Vectors

How we deal with forces in 2 dimensions.

Vectors

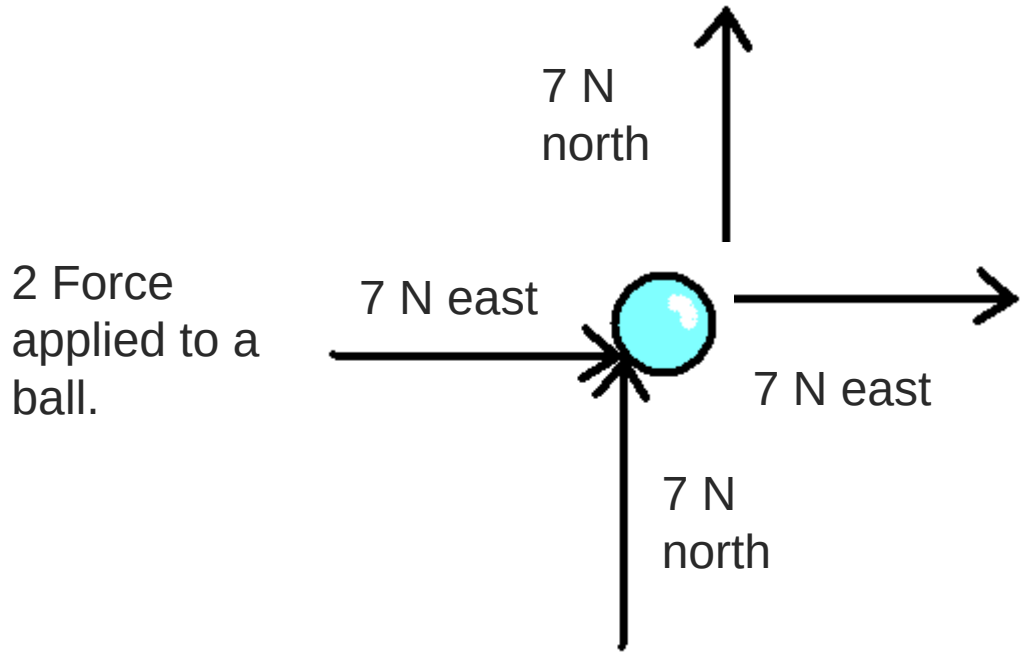
- Forces are vector quantities – they have a magnitude (N) and a direction (° from).
- As we saw when examining work the direction of the force makes a big difference to the outcome.

Forest Lakes.net

Vectors

- Vector quantities can only be added by vector means.
- 7 N north plus 7 N east **does not** make 14 N north east
- So how do we add them?

Vectors

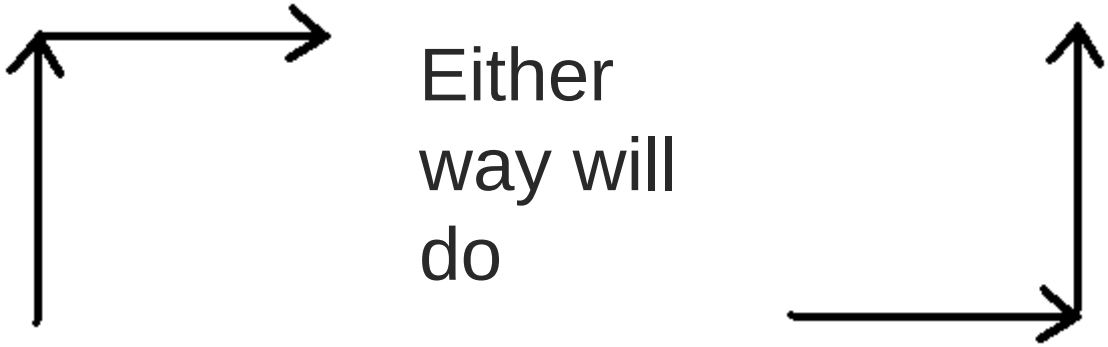


Where will the ball go?

You can probably intuitively tell what would happen but can we use mathematics?

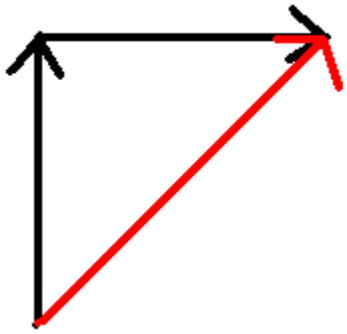
Vectors

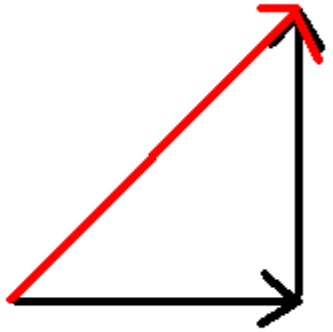
- Rule one: add vectors head to tail.



Vectors

- Rule 2: Complete the triangle



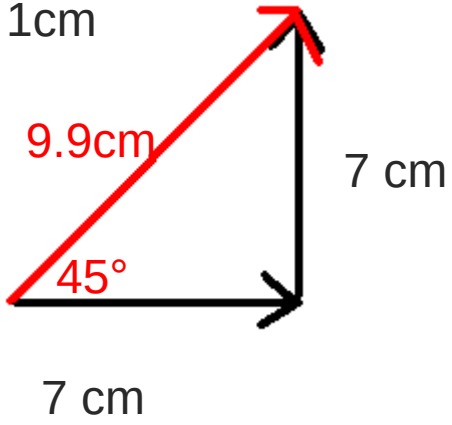


The hypotenuse is the resultant – combination of the two vectors.

Vectors

- Number crunching.
- The vectors could be drawn to scale with the angles drawn accurately and then the hypotenuse and its angle to one of the other vectors measured.

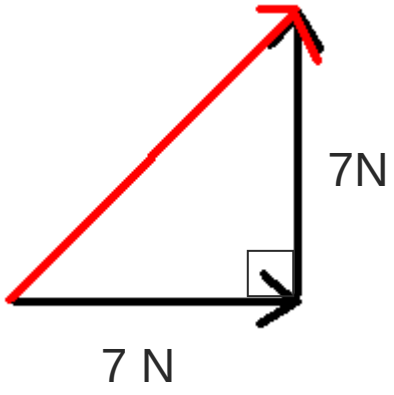
Scale: 1cm
= 1 N



The resultant force is
9.9 N 45° North of East

Vectors

- Or because your teacher cleverly chose vectors that were at right angles Pythagoras' Theorem could be used along with trigonometry.



$$c^2 = a^2 + b^2$$

$$c^2 = 7^2 + 7^2$$

$$c^2 = 98$$

$$c = \sqrt{98}$$

$$c = 9.89$$

$$Tan\,\theta = \frac{7}{7}$$

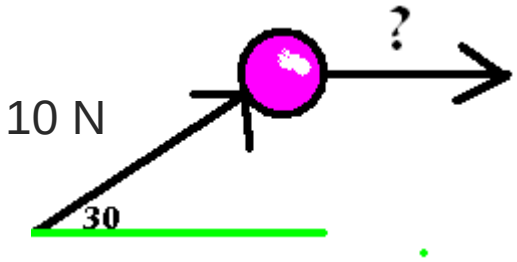
$$\theta = Tan^{-1}1$$

$$\theta = 45°$$

The resultant force was 9.89N 45° North of East

Vectors

- Resolving a vector into components.
- Often we only need to consider the force vector in one direction.

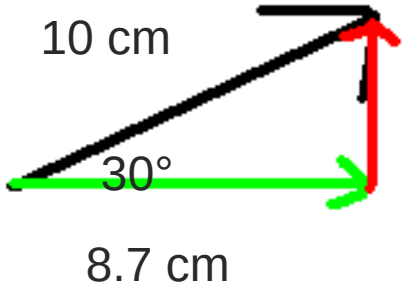


What force acts on the ball to the right?

Vectors

- We could draw a scale diagram and measure

1N = 1 cm

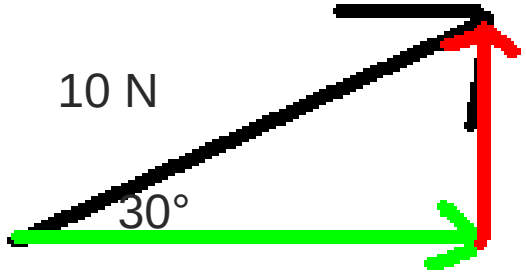


The ball experiences a force of 8.7 N to the right.

Vectors

- Or we could use trigonometry (they're on the card I gave you at the start of the year).

$$\cos\theta = \frac{adj}{hyp} \qquad \cos 30 = \frac{adj}{10}$$



$$adj = 10 \times \cos 30$$

$$adj = 8.66$$

The ball experiences a force of 8.66 N to the right