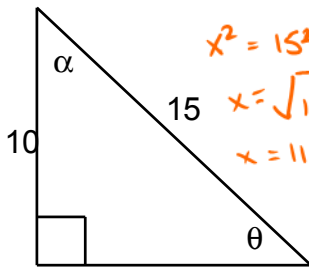


# Physics 11 - Trigonometry Review and Vector Addition Worksheet

1. Solve the following triangles using SOH – CAH - TOA and Pythagoras



$$x^2 = 15^2 - 10^2$$

$$x = \sqrt{15^2 - 10^2}$$

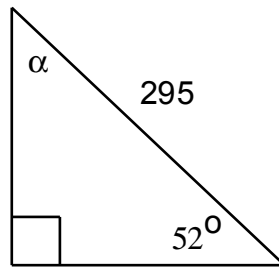
$$x = 11.2$$

$$\sin(\theta) = \frac{10}{15}$$

$$\theta = \sin^{-1}\left(\frac{10}{15}\right) = 41.8^\circ$$

$$\cos(\alpha) = \frac{10}{15}$$

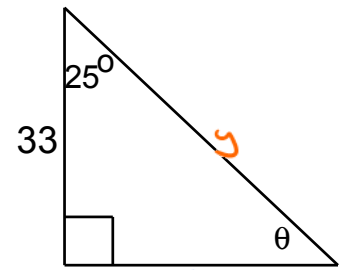
$$\alpha = \cos^{-1}\left(\frac{10}{15}\right) = 48.2^\circ$$



$$\alpha = 180^\circ - 90^\circ - 52^\circ = 38^\circ$$

$$\cos(52^\circ) = \frac{x}{295} \Rightarrow x = 182$$

$$\sin(52^\circ) = \frac{y}{295} \Rightarrow y = 232$$

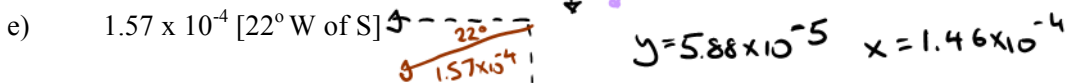
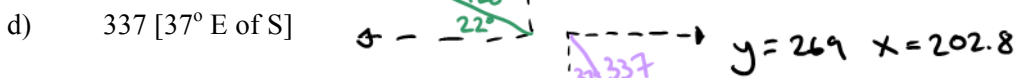


$$\theta = 180^\circ - 90^\circ - 25^\circ = 65^\circ$$

$$\tan(25^\circ) = \frac{x}{33} \Rightarrow x = 15.4$$

$$\cos(25^\circ) = \frac{33}{y} \Rightarrow y = 36.4$$

2. Convert the following vectors to x and y components



3. Convert the following x and y components to vectors

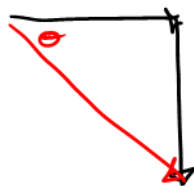
$$r^2 = x^2 + y^2$$

a) x: 3.4 y: 2.7



4.34 @ 38.5° N of E

b) x: 5.6 y: -7.1



9.0 @ 51.7° S of E

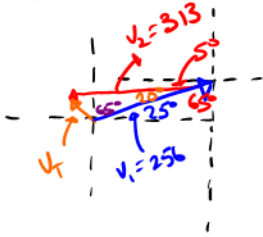
c) x: -211 y: -44.0



215 @ 11.8° S of W

4. Add the following vectors using the trig method OR the components method

a)  $256 [25^\circ \text{ N of E}] + 313 [5^\circ \text{ S of W}]$



$$c^2 = a^2 + b^2 - 2ab \cos(C)$$

$$c = \sqrt{256^2 + 313^2 - 2(256)(313)\cos(20^\circ)}$$

$$v_r = 114$$

$$\frac{\sin \theta}{313} = \frac{\sin(20^\circ)}{114} \Rightarrow \theta = \sin^{-1}\left(\frac{313}{114} \sin(20^\circ)\right) = 70^\circ$$

$$\therefore \text{head} = 70.4^\circ - 65^\circ = 5.4^\circ$$

$$v_r = 114 @ 5.4^\circ \text{ W of N}$$

b)  $1.56 \times 10^4 [35^\circ \text{ W of N}] + 8.82 \times 10^3 [72^\circ \text{ W of S}] + 3.33 \times 10^4 [27^\circ \text{ S of W}]$  → 3 vectors must use component method!

$y = +1.28 \times 10^4$   
 $x = -8.95 \times 10^3$   
 $\sum y = y_1 + y_2 + y_3 = -5030$  ;  $\sum x = x_1 + x_2 + x_3 = -30260$

$y = -2.73 \times 10^3$   
 $x = -8.39 \times 10^3$

$y = -1.51 \times 10^4$   
 $x = -2.97 \times 10^4$

$v_r = 3.07 \times 10^4 @ 9.4^\circ \text{ S of W}$

5. A sailboat is heading  $35^\circ$  East of North at 7.2 knots. The ocean current is  $25^\circ$  South of East at 1.2 knots. What speed and direction is the sailboat tracking? (Find the answer using the add components method)

$y = 5.9$   
 $x = 4.1$   
 $\sum y = 5.4$   
 $\sum x = 5.2$

$y = -0.51$   
 $x = 1.09$

$v_r = \sqrt{5.4^2 + 5.2^2}$   
 $v_r = 7.5 \text{ knots}$   
 $\theta = \tan^{-1}\left(\frac{5.4}{5.2}\right) = 46.1^\circ$   
 $7.5 \text{ knots @ } 46.1^\circ \text{ N of E}$

6. A B747 is crossing the Pacific at 420 knots on a heading of  $44^\circ$  S of W. Air Traffic Control radar is tracking the plane at 470 knots  $[49^\circ \text{ S of W}]$ . What is the wind speed and direction?

$\theta = 44^\circ + 41^\circ + 9^\circ = 175^\circ$

$v_r^2 = v_1^2 + v_2^2 - 2v_1v_2 \cos(\theta)$   
 $v_r = \sqrt{(420)^2 + (470)^2 - 2(420)(470)\cos(175^\circ)}$   
 $v_r = 889 \text{ knots}$

$\frac{\sin x}{470} = \frac{\sin 175}{889} \Rightarrow x = \sin^{-1}\left(\frac{470}{889} \sin(175)\right) = 2.6^\circ$   
 $889 \text{ knots @ } 46.6^\circ \text{ S of W}$