

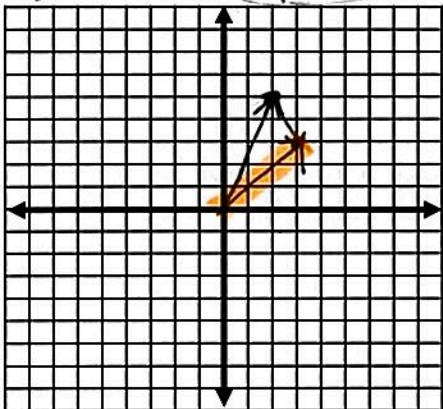
6.3 (Day 2) Geometric Representation of Vectors

Vector addition: graphically:

Let $\mathbf{u} = \langle 2, 5 \rangle$ and $\mathbf{v} = \langle 1, -2 \rangle$. Find each of the following vectors.

A) $\mathbf{u} + \mathbf{v}$

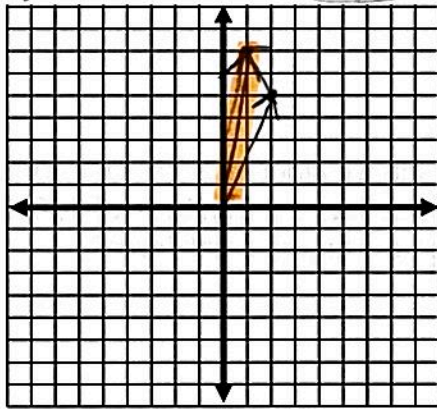
$\langle 3, 3 \rangle$



B) $\mathbf{u} - \mathbf{v}$

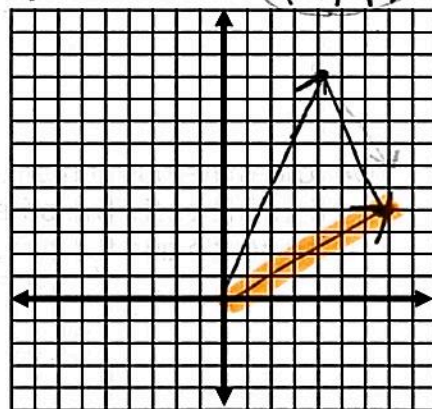
$\langle -1, 2 \rangle$

$\langle 1, 7 \rangle$



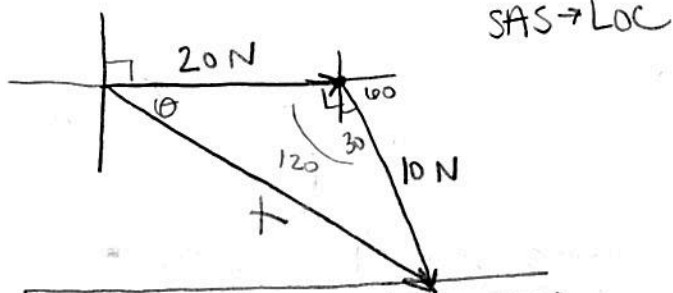
C) $2\mathbf{u} + 3\mathbf{v}$

$\langle 7, 4 \rangle$



Situation Examples:

- Make a scale drawing showing a force of 20 N (newtons) pulling an object east and another force of 10 N pulling the object in the compass direction 150° . Draw the resultant force vector and use your drawing to find the magnitude and direction of the resultant vector



$$X = \sqrt{20^2 + 10^2 - 2(20)(10)\cos 120^\circ}$$

$$X = 26.457 \text{ N}$$

$$\frac{\sin 120}{26.457} = \frac{\sin \theta}{10}$$

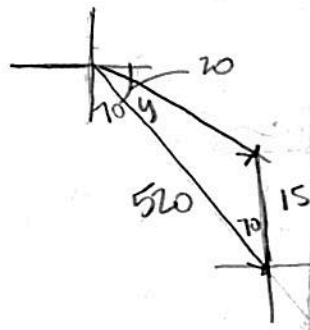
$$\theta = \sin^{-1}\left(\frac{10\sin 120}{26.457}\right)$$

$$\theta = 19.106 + 90$$

$$109.106^\circ$$

- The airspeed of a plane is 520 mph and its heading is 110° . The wind is blowing from the south 15 mph. Find the speed and course of the plane.

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$$X = \sqrt{520^2 + 15^2 - 2(520)(15)\cos 70^\circ}$$

$$X = 515.002$$

$$\frac{\sin 70}{515.002} = \frac{\sin y}{15}$$

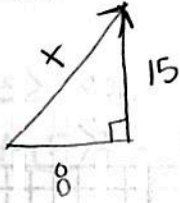
$$y = \sin^{-1}\left(\frac{15\sin 70}{515.002}\right)$$

$$y = 1.568$$

$$20 - 1.568 = 18.432 + 90$$

$$108.432^\circ$$

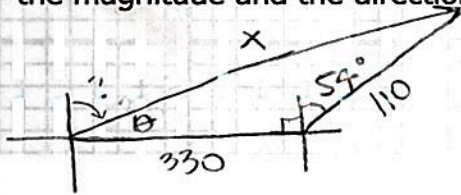
3. Forces of 8.0 lb and 15 lb act on a body at right angles. Find the magnitude of the resultant force.



$$\|\vec{x}\| = \sqrt{8^2 + 15^2}$$

$$\|\vec{x}\| = \boxed{17}$$

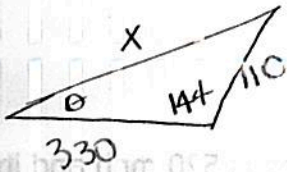
4. Two forces are pushing an ice shanty along the ice. One force has a magnitude of 330 lb in a direction due east. The other force has a magnitude of 110 lb in a direction N54°E. What are the magnitude and the direction of the resultant force?



$$\frac{\sin 144}{423.951} = \frac{\sin \theta}{110}$$

$$\theta = \sin^{-1} \left(\frac{110 \sin 144}{423.951} \right)$$

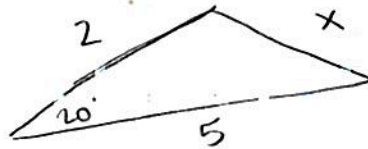
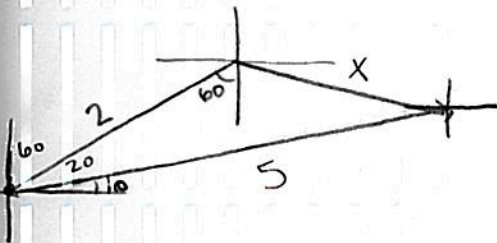
$$\theta = 8.772$$



$$x = \sqrt{330^2 + 110^2 - 2(330)(110) \cos 144}$$

$$x = \boxed{423.951 \text{ lbs}}$$

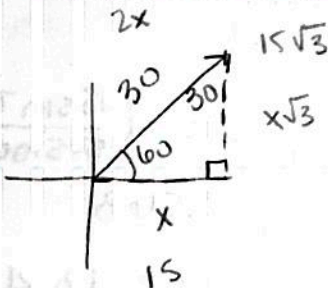
5. A long distance swimmer starts out swimming a steady 2 miles per hour at S60°W. A 5 mile per hour current is flowing at a heading of 80°. What is the swimmer's resultant velocity?



$$x = \sqrt{2^2 + 5^2 - 2(2)(5) \cos 20}$$

$$x = \boxed{3.194 \text{ mph}}$$

6. A 30 pound force is applied to an object at an angle of 60° with the horizontal. Find the magnitude of the horizontal and vertical components of the force.



$$\boxed{\langle 15, 15\sqrt{3} \rangle}$$

Horiz.

vert.