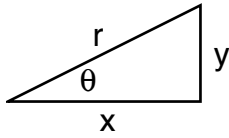


Vector Concepts (Trig)

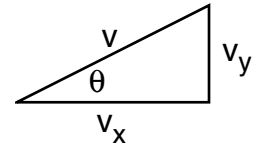
The diagrams below shows right triangles, one representing position and the other representing velocity.



For each picture, what is the Pythagorean Theorem?

What is the sine of θ ?

What is the cosine of θ ?



In terms of the hypoteneuse and the angles shown above, what are x & y and v_x & v_y ?

x =

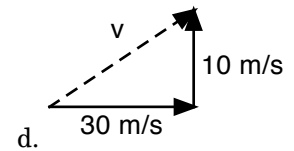
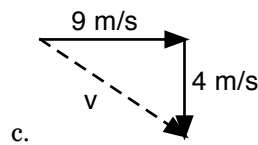
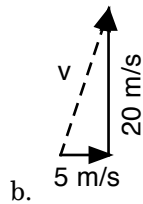
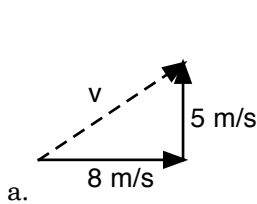
y =

v_x =

v_y =

Questions

1. Use the Pythagorean Theorem to find the speeds of the following velocity vectors:

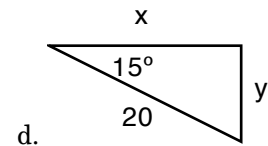
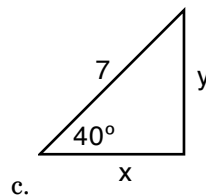
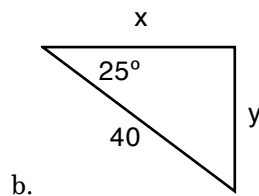
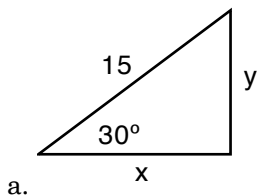


2. You are given the horizontal and vertical components of different velocity vectors. Find the resultant speed:

a. $v_x = 7 \text{ m/s}$ $v_y = 5 \text{ m/s}$ $v = \underline{\hspace{2cm}}$ b. $v_x = 15 \text{ m/s}$ $v_y = 8 \text{ m/s}$ $v = \underline{\hspace{2cm}}$

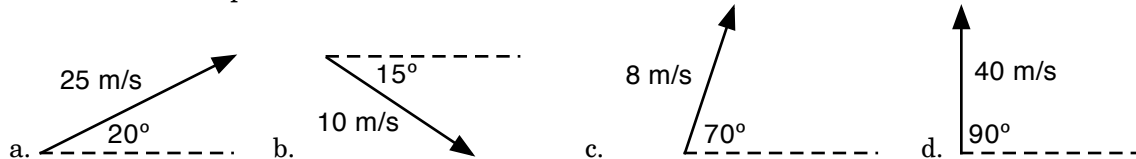
c. $v_x = 20 \text{ m/s}$ $v_y = 25 \text{ m/s}$ $v = \underline{\hspace{2cm}}$ d. $v_x = 10 \text{ m/s}$ $v_y = -15 \text{ m/s}$ $v = \underline{\hspace{2cm}}$

3. For each of the triangles shown, calculate the sides of the right triangles, given the hypoteneuse and angle:



Vector Concepts (Trig)

4. Calculate the components of each of the velocities shown:



5. Calculate the components of the given velocities:

 a. A ball is kicked with a velocity of 30 m/s at an angle of 35° above the horizontal.

$$v_x = \text{_____ m/s} \qquad v_y = \text{_____ m/s}$$

 b. A pen is tossed with an initial velocity of 5 m/s at an angle of 65° above the horizontal.

$$v_x = \text{_____ m/s} \qquad v_y = \text{_____ m/s}$$

 c. A projectile hits the ground with a velocity of 25 m/s at an angle of 40° below the horizontal.

$$v_x = \text{_____ m/s} \qquad v_y = \text{_____ m/s}$$

 d. A block of ice slides off a roof with an initial velocity of 9 m/s at an angle of 30° below the horizontal.

$$v_x = \text{_____ m/s} \qquad v_y = \text{_____ m/s}$$

e. A ball rolls horizontally off a table with a speed of 8 m/s.

$$v_x = \text{_____ m/s} \qquad v_y = \text{_____ m/s}$$

 f. A soccer ball in the air has a velocity of 32 m/s at an angle of 25° above the horizontal.

$$v_x = \text{_____ m/s} \qquad v_y = \text{_____ m/s}$$

g. A pen is thrown straight up in the air with an initial velocity of 18 m/s.

$$v_x = \text{_____ m/s} \qquad v_y = \text{_____ m/s}$$

 h. A bullet is fired with an initial velocity of 400 m/s at an angle of 15° above the horizontal.

$$v_x = \text{_____ m/s} \qquad v_y = \text{_____ m/s}$$

Answers: 1. a) 9.43 m/s b) 20.6 m/s c) 9.85 m/s d) 31.6 m/s 2. a) 8.6 m/s b) 17 m/s
 c) 32 m/s d) 18 m/s 3. a) $x=13, y=7.5$ b) $x=36.3, y=-16.9$ c) $x=5.36, y=4.5$ d) $x=19.3, y=-5.18$
 4. a) $v_x=23.5, v_y=8.55$ b) $v_x=9.66, v_y=-2.59$ c) $v_x=2.74, v_y=7.52$ d) $v_x=0, v_y=40$
 5. a) $v_x=24.6, v_y=17.2$ b) $v_x=2.11, v_y=4.53$ c) $v_x=19.2, v_y=-16.1$ d) $v_x=7.79, v_y=-4.5$
 e) $v_x=8, v_y=0$ f) $v_x=29, v_y=13.5$ g) $v_x=0, v_y=18$ h) $v_x=386, v_y=104$