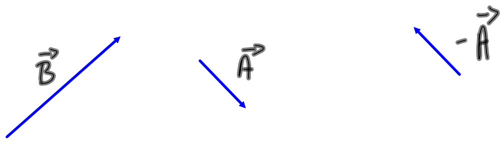
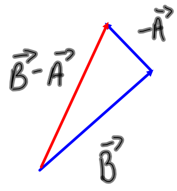
Subtraction of Vectors

$5 - 3 = 5 + (-3)$

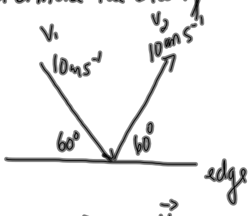
$\vec{B} - \vec{A} = \vec{B} + (-\vec{A})$





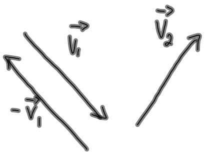
Example

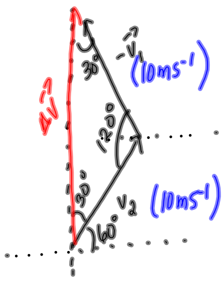
A billiard ball moving with a velocity of $10\,ms^{-1}$ inclined at $60°$ to the edge of the table bounces off the edge of the table at the same angle but with no change in speed. Determine the change in velocity of the ball?



$\Delta\vec{v} = \vec{v}_2 - \vec{v}_1$

$\Delta\vec{v} = \vec{v}_2 + (-\vec{v}_1)$





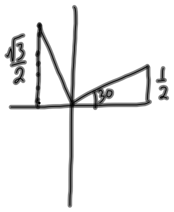
Using Law of Sines

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

$$\frac{10}{\sin 30°} = \frac{b}{\sin 120°}$$

$$b \sin 30° = 10 \sin 120°$$

$$b = \frac{10 \sin 120°}{\sin 30°}$$



$$b = \frac{10\,\frac{\sqrt{3}}{2}}{\frac{1}{2}}$$

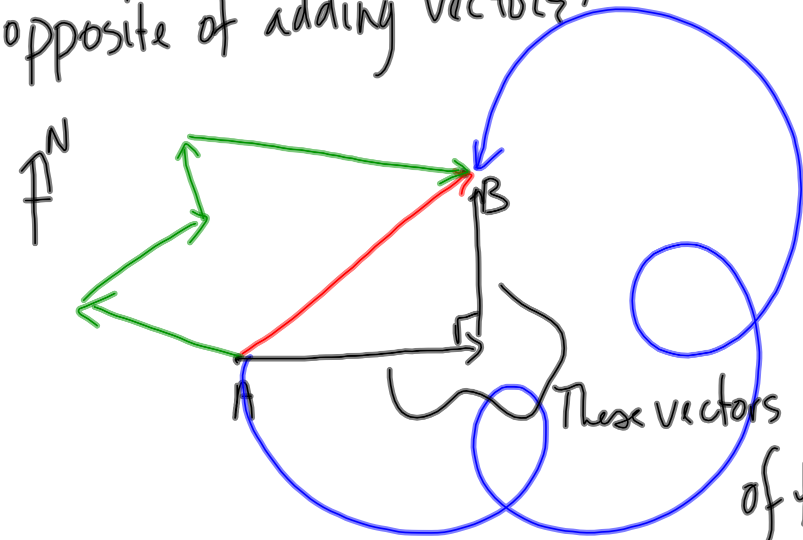
$$b = 10\sqrt{3}$$

$$b = 17\,ms^{-1}$$

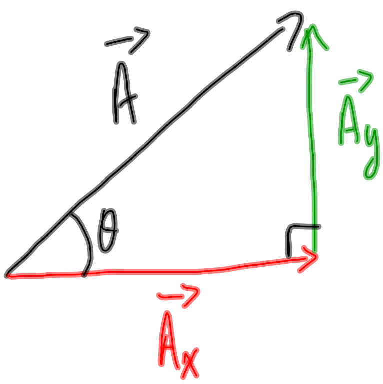
$\therefore \Delta\vec{v} = 17\,ms^{-1}$ [directly away from the edge]

Components of Vectors

Resolving a vector into components is really just the opposite of adding vectors.



These vectors are components of the red vector (they are perpendicular to each other)



($\vec{A}_y$ is the vertical component of $\vec{A}$)

$$\sin\theta = \frac{A_y}{A}$$

$$A_y = A\sin\theta$$

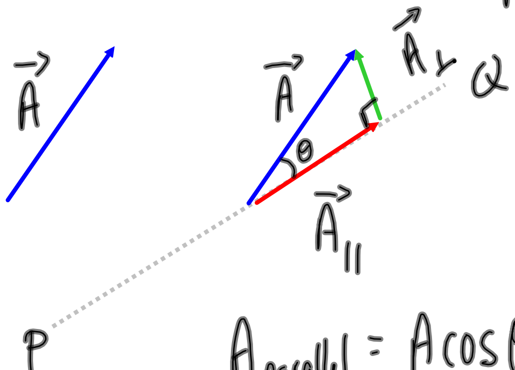
($\vec{A}_x$ is the horizontal component of $\vec{A}$)

$$\cos\theta = \frac{A_x}{A}$$

$$A_x = A\cos\theta$$

Resolving a vector into parallel and perpendicular components in relation to direction PQ.

$A_{perpendicular} = A\sin\theta$



$A_{parallel} = A\cos\theta$

<u>Example</u>

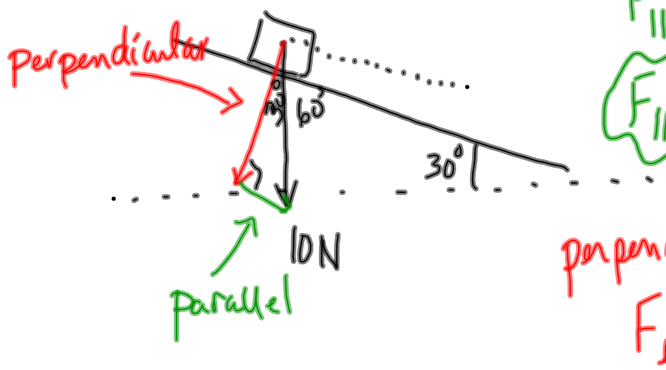
A 10N weight is placed on a board which is inclined at an angle of 30° to the horizontal.

Determine the components of the weight acting down the incline (parallel) and normal to the incline (perpendicular).

parallel component.

$F_{\parallel} = (10N)(\sin 30^\circ)$

$F_{\parallel} = 5N$



perpendicular component

$F_{\perp} = (10N)(\cos 30^\circ)$

$F_{\perp} = 8.7N$