), B(4,1), C(-1,4), D(3,6)$. Find the component form and magnitude of each vector.

4. \overrightarrow{AB}

5. \overrightarrow{BC}

6. \overrightarrow{CA}

7. $3\overrightarrow{BD}$

8. $2\overrightarrow{AD} - 5\overrightarrow{AB}$

In exercises 9 – 13, let $\vec{u} = \langle 2, 6 \rangle$, $\vec{v} = \langle -1, 2 \rangle$, and $\vec{w} = \langle 5, -2 \rangle$. Find the component form of each vector.

9. $\vec{u} + \vec{v}$

10. $\vec{v} - \vec{w}$

11. $2\vec{u} + 3\vec{w}$

12. $4\vec{v} - \vec{w}$

13. $-\vec{u} - \vec{v} + \vec{w}$

In exercises 14 – 17, find a unit vector in the same direction as the given vector.

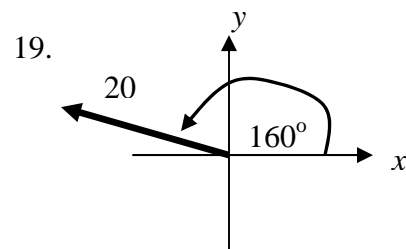
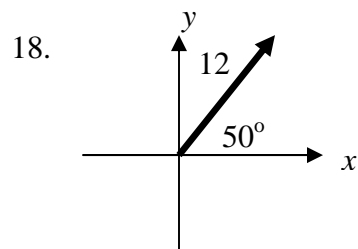
14. $\langle 3, 4 \rangle$

15. $\langle -1, 5 \rangle$

16. $5\vec{i} - 12\vec{j}$

17. $-\vec{i} + \vec{j}$

In exercises 18 – 19, find the component form of the vector shown.



In exercises 20 – 23, find the magnitude and direction of the vector.

20. $\langle 6, 8 \rangle$

21. $\langle -2, 5 \rangle$

22. $5\vec{i} - 3\vec{j}$

23. $-7\vec{i} - 24\vec{j}$

24. Find a vector with the same direction as $\langle -3, 4 \rangle$ with magnitude 20.25. An airplane is flying at a bearing of 200° at a speed of 500 mph. Find the component form of the velocity of the plane.26. An airplane is flying on a compass heading (bearing) of 300° at 400 mph. A wind is blowing from the southwest at 100 mph. Find the actual ground speed and direction of the plane.

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