Tangential displacement: s = r ω t (s is scalar in nature)

Tangential speed: vt = r ω (vt is scalar)

Tangential acceleration: at = r (here

Centripetal acceleration: ac = vt2/r = r ω2

Centripetal force: Fc = m ac  = m vt2/r = m r ω2

Torque: τ = I = **r x F** ( so torque is a vector, r goes from center to rim)

Rotational kinetic energy: E = (1/2) I ω2

Work Energy: Wnet = (1/2) I ωf2 - (1/2) I ωi2

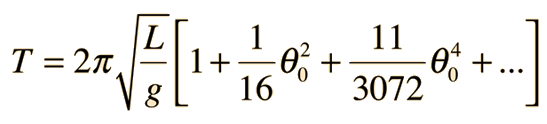
For constant torque: W = τ θ = I θ

Combine the two: ωf2 = ωi2 + 2 θ

Angular acceleration: ω/dt = d2 θ/dt2 = at /r

Tangential force: F = m at

Simple Pendulum: T = 2π sqrt(L/g)



fT = 1

acceleration: a = -(2 πf)2x x = displacement from the central position in m.

x = A cos(2 πft) A=maximum applitude.

V = ±2πf sqrt(A2 – x2)

Max speed = 2 πfA

Max acceleration = (2πf)2A

Spring system: T = 2π sqrt(m/k)

Pendulum: T = 2π sqrt(l/g)

For any [Keplerian orbit](https://en.wikipedia.org/wiki/Keplerian_orbit) ([elliptic](https://en.wikipedia.org/wiki/Elliptic_orbit), [parabolic](https://en.wikipedia.org/wiki/Parabolic_trajectory), [hyperbolic](https://en.wikipedia.org/wiki/Hyperbolic_trajectory), or [radial](https://en.wikipedia.org/wiki/Radial_trajectory)), the *vis-viva* equation[[1]](https://en.wikipedia.org/wiki/Vis-viva_equation#cite_note-1) is as follows:

where:

* *v* is the relative speed of the two bodies
* *r* is the distance between the two bodies
* *a* is the [semi-major axis](https://en.wikipedia.org/wiki/Semi-major_axis) (*a* > 0 for [ellipses](https://en.wikipedia.org/wiki/Ellipse), *a* = ∞ or 1/*a* = 0 for [parabolas](https://en.wikipedia.org/wiki/Parabola), and *a* < 0 for [hyperbolas](https://en.wikipedia.org/wiki/Hyperbola))
* *G* is the [gravitational constant](https://en.wikipedia.org/wiki/Gravitational_constant)
* *M* is the mass of the central body

The product of GM can also be expressed as the [standard gravitational parameter](https://en.wikipedia.org/wiki/Standard_gravitational_parameter) using the Greek letter μ.

**gravitational binding energy:**The gravitational self potential energy

For a spherical [mass](https://en.wikipedia.org/wiki/Mass) of uniform [density](https://en.wikipedia.org/wiki/Density), the gravitational binding energy *U* is given by the formula[[1]](https://en.wikipedia.org/wiki/Gravitational_binding_energy#cite_note-Chandrasekhar_1939-1)[[2]](https://en.wikipedia.org/wiki/Gravitational_binding_energy#cite_note-Lang_1980-2):

