

Questions involving forces in two directions require the use of **trigonometry** and / or **Pythagorean theorem**.

Key formulas

Force: $F_{net} = ma$, $\vec{F}_{net} = \vec{F}_1 + \vec{F}_2 + \dots + \vec{F}_n$ and $\vec{F}_{net} = \vec{F}_{net_y} + \vec{F}_{net_x}$

Trig: $\sin \theta = \frac{O}{H}$, $\cos \theta = \frac{A}{H}$, $\tan \theta = \frac{O}{A}$ (for right angled triangles only)

Cosine Law: $c^2 = a^2 + b^2 - 2ab \cos(C)$ or $c = \sqrt{a^2 + b^2 - 2ab \cos(C)}$

Sine Law: $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

Examples:

- Two boys are pulling on a 10kg sled with a force of 6N [N] and 8N[E] respectively. Find;
 - The net force acting on the sled (assume no friction)
 - The acceleration of the sled.
 - One of the boy's annoying brother decided to start pulling the sled due south with a force of 12N,
 - what is the new net force acting on the sled?
 - what is the new acceleration?
- Johnny Light year is zipping across the Cosmos in his ultra sleek rocket. His forward rocket is firing with a force of 50,000N when all of a sudden he sees an asteroid popup on his screen. He immediately fires his left retro rocket that is angled [$F45^{\circ}L$]. The rocket fires with a force of 10000N.
 - What is the net force acting on the rocket?
 - What would be the acceleration of the rocket if it had a mass of 5000kg?
- Two workers are lifting a 10kg sign with ropes. The worker on the left is applying a force $70N[R60^{\circ}U]$ and the worker on the right is applying a force of $50N[L60^{\circ}U]$.
 - Using a chart, find the vertical and horizontal components of the forces.
 - From the chart find the net vertical and net horizontal force.
 - Find the acceleration of the sign.