Physics Lecture #7: Drawing Vector Diagrams

A scalar quantity is just a size or magnitude.

Examples of scalar quantities:
10 m/s 20 lbs of pressure.

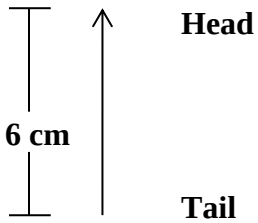
A vector has both size and direction.

Examples of vectors:
10 m/s west 20 lbs of pressure pushing down

Speed is a scalar quantity. 10 m/s is a scalar quantity because it tells us how fast an object moves but not its direction.

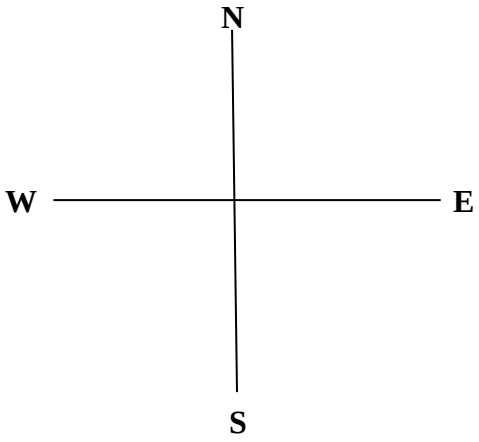
Velocity has both speed and direction, so it is a vector. 10 m/s west gives a speed of 10 m/s and a direction of west.

We use arrows to represent vectors. For example, suppose we were to draw an arrow representing a vector of 6 miles north.

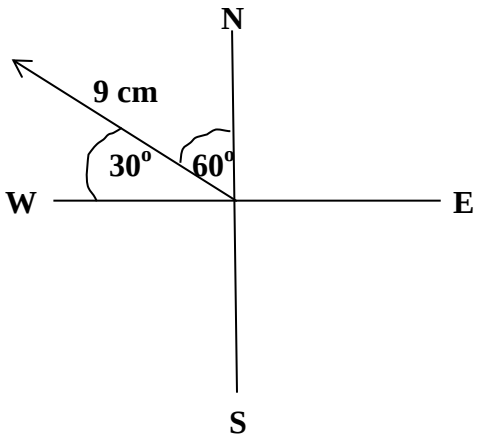


The tip of the arrow is the head, and the other end of the arrow is the tail. The arrow points up to indicate that the vector is pointing north. We make the arrow 6 cm long to represent a scalar quantity of 6 miles.

Suppose we want to draw a vector to represent a velocity of 90 m/s in a direction 30 degrees north of west. We draw x and y axis and label them with compass headings.



"30 degrees north of west" can be read as "30 degrees above the west axis." So draw a line starting at the origin of the graph, and have it point 30 degrees above west axis. To represent 90 m/s we can draw the line 9 cm long.



This vector is pointing 30 degrees north of west.

It is also pointing 60 degrees west of north.

Incidentally, "30 degrees north of west" can also be expressed as "60 degrees west of north." This is because the angle between the west axis and the north axis is 90 degrees, and 30 + 60 = 90.

We can solve problems by drawing vectors and adding them together.

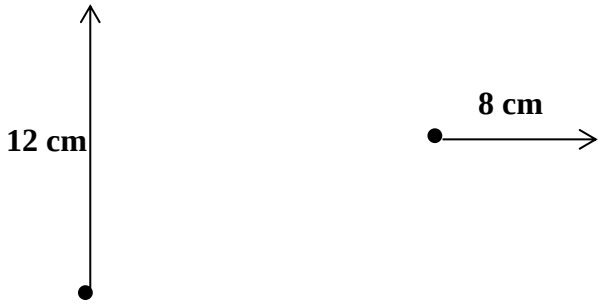
Rules for drawing and adding vectors

1. **Draw the first vector. Put a big dot at the tail.**
2. **Place the tail of the 2nd vector at the head of the first vector.**
3. **Draw a line from the tail of the 1st to the head of the second.**

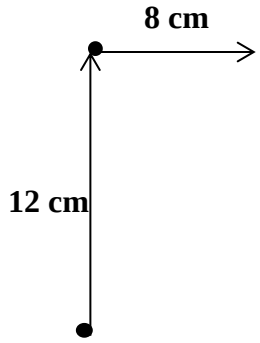
A man walks 12.0 m north, then 8.0 m east. Find his displacement and direction.

Solution

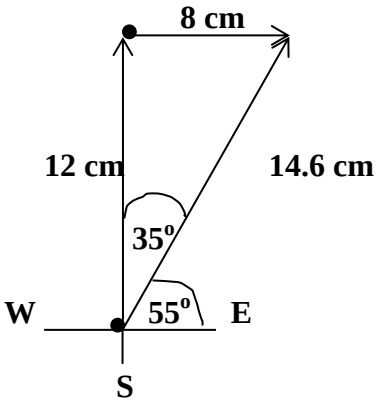
We'll draw a 12 cm line pointing north to represent the first vector. The second vector can be represented by an 8 cm line pointing to the east.



We then place the tail of the 2nd vector at the head of the first vector.



Finally, draw a line from the tail of the first vector to the head of the second vector.



The final line drawn is called the resultant. If you measure the length of the resultant, it would be 14.6 cm. Converted to meters, we would call it 14.6 m. Thus, the man's displacement is 14.6 m.

If we make the tail of the 1st vector the origin of the graph, we see that the resultant points 35° to the right of north, or 35° east of north. It also points 55° north of east.

Thus, the resultant vector is 14.6 m, 35° east of north.