Newton's Laws

1. A body remains at rest, or in motion at a constant speed in a straight line, unless acted upon by a force. (Things don't move on their own, bodies are lazy)
2. When a body is acted upon by a force, the time rate of change of its momentum equals the force. ($F = ma$)
3. If two bodies exert forces on each other, these forces have the same magnitude but opposite directions. (If I push a thing that won't budge, it pushes back at me with the same magnitude, but opposite direction)

Gravity and Normal Forces

The force of gravity is given as $F = mg$. $g = 9.82$ in Sweden.

Normal forces are always perpendicular to the ground. On a level plane at rest this is equal to the force of gravity. These are *not* counter forces according to Newton's 3rd law, since they act only on one object, not two separate ones.

Law of Gravitation

$$F = G \times \frac{m_1 \times m_2}{r^2}$$

Where M_1 and m_2 are the masses of the objects, such as the earth and moon, r is the distance between them, and $G = 6.67 \times 10^{-11} Nm^2/kg^2$. F is the force attracting each body towards the other.

Hooke's Law

$$F = k \times \Delta l$$

Where F is the force pulling the spring, Δl is the change in length of the spring, and k is the spring constant, which is an intrinsic property of the spring and is measured in the unit N/m

Friction

$$F_f = \mu \times F_N$$

Where F_f is the force of friction, μ is the coefficient of friction, and F_N is the normal force.

Motion Formulae

$$\Delta s = v \times \Delta t$$

$$\Delta v = a \times \Delta t$$

$$\Delta s = v_0 t + \frac{at^2}{2}$$

$$2 \times a \times \Delta s = v_1^2 - v_0^2$$

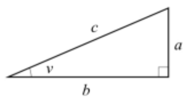
Where Δs is change in position, Δt is change in time, Δv is change in velocity, a is acceleration, v is velocity, t is time, s is position, g is $9.82 m/s^2$ (in Sweden).

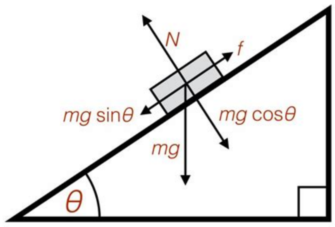
Trigonometry & Tilted Planes

$$\sin v = \frac{a}{c}$$

$$\cos v = \frac{b}{c}$$

$$\tan v = \frac{a}{b}$$





Energy

$$W = F_{res} \times \Delta S$$

$$\Delta E = W$$

$$E_p = mgh$$

$$E_k = \frac{m \times v^2}{2}$$

$$P = \frac{\Delta E}{\Delta t}$$

$$\eta = \frac{\Delta E_{useful}}{\Delta E_{total}} = \frac{P_{useful}}{P_{total}}$$

$$p = m \times v$$

$$F \Delta t = \Delta p = mv_2 - mv_1$$

Where E is energy (J), P is power (W), η is efficieny, p is momentum (kgm/s), Δp is impulse (kgm/s) and W is work (Nm)

Energy Principle

Energy is always conserved, it is the same both before and after an event.

Conservation of Momentum

The sum of the momentum before and after a collsion always equal.

$$p_{a1} + p_{b1} = p_{a2} + p_{b2}$$