

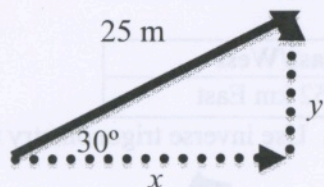
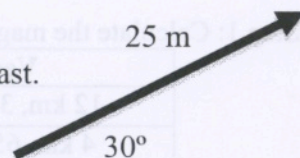
Name: KEY
 ACP Physics – Vector Components

Part 1: Finding Components of a Vector

A two-dimensional vector can be broken down into two perpendicular components that are each one-dimensional using trigonometry.

Example:

Find the “east” and “north” components of a 25 m vector directed 30° north of east.

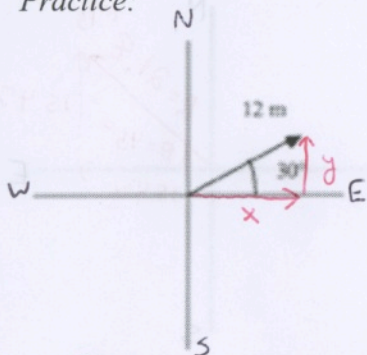


- Step 1: Draw the perpendicular component vectors (forming right triangle)
- Step 2: Use SOH-CAH-TOA to determine the unknown sides
- Step 3: Determine directions of components from diagram

$$\sin 30^\circ = \frac{y}{25\text{m}} \rightarrow y = (25\text{m})\sin 30^\circ = 12.5\text{m NORTH}$$

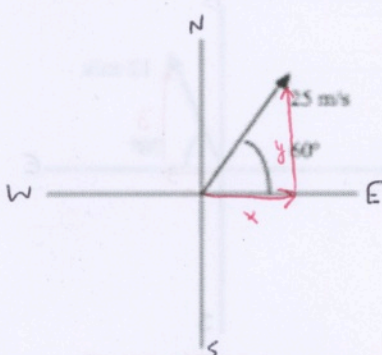
$$\cos 30^\circ = \frac{x}{25\text{m}} \rightarrow x = (25\text{m})\cos 30^\circ = 21.7\text{m EAST}$$

Practice:



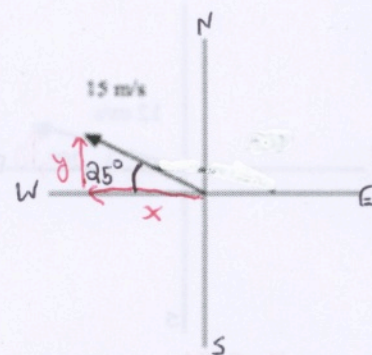
$$x = (12\text{m})\cos 30^\circ = 10.4\text{m EAST}$$

$$y = (12\text{m})\sin 30^\circ = 6\text{m NORTH}$$



$$x = (25\text{m/s})\cos 60^\circ = 12.5\text{m/s EAST}$$

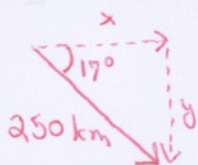
$$y = (25\text{m/s})\sin 60^\circ = 21.7\text{m/s NORTH}$$



$$x = (15\text{m/s})\cos 25^\circ = 13.6\text{m/s WEST}$$

$$y = (15\text{m/s})\sin 25^\circ = 6.34\text{m/s NORTH}$$

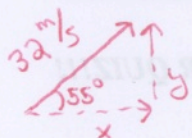
• A plane flies 250 km in the direction 17° South of East. Determine how far South and how far East it has flown.



$$x = (250\text{km})\cos 17^\circ = 239\text{km EAST}$$

$$y = (250\text{km})\sin 17^\circ = 73.1\text{km SOUTH}$$

• A car travels with a velocity of 32 m/s in the direction 55° North of East. Determine the North and East components of its velocity.



$$x = (32\text{m/s})\cos 55^\circ = 18.4\text{m/s EAST}$$

$$y = (32\text{m/s})\sin 55^\circ = 26.2\text{m/s NORTH}$$

Part 2: Adding Vectors using Components

Adding vectors that are perpendicular to each other is easy using the Pythagorean theorem. If two vectors are NOT perpendicular to each other, they can be added using vector components.

Example:

A hiker travels 12 km at an angle of 35° North of East, and then 4 km at an angle of 65° North of East. What is his net (overall) displacement?

- Step 1: Calculate the magnitude and direction of the components of each vector.

Vector	North/South	East/West
12 km, 35° N of E	6.88 km North	9.83 km East
4 km, 65° N of E	3.63 km North	1.69 km East

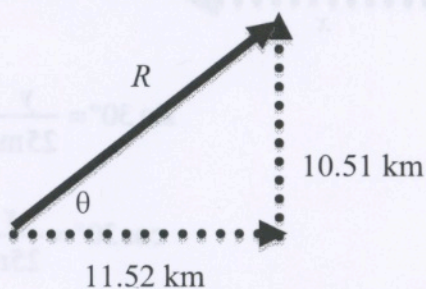
- Step 2: Combine (add) the North/South vectors. Combine (add) the East/West vectors. These are the components of the Resultant vector.

Vector	North/South	East/West
Resultant	10.51 km North	11.52 km East

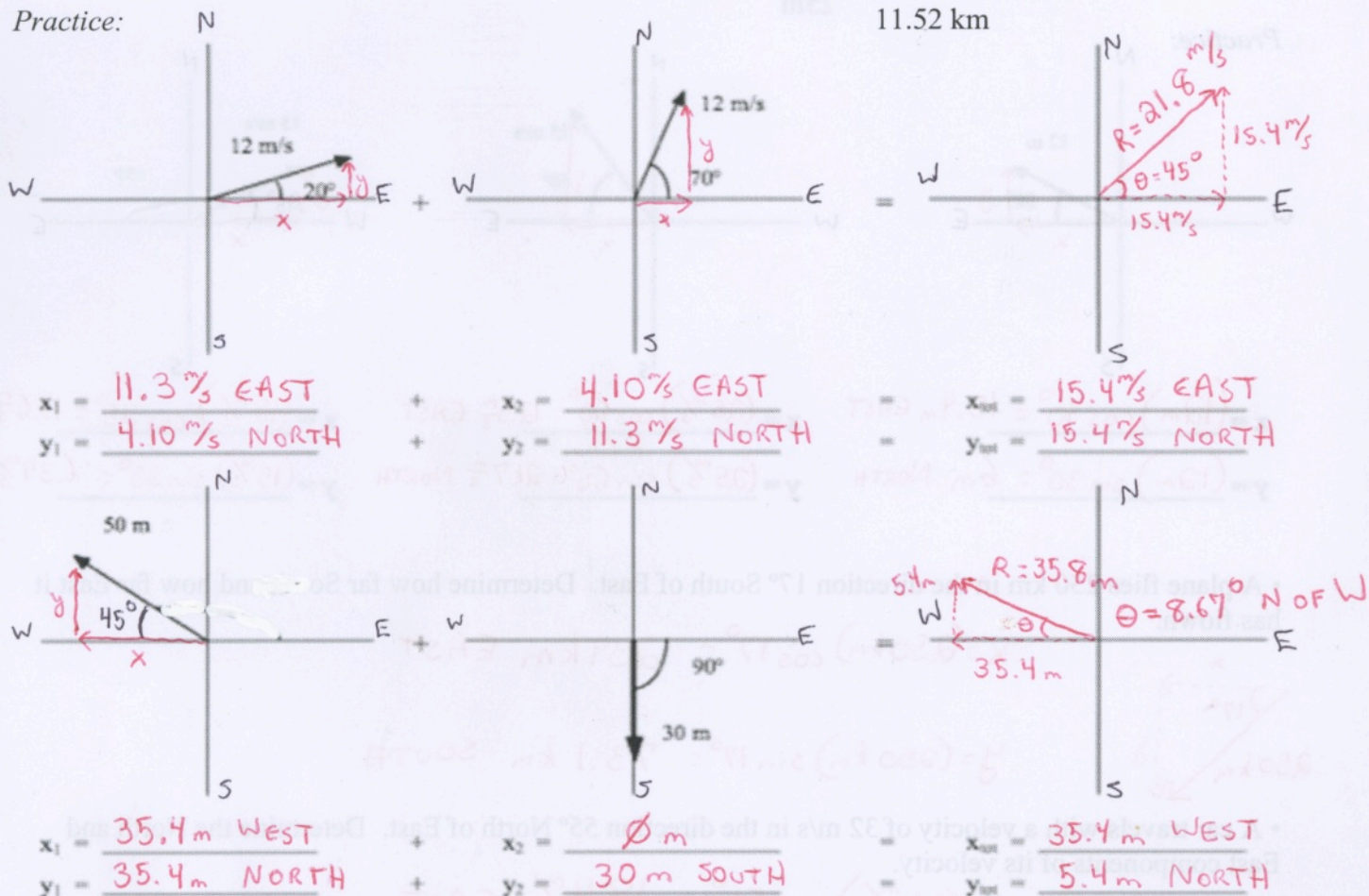
- Step 3: Use the Pythagorean theorem to determine the magnitude of the Resultant. Use inverse trigonometry to determine the direction of the resultant.

$$R = \sqrt{(10.51\text{km})^2 + (11.52\text{km})^2} = 15.6\text{km}$$

$$\tan\theta = \frac{10.51}{11.52} \rightarrow \theta = \tan^{-1}\left(\frac{10.51}{11.52}\right) = 42.4^\circ \text{ N of E}$$



Practice:



ANSWER KEY IS POSTED ON MY WEBSITE (UNDER HANDOUTS). REVIEW FOR QUIZ!!!