Angular Velocity and Newton's Universal law of Gravitation

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Finding Measures of Angles

Given arc length and radius, angles measure can be found as

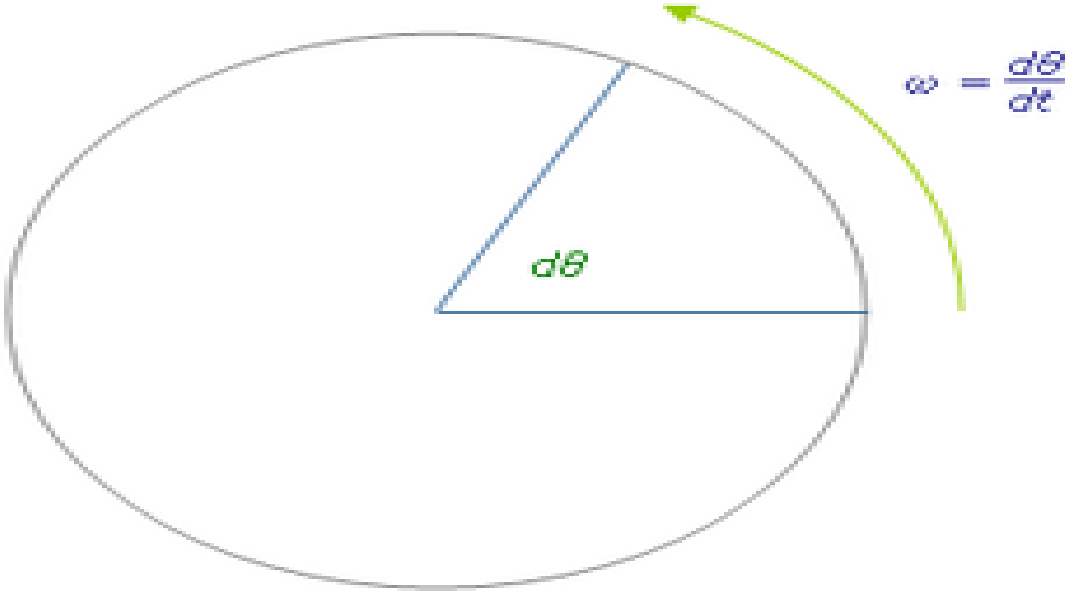
$$Measure = \frac{arclength}{Radius}$$

Or

$$\theta = \frac{s}{r}$$

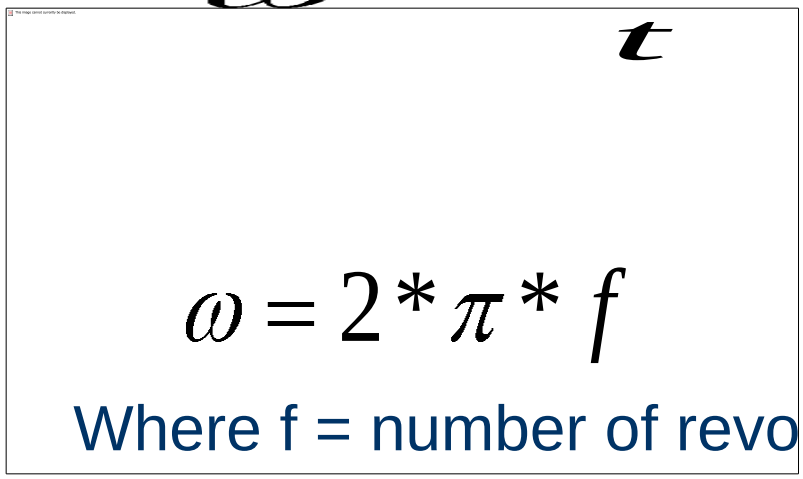
Angular Velocity

- The time rate of Change in angular displacement is called **Angular Velocity**



How to Find ω

$$\omega = \frac{\theta}{t}$$

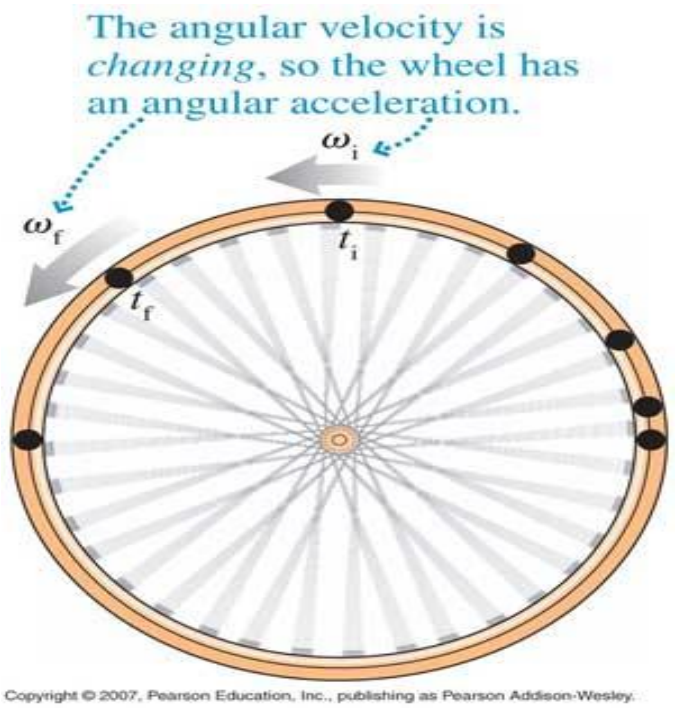


$$\omega = 2 * \pi * f$$

Where f = number of revolutions per second

Angular Acceleration

Angular acceleration is the rate of change of angular velocity over time. In standard units, it is measured in radians per second squared (rad/s2), and is usually denoted by the Greek letter alpha (**α**).



Idea of a Derivative

From calculus, It is obvious that the derivative of velocity would give us the acceleration.

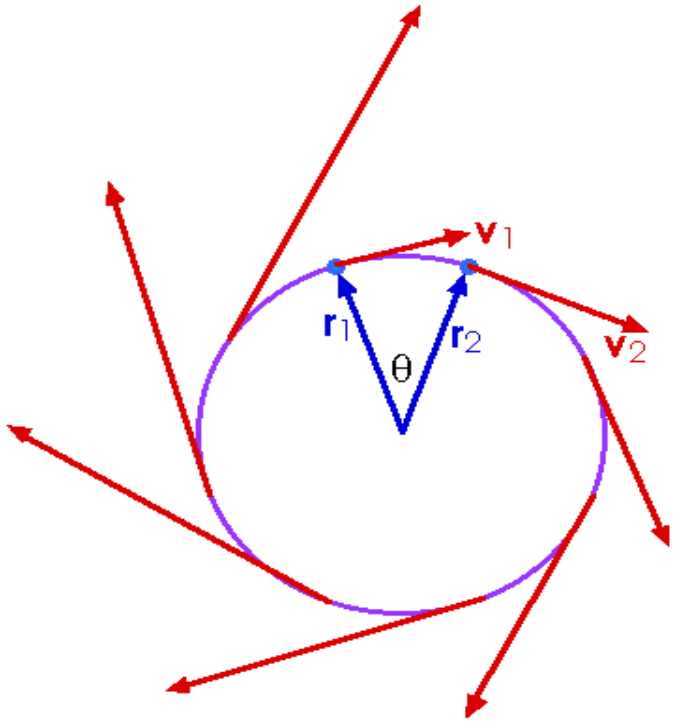
Derivative is a measure of how a function changes as its input changes.

Derivative can be thought of as how much one quantity is changing in response to changes in some other quantity

Angular Velocity is the rate and change of an angle whereas Angular Acceleration is the rate of change of the Velocity of that angle.

Tangential Acceleration

This is the acceleration an object feels due to a change in the object's Speed



How to Find

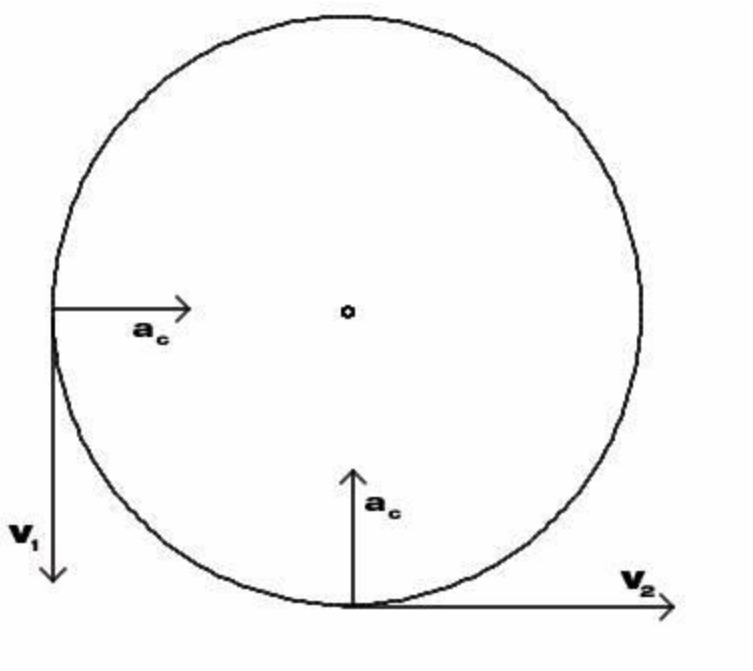
Tangential acceleration or (at) can be found by the following equation

$$at = \frac{(v_f - v_0)}{t}$$

*note that the subscript f stands for final and subscript 0 means initial or at time zero

Centripetal Acceleration

The direction of the force that is toward the center of the circle in which the object is moving

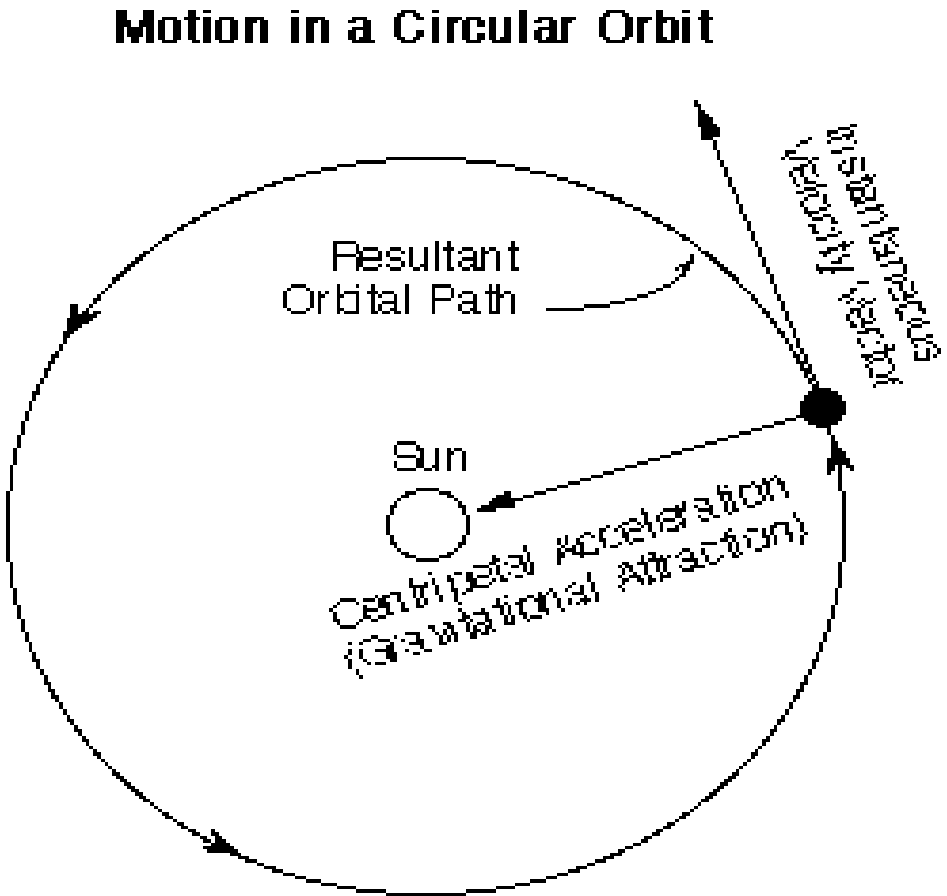


How to Calculate

$$a_c = \frac{v^2}{r}$$

http://www.youtube.com/watch?v=r_SwUWqKg0A

What is the Difference?



Kinetic Energy

the energy which it possesses due to its motion

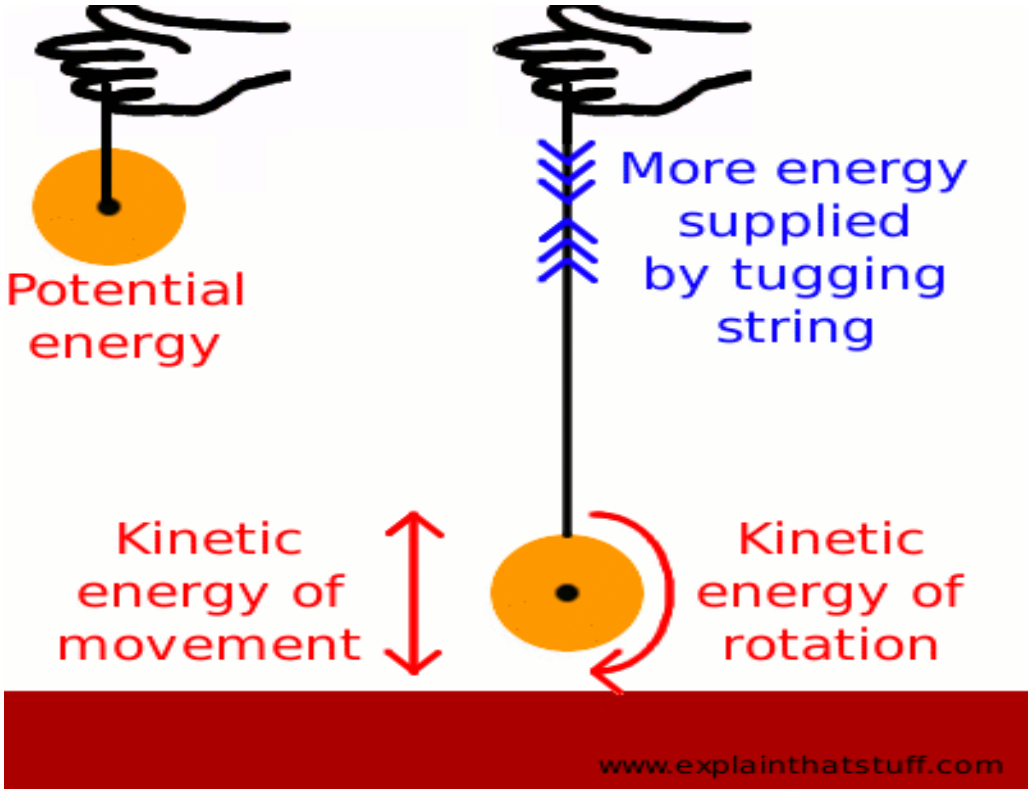
the work needed to accelerate a body of a given mass from rest to its stated velocity

Having gained this energy during its acceleration, the body maintains this kinetic energy unless its speed changes

$$Ek = \frac{1}{2} mv^2$$

M= Mass

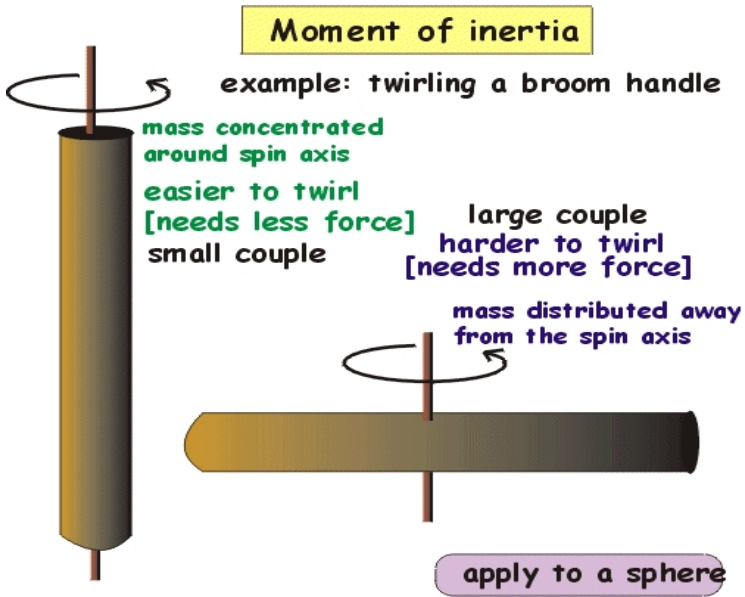
V= Velocity



Moment of Inertia

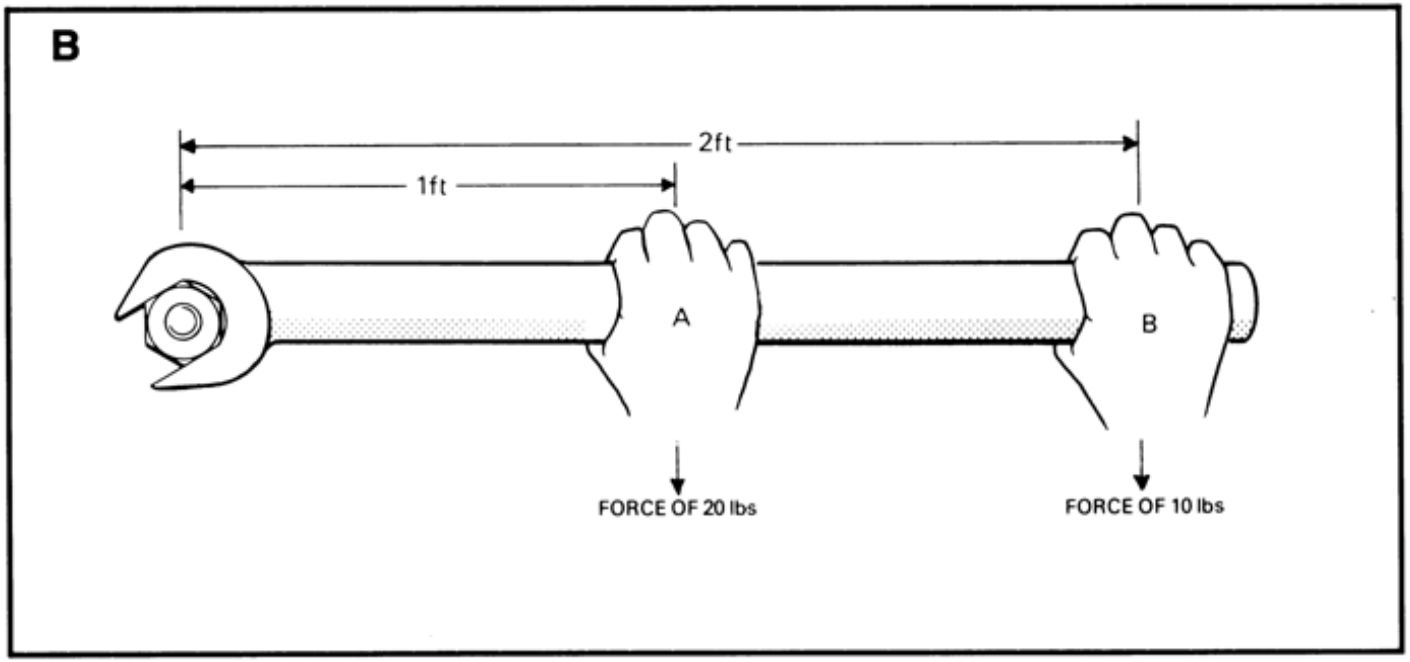
A measure of an object's resistance to changes to its rotation

$$I = m*r_1^{\,2} + m*r_2^{\,2} + m*r_3^{\,2} + \ldots\ldots + m*r_n^{\,2}$$



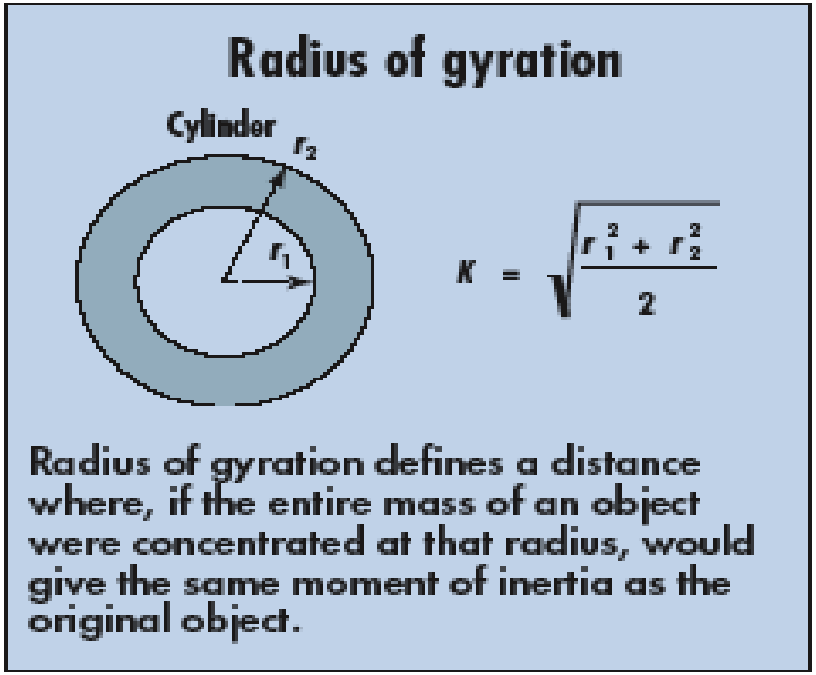
Torque

Torque is the tendency of a force to rotate an object about an axis, fulcrum, or pivot. Just as a force is a push or a pull, a torque can be thought of as a twist.



Radius of Gyration

the distance from the axis that all mass can be concentrated to obtain the same mass moment of inertia



Work and Power

Work is force*distance

Power is work divided by time

Angular Momentum

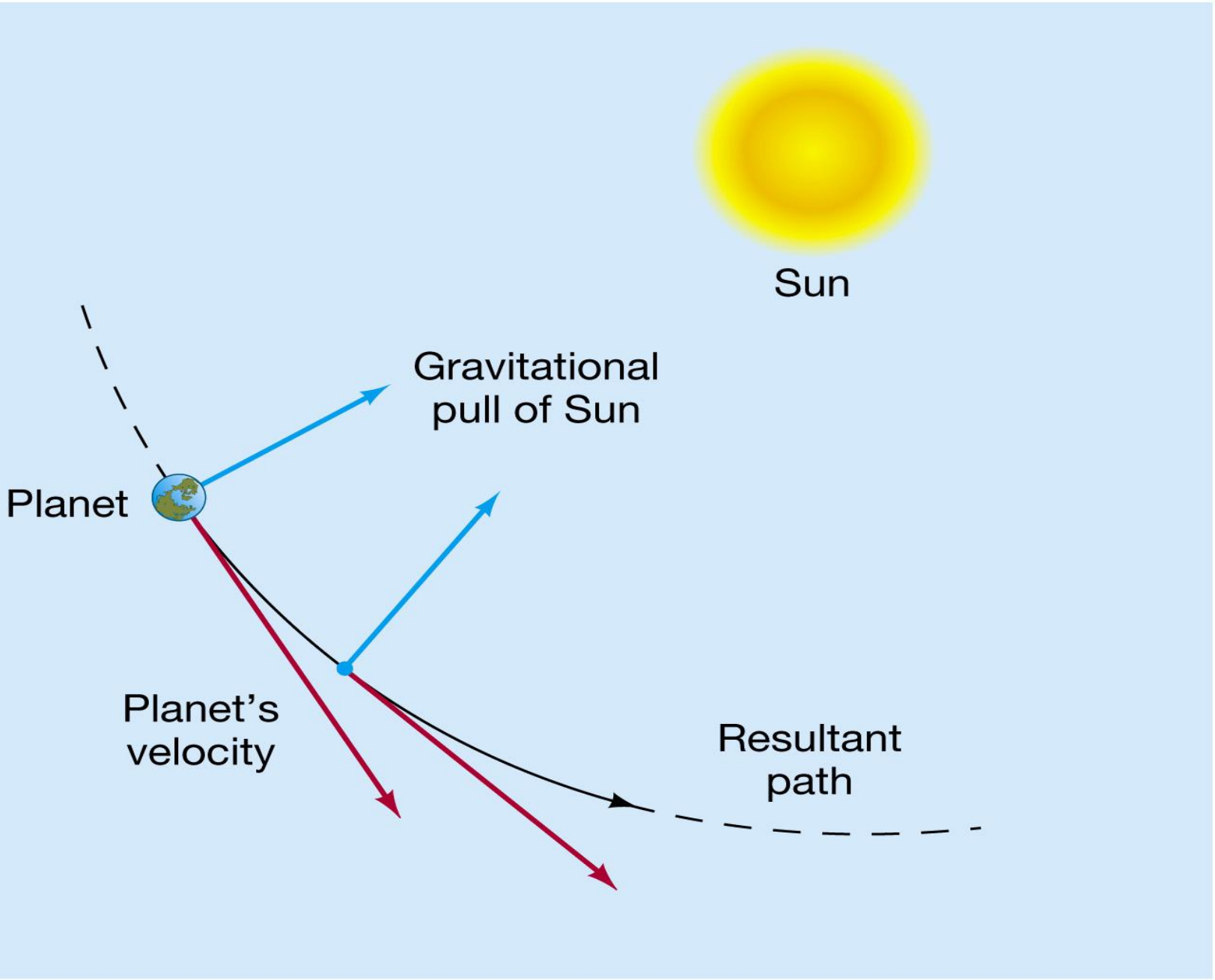
a conserved vector quantity that can be used to describe the overall state of a physical system

Angular Momentum is the same at every point on an orbit. When it is closer, it increases speed

http://www.youtube.com/watch?v=AQLtcEAG9v0

Newton's Law of Gravitation

Every massive particle in the universe attracts every other massive particle with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance between them


Sun
Gravitational pull of Sun
Planet
Planet's velocity
Resultant path

Who was Newton

Whole name was Sir Isaac Newton

Born in January in 1643

He was a physicist, mathematician, astronomer, philosopher, alchemist, and theologian

Example Exercises