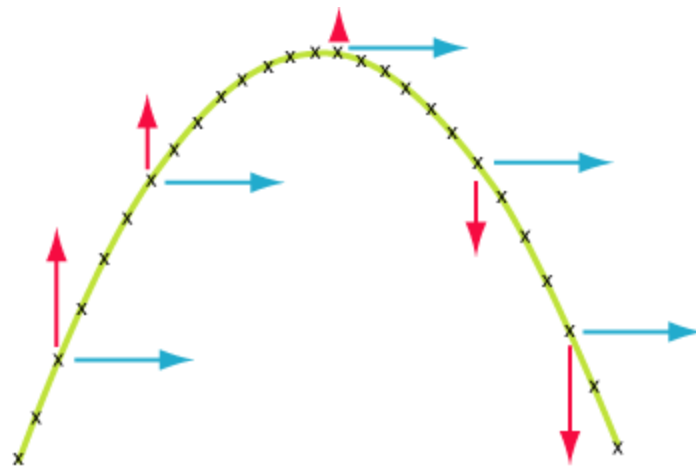
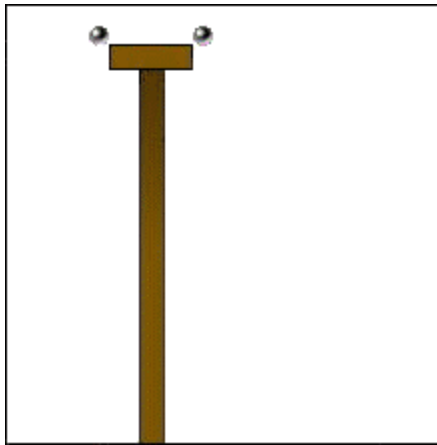


X-Y

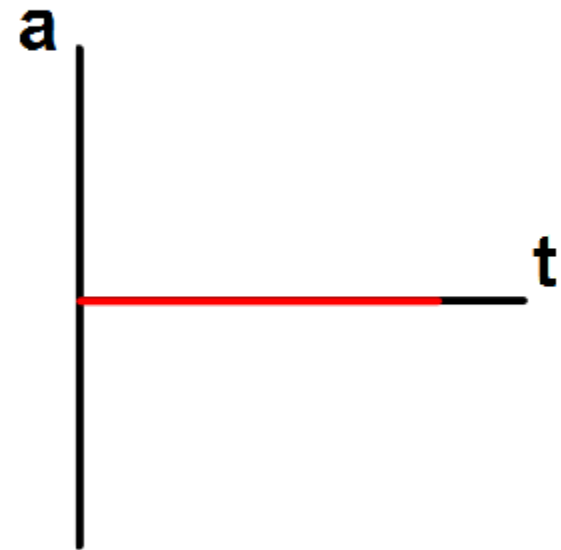
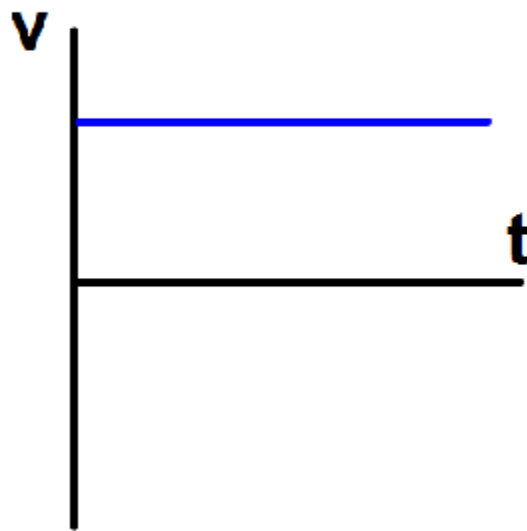
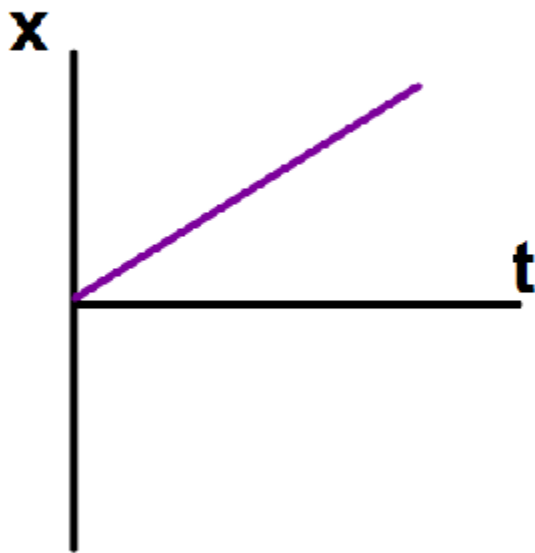
Independence



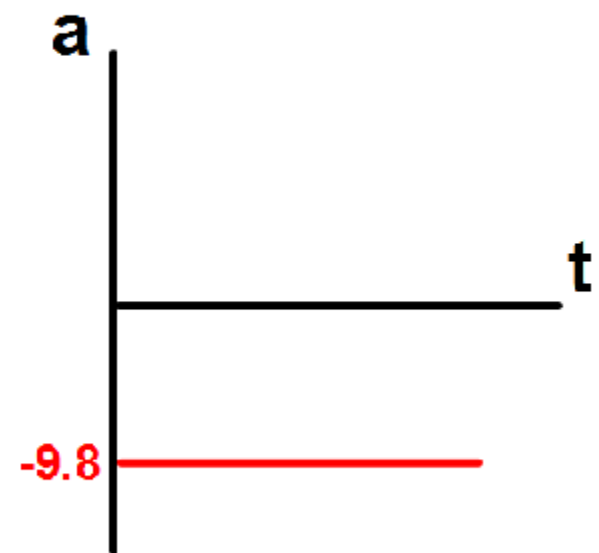
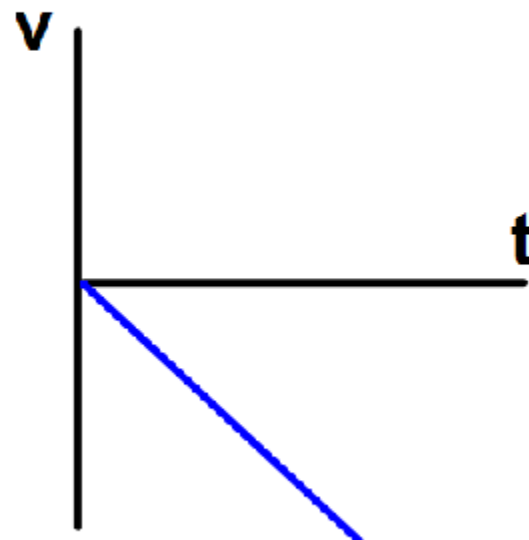
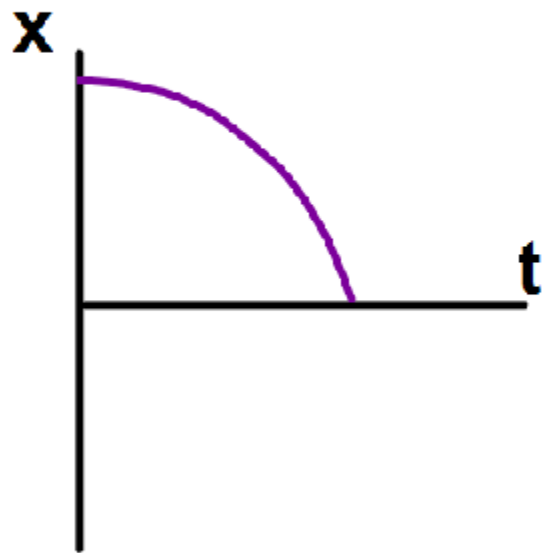




X-Direction

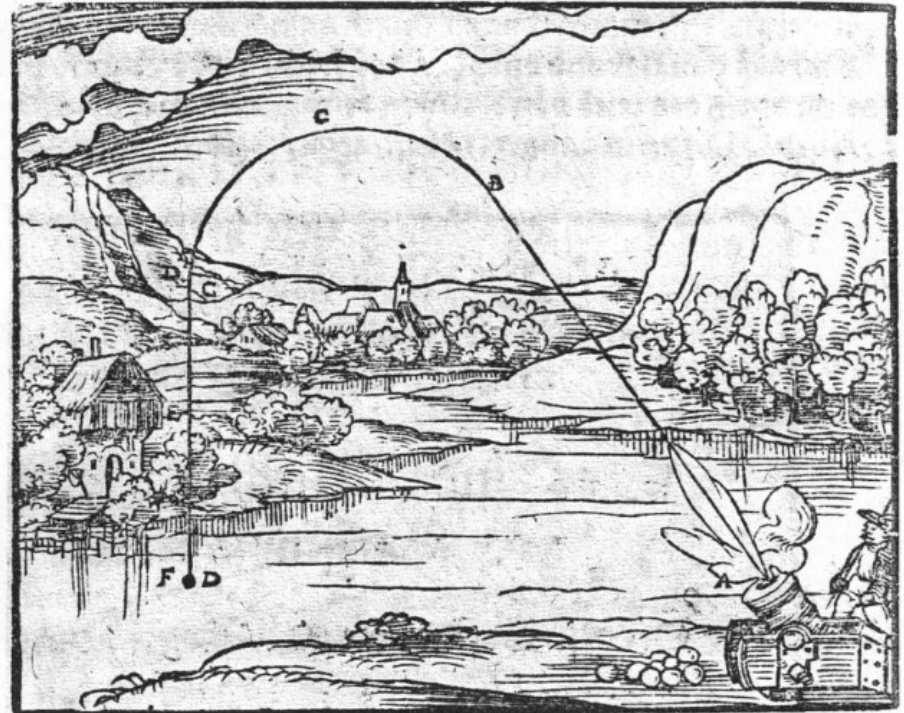
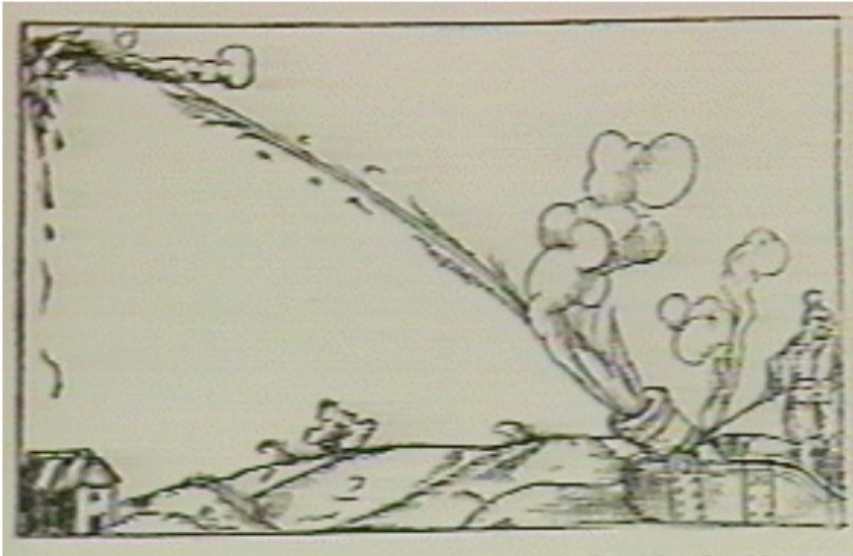


Y-Direction



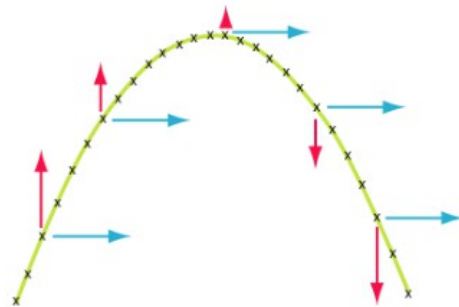
Vectors

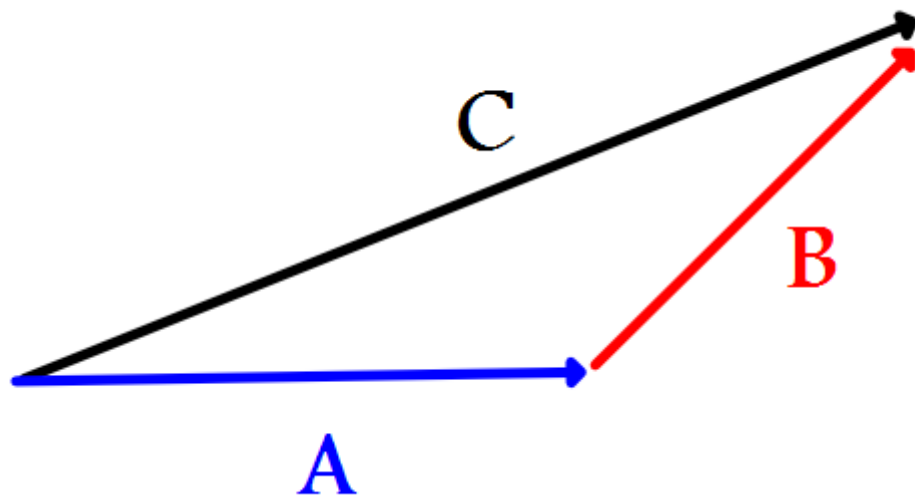
Before 1638



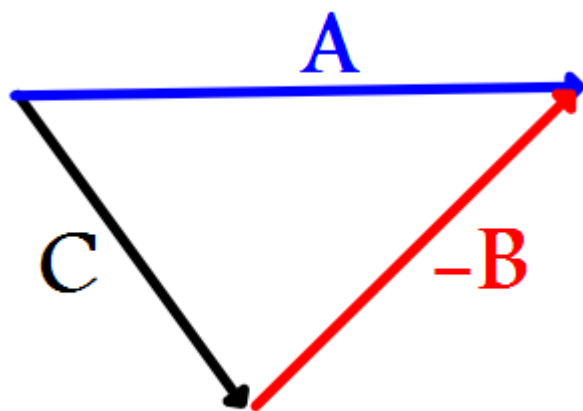
1638:

*Galileo, Dialogues of the Two
New Sciences*

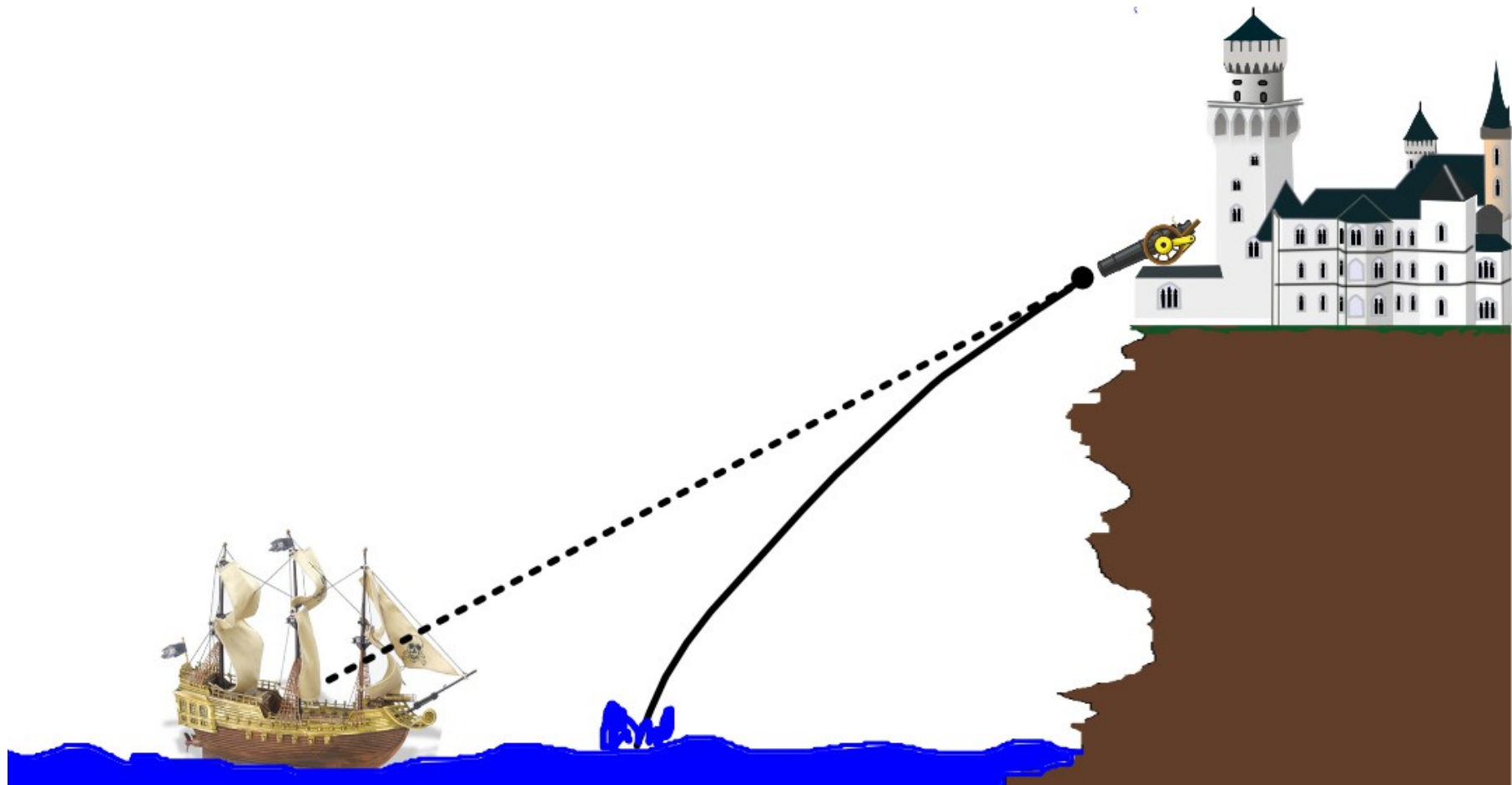




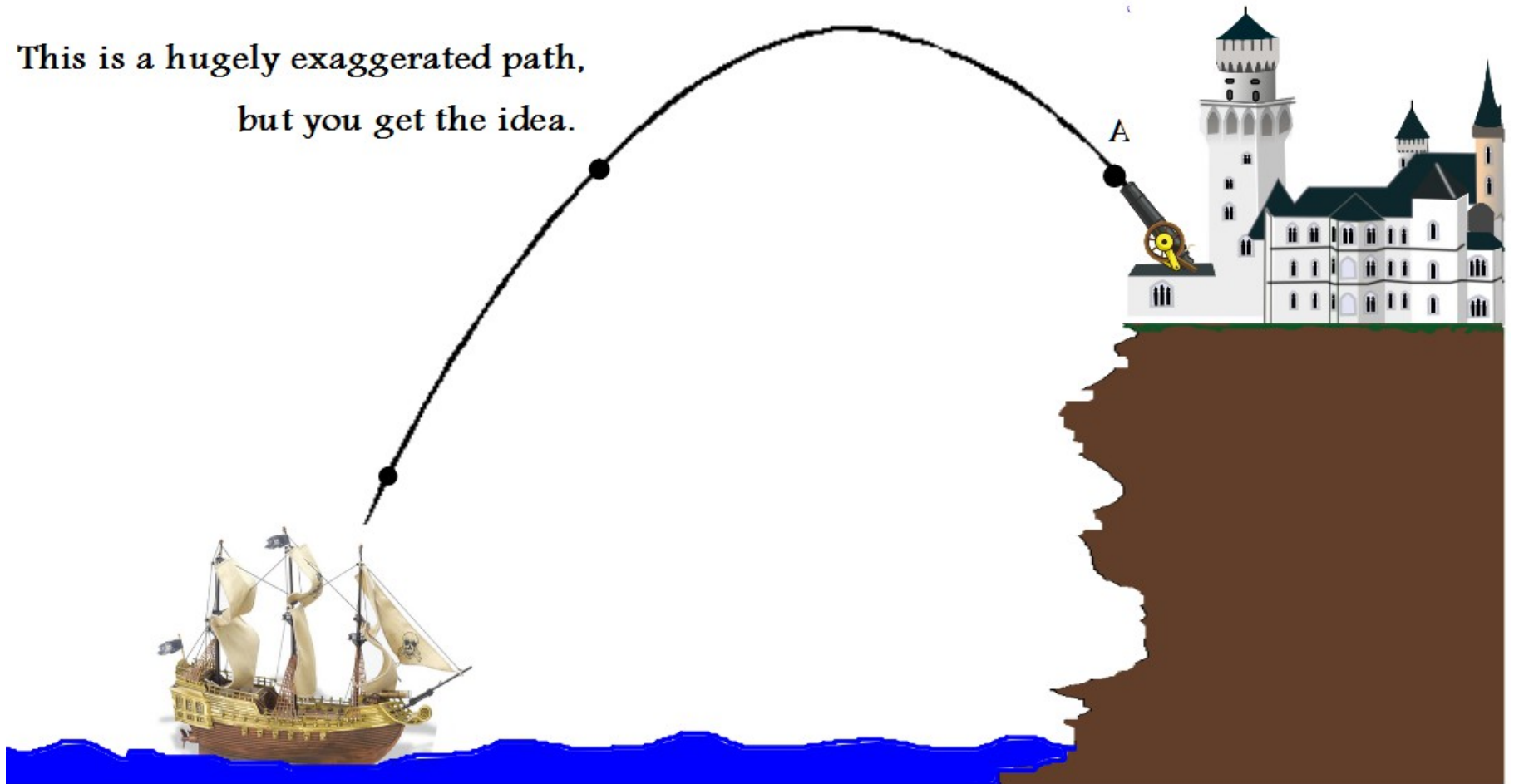
$$\vec{A} + \vec{B} = \vec{C}$$

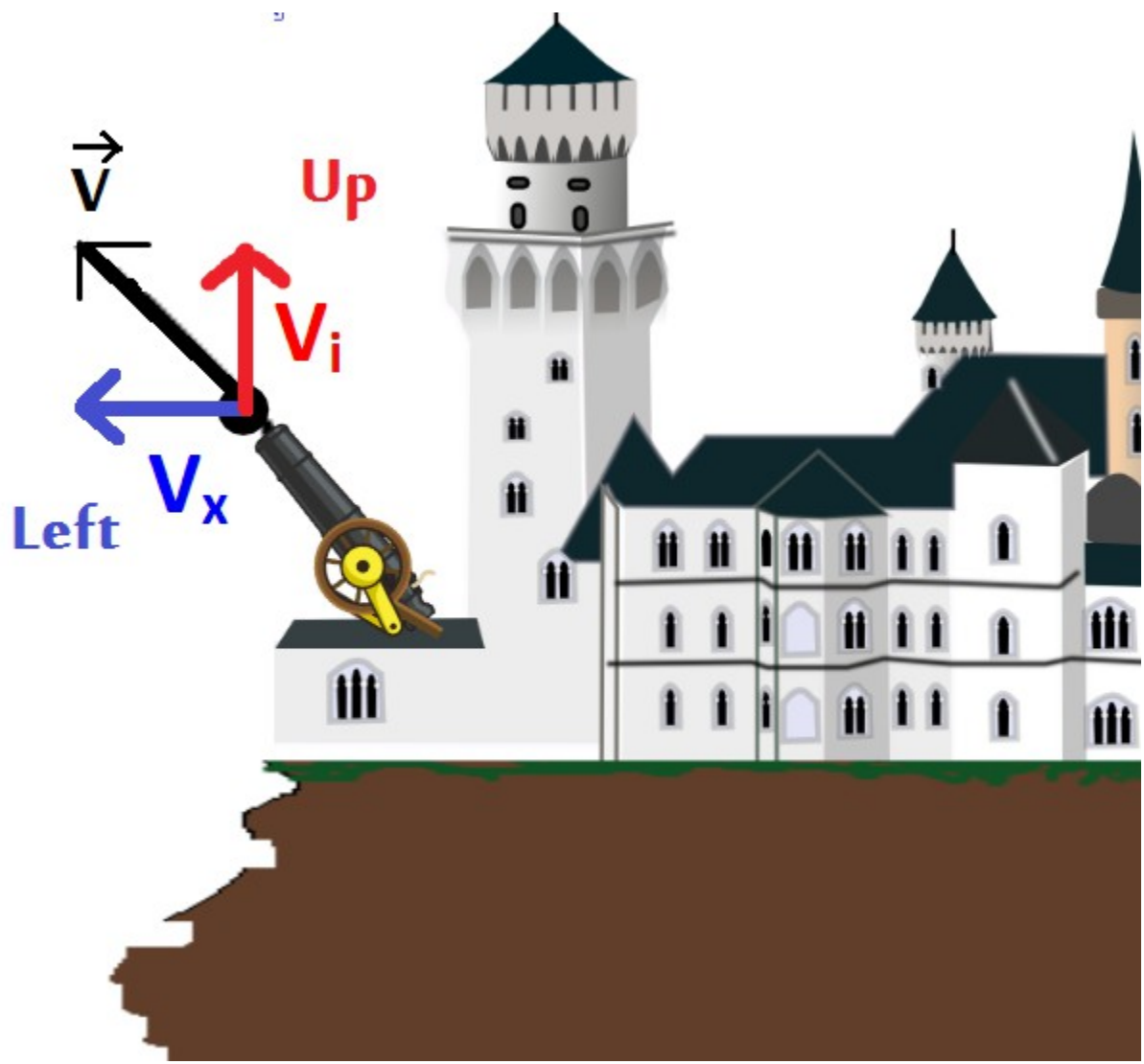


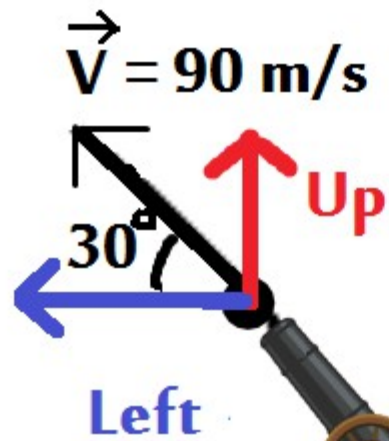
$$\vec{A} - \vec{B} = \vec{C}$$



This is a hugely exaggerated path,
but you get the idea.



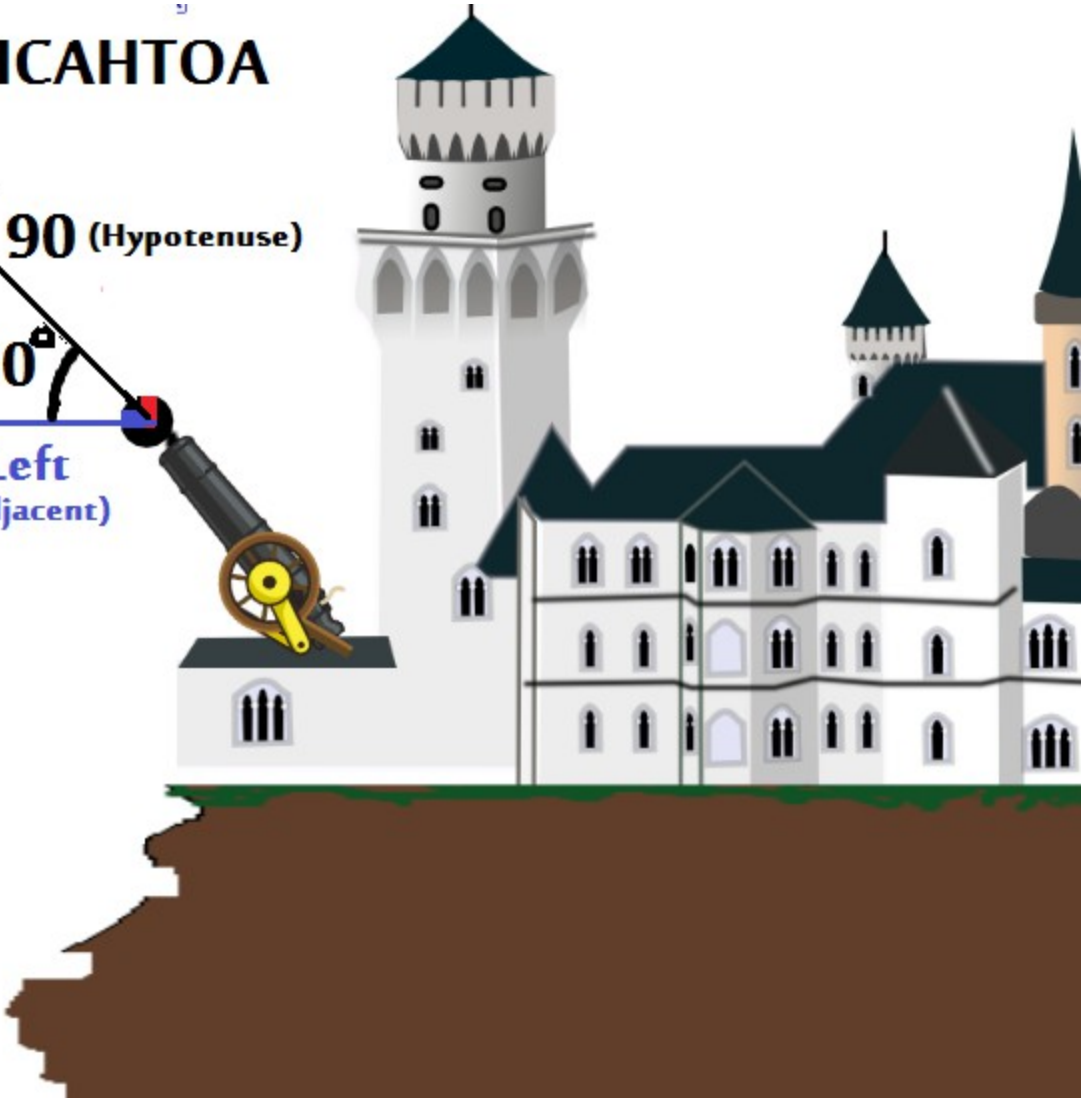
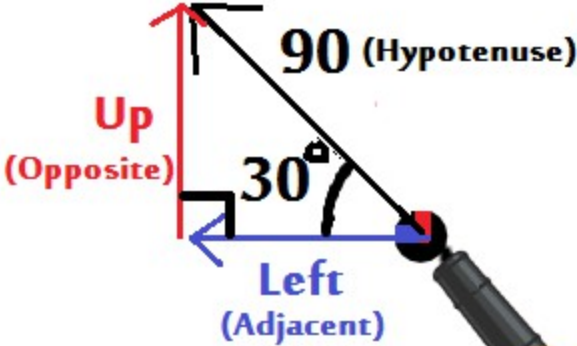




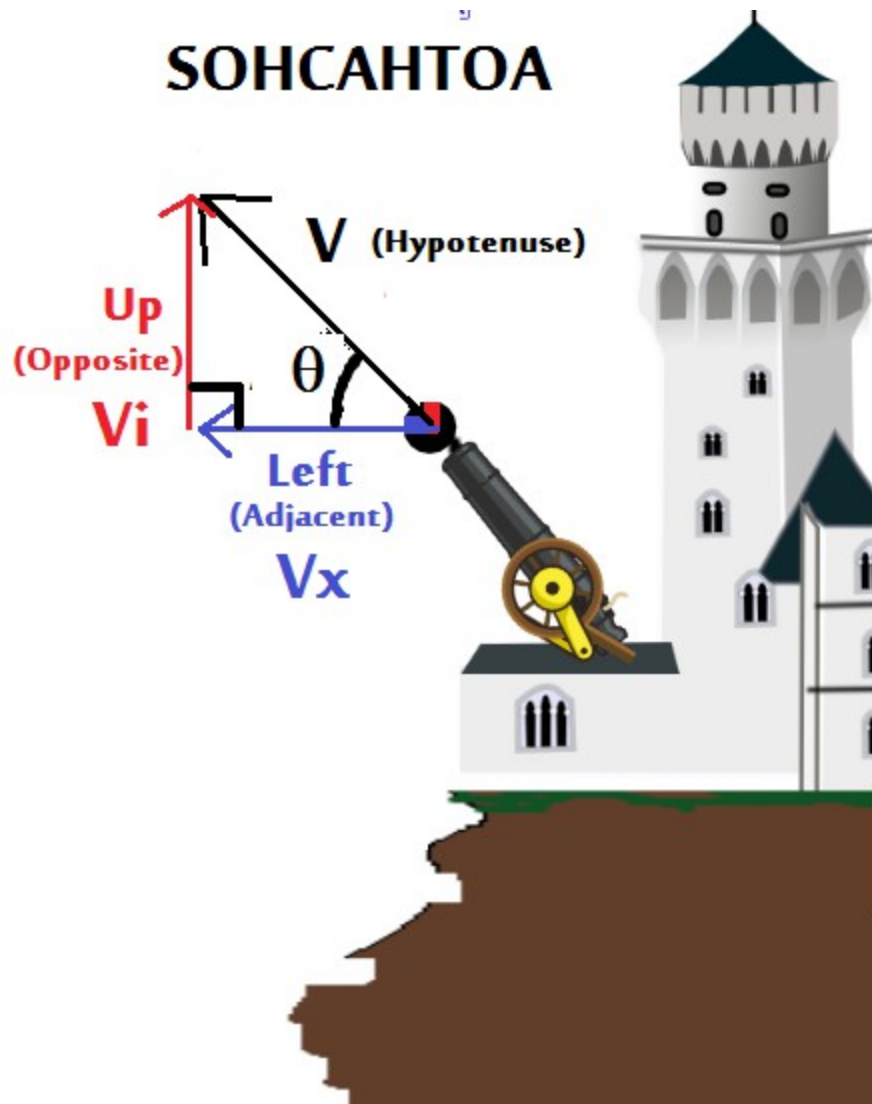
Two Components

- > Horizontal (Left)
- > Vertical (Up)

SOHCAHTOA



SOHCAHTOA



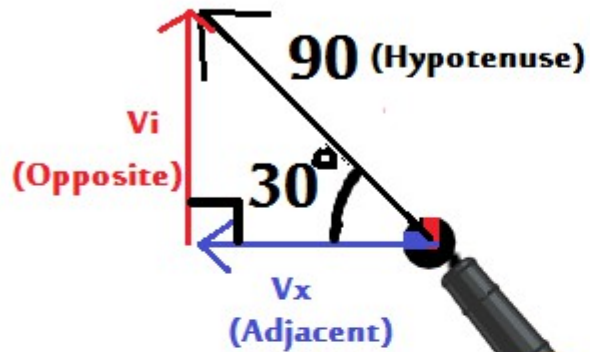
$$\sin \theta = \frac{\text{Opp}}{\text{Hyp}} = \frac{V_i}{V}$$

$$V \sin \theta = V_i$$

$$\cos \theta = \frac{\text{Adj}}{\text{Hyp}} = \frac{V_x}{V}$$

$$V \cos \theta = V_x$$

SOHCAHTOA



$$\sin 30 = \frac{\text{Opp}}{\text{Hyp}} = \frac{V_i}{90}$$

$$90 \sin 30 = V_i$$

$$V_i = 90 \sin 30$$

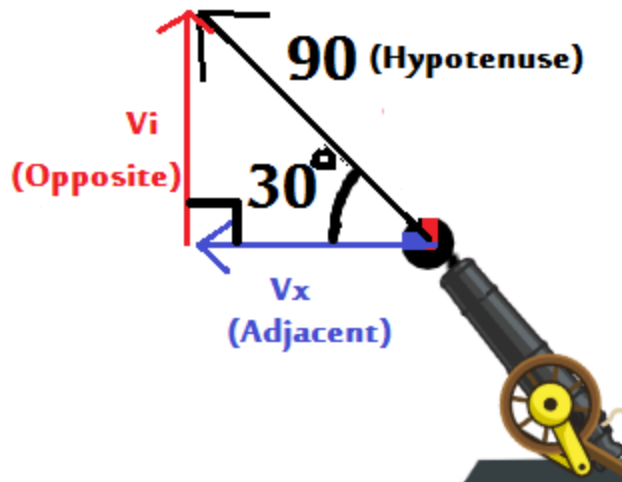
$$V_i = 45 \text{ m/s up}$$

$$\cos 30 = \frac{\text{Adj}}{\text{Hyp}} = \frac{V_x}{90}$$

$$90 \cos 30 = V_x$$

$$V_x = 90 \cos 30$$

$$V_x = 78 \text{ m/s left}$$



This will CHANGE
over time because
of gravity.



$$\sin 30 = \frac{\text{Opp}}{\text{Hyp}} = \frac{V_i}{90}$$

$$90 \sin 30 = V_i$$

$$V_i = 90 \sin 30$$

$$V_i = 45 \text{ m/s up}$$

$$\cos 30 = \frac{\text{Adj}}{\text{Hyp}} = \frac{V_x}{90}$$

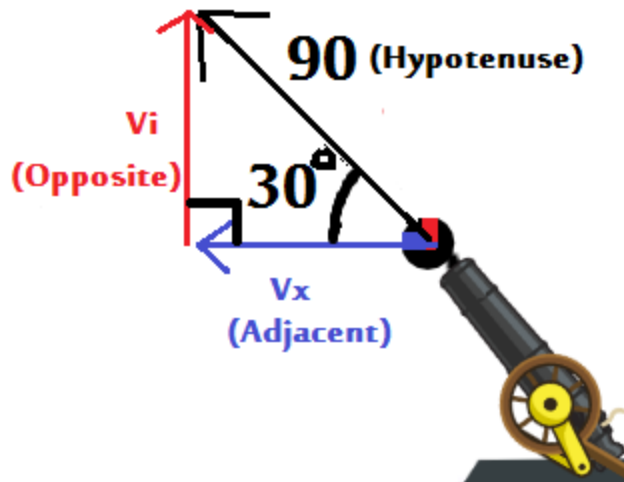
$$90 \cos 30 = V_x$$

$$V_x = 90 \cos 30$$

$$V_x = 78 \text{ m/s left}$$

This is a
CONSTANT
VELOCITY.





Can be used in
the eqns of
constant
acceleration

$$\sin 30 = \frac{\text{Opp}}{\text{Hyp}} = \frac{V_i}{90}$$

$$90 \sin 30 = V_i$$

$$V_i = 90 \sin 30$$

$$V_i = 45 \text{ m/s up}$$

$$\cos 30 = \frac{\text{Adj}}{\text{Hyp}} = \frac{V_x}{90}$$

$$90 \cos 30 = V_x$$

$$V_x = 90 \cos 30$$

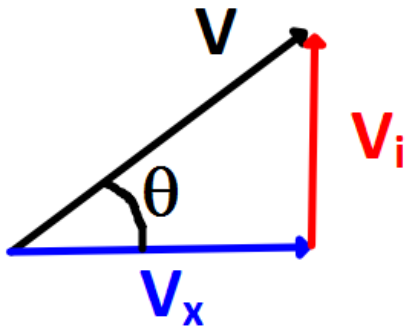
$$V_x = 78 \text{ m/s left}$$

Can be used
in equation
 $V_x = \frac{x}{t}$



Working with Angles

The difference with these problems, is that we have one extra step.



$$V_i = V \sin \theta$$

$$V_x = V \cos \theta$$

A. Equations for an acceleration (y-direction, vertical)

$$\mathbf{a} = \frac{\mathbf{v}_f - \mathbf{v}_i}{t}$$

$$\mathbf{x} = \mathbf{v}_i t + \frac{1}{2} \mathbf{a} t^2$$

$$\mathbf{v}_f^2 = \mathbf{v}_i^2 + 2\mathbf{a}\mathbf{x}$$

$$\mathbf{x} = \frac{(\mathbf{v}_f + \mathbf{v}_i) t}{2}$$

B. Equation for constant velocity (x-direction, horizontal)

$$\mathbf{V}_x = \frac{\mathbf{x}}{t}$$

\mathbf{V}_x = velocity in x-direction

