Isaac Newton`s Laws of Motion

Isaac Newton was born on Christmas day 1642 and died in 1726.

He is famous for discovering calculus and the three laws of motion

His famous book is called ***Principia***

Law 1

An object will remain at rest or move with a constant speed unless acted on by an unbalanced force.

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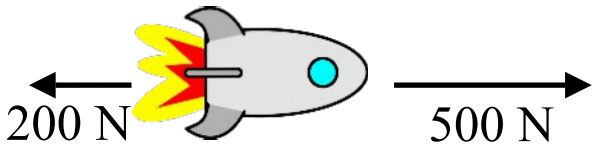

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Law 2

An unbalanced force will cause an object to accelerate, ie change its speed..

Then size of the acceleration, or as we say its magnitude depends on...

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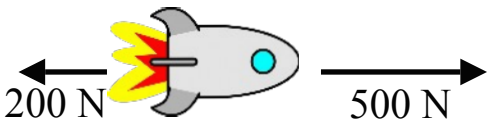
$$F_{un} = ma$$

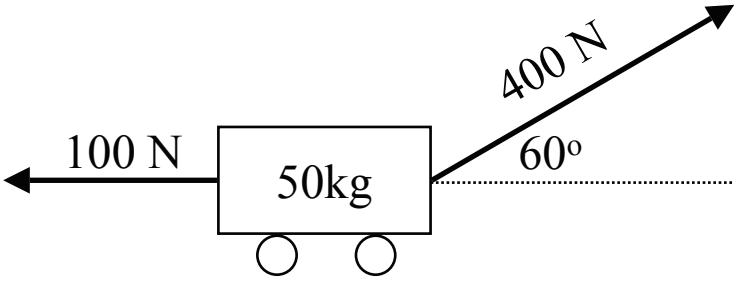
Example 1

Calculate the acceleration of this rocket which has a mass 60 kg

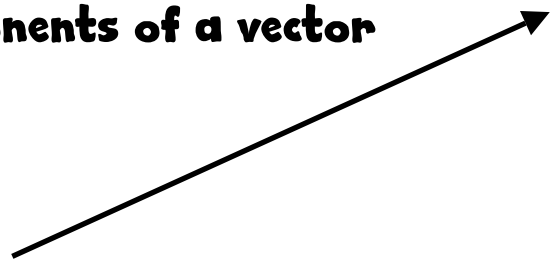


Example 2

Calculate the acceleration of this truck of mass 50 kg if forces shown are applied to it.



Components of a vector



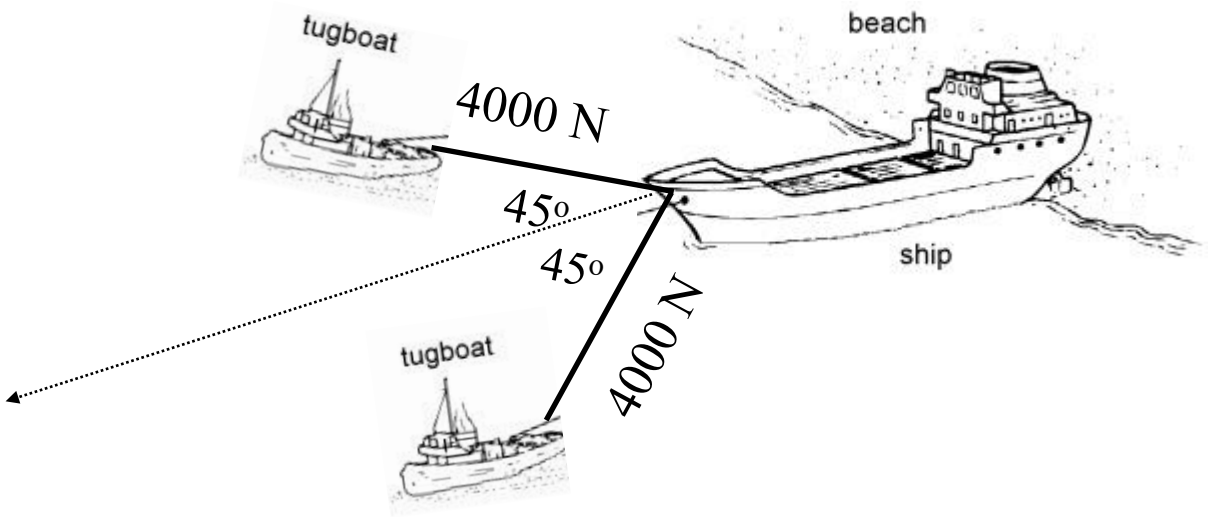
Example 3

A space rocket has a mass of 20,000 kg at launch.

Its initial acceleration is 15 ms^{-2}

Determine the force produced by its engines at launch.

Example 4

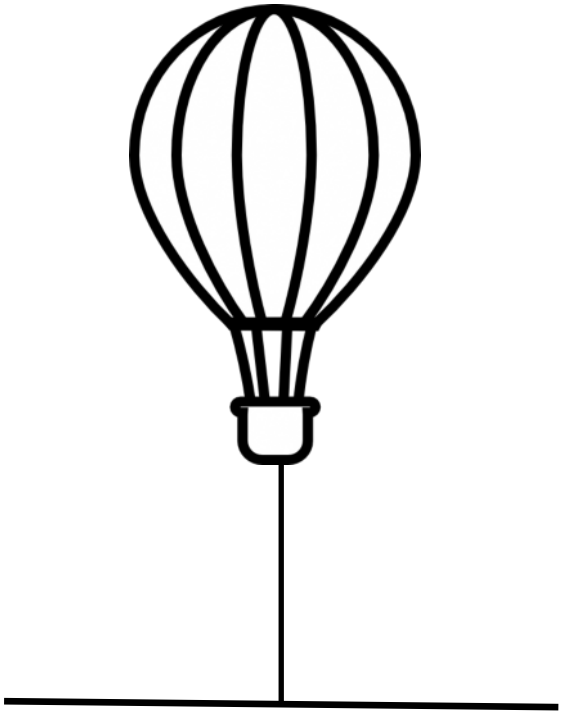


Use a scale drawing or components to find the resultant force the tugboats make on the stranded ship.

Balloon example 1

An hot air balloon of mass 80 kg is tied to the ground with a piece of rope

The tension of the rope is 16 N. Determine the buoyancy force of the balloon.

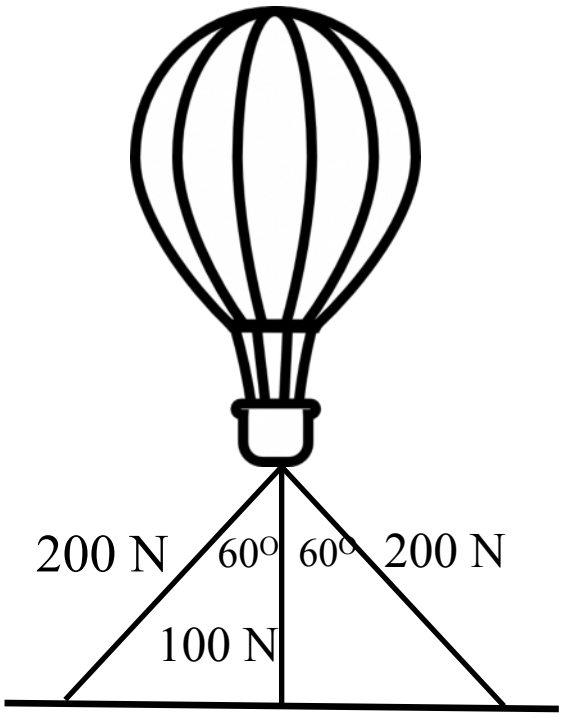


Calculate the acceleration of the balloon if the rope is cut.

Balloon example 2

An hot air balloon of mass 80 kg is tied to the ground with three ropes as shown in the diagram. Two ropes have tension 200 N at 60^{o} to the central rope which has a tension of 100 N.

Determine the buoyancy force acting on the balloon.



Calculate the acceleration of the balloon if the ropes are cut.

Springs, lifts and tows.

Let`s look at the physics of the forces in springs, lifts and tows.

General situation:
Newton balance held stationary. Mass = 2 kg

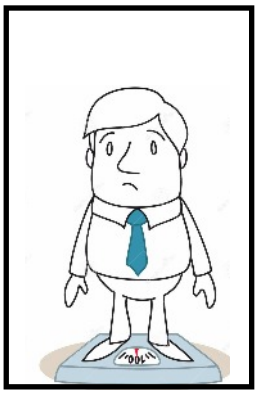
Moving up or down with constant speed:
Mass = 2 kg

Moving up with an acceleration of 2 ms^{-2}
Mass = 2 kg

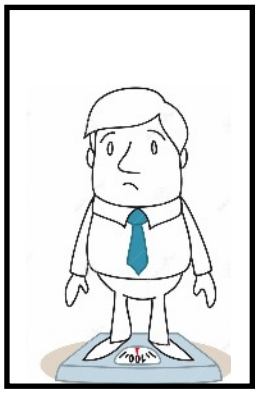
Moving downwards with
an acceleration of 2 ms^{-2}
Mass = 2 kg

Lifts or elevators.

A 70 kg person is standing on scales in a lift.

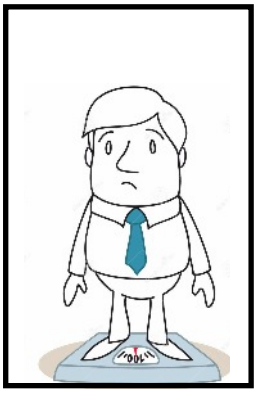


Lift is stationary or moving up or down with a constant speed.



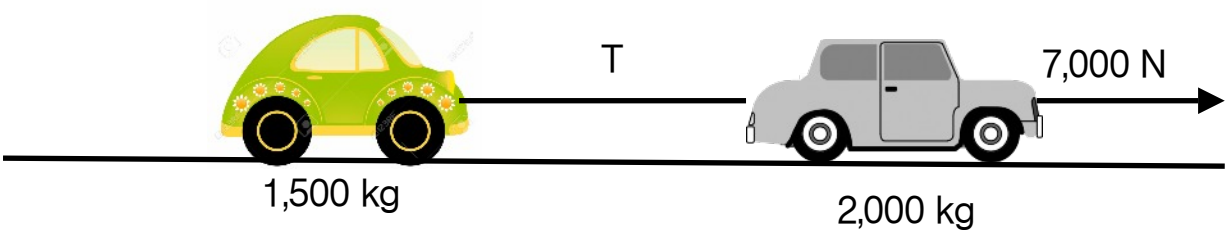
Lift is accelerating upwards at 1 ms^{-2}

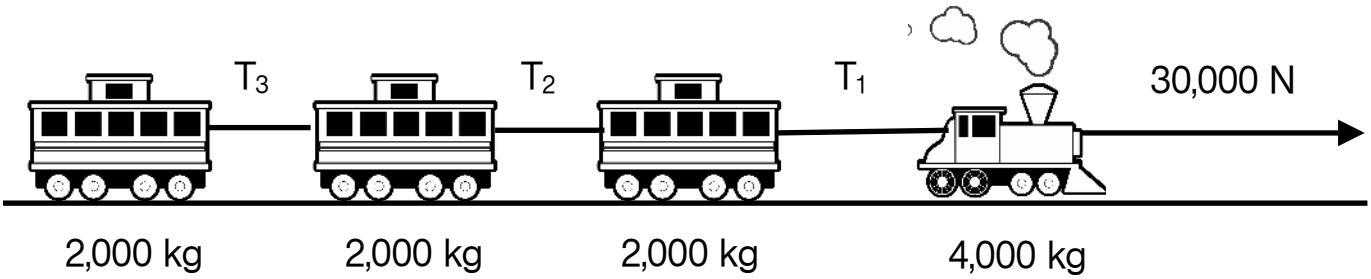
http://goo.gl/Px1Tj



Lift is accelerating downwards at 1 ms^{-2}

Towing forces

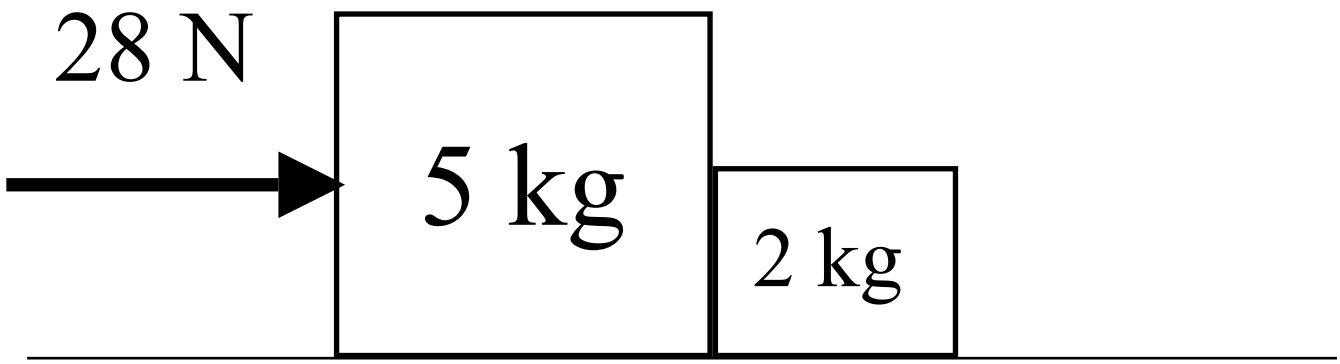




Pushing Boxes

Two boxes are pushed with a force of 28 N.

What force does the smaller box experience?

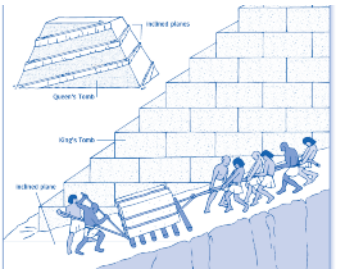


http://goo.gl/z9S1D8

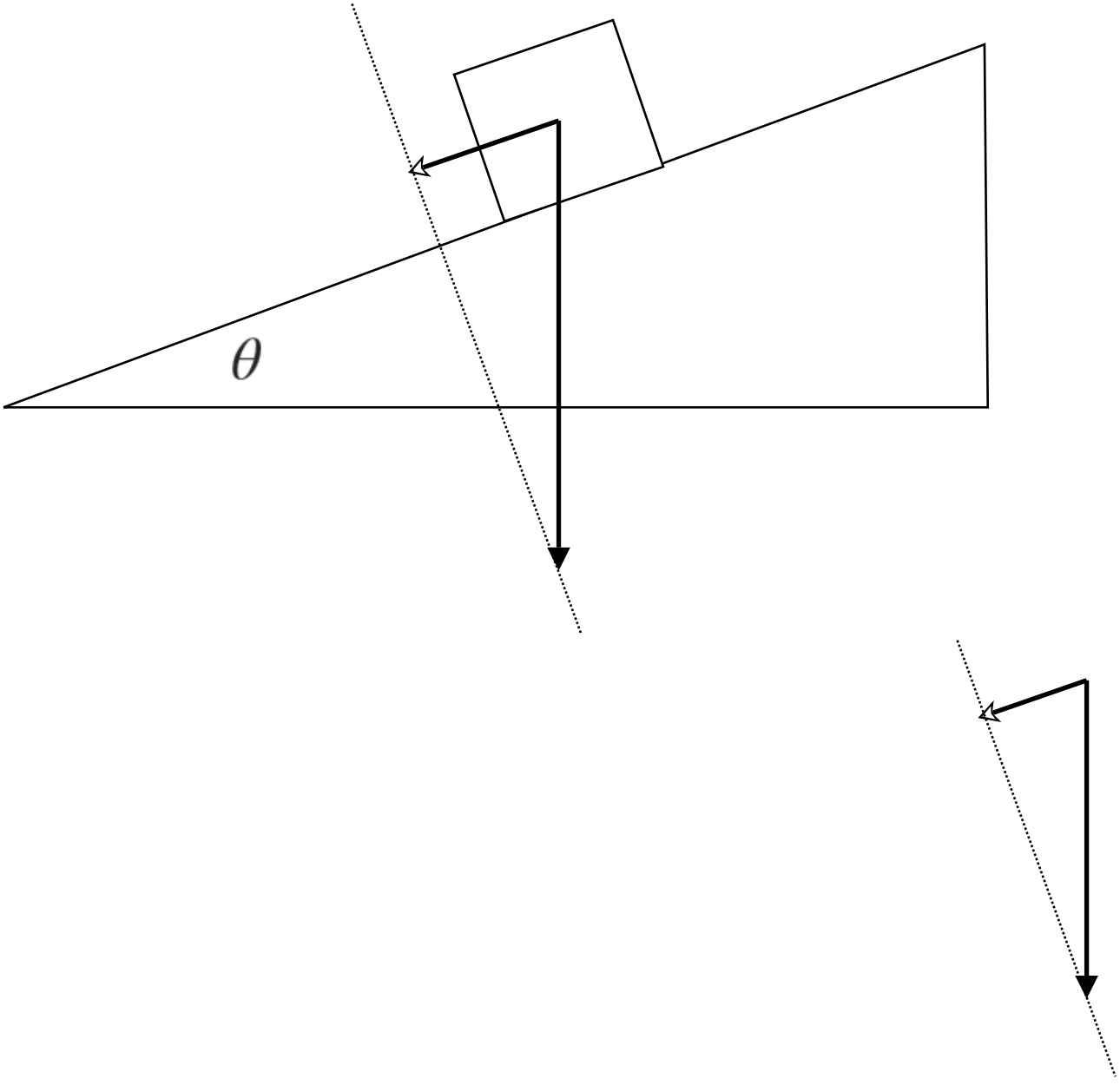
The inclined plane

An inclined plane is really a slope. In building the slope has been used to `dilute gravity` ie a slope makes it easier to lift things up height.

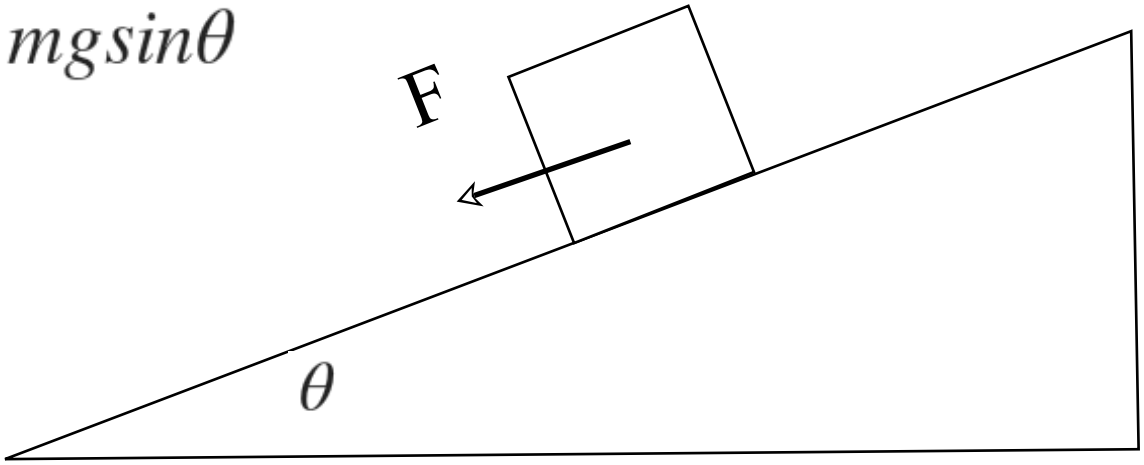
The Egyptians built stunning pyramids to mimic the stars in the sky. They built them using inclined planes.



The force acting down a slope



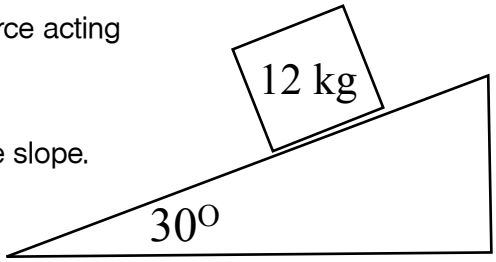
$$F = mg\sin\theta$$



Example 1

Find the size of the force acting parallel to the slope.

Determine the box`s acceleration down the slope.



A box is placed on an inclined plane. There is a force of friction of 5 N acting on the box.

Find the unbalanced force acting on the box.

Determine the box`s acceleration