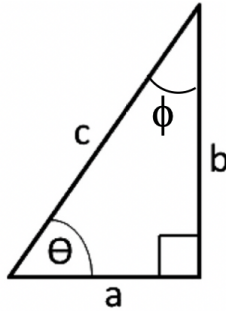


Name \_\_\_\_\_

1. Make a prediction: Two identical balls are placed at the same height above the ground. One ball is dropped from rest, while the other one is launched horizontally at the same time. Which one will reach the ground first? Why?

**A:** Ball dropped from rest, **B:** Ball launched horizontally, **C:** Both will hit ground at same time



For the triangle on the left, what is...

$$\sin(\theta) =$$

$$\sin(\phi) =$$

$$\cos(\theta) =$$

$$\cos(\phi) =$$

$$\tan(\theta) =$$

$$\tan(\phi) =$$

- 2.
- Find an expression for  $c$ , if you know  $a$  and  $b$ :
  - Find an expression for  $c$ , if you know  $a$  and  $\phi$ :
  - Find an expression for  $b$ , if you know  $c$  and  $\theta$ :
  - Find an expression for  $\theta$ , if you know  $a$  and  $b$ :
  - If  $a = 2$  and  $b = 3$ , what is  $c$ ?  
What is  $\theta$ ?
3. You are hiking in the flat desert and see on the map a small oasis located  $5\text{ km}$  due East and  $2\text{ km}$  due South of your current position. How far will you have to walk to get there on the shortest path, i.e. what is your displacement? In which direction should you head? Express as an angle measured South of East.

Note: The magnitude of a vector is **always** the "length" of the hypotenuse (not always a distance, could be a speed, acceleration, Force, etc)

4. Suppose you are driving in the city and you need to get from your apartment to the hospital. The hospital is 2.4 miles away from your apartment in a direction  $20^\circ$  North of West. How far West should you drive and how far North should you drive to get there in the shortest time?

5. An object has a velocity of  $3m/s$  and is headed in a direction  $32^\circ$  above the - x axis. What is the magnitude of the velocity vector?  
What is the x-component of the velocity?

What is the y-component of the velocity?

6. If the components of the velocity of an object are  $v_x = +1.4m/s$  and  $v_y = -3m/s$ , what is the speed of the object (magnitude of velocity)?

In which direction is the object moving? (Specify an angle)

7. The acceleration due to gravity is a vector that always points down (towards the center of the Earth). If we choose up to be the +y axis and right to be the +x axis, what are the x and y components of the acceleration of any falling object? **A:**  $+9m/s^2$  **B:**  $-9m/s^2$  **C:**  $0m/s^2$  **D:** Depends on situation

x component:

y component:

8. If an object is launched horizontally with speed of  $+5m/s$  to the right, what are the x and y components of the initial velocity?

What is the magnitude of the initial velocity?