Dynamics Review Map

Newton's 1st Law – Inertia

Objects have inertia in direct proportion to mass.
Inertia and mass are UNIVERSAL – weight is NOT (depends on location)

Weight and mass are NOT the same thing!

$$g = \frac{F_g}{m}$$

Newton's 2nd Law

What is F_{net}?

$F_{net} = 0$ → equilibrium → $a = 0$

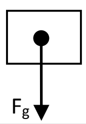
$$a = \frac{F_{net}}{m} \qquad F_f = \mu F_N$$

Newton's 3rd Law – Action/Reaction

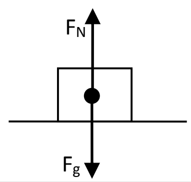
For every action there is an equal and opposite reaction.

ex. #1 : A planet and its moon exert equal and opposite gravitational forces on one another.

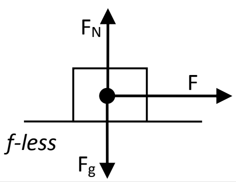
ex. #2 : Pushing an object (even one that moves) results in an equal push back FROM the object.



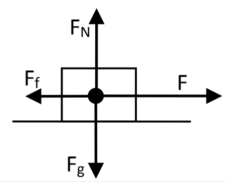
$F_{net} = F_g$
Freefall - accelerating downward



$F_{net} = 0$
$F_N = F_g$
Motionless



$F_{net} = F$
$F_N = F_g$
Must accelerate



$F_{net} = F - F_f$
$F_N = F_g$
If moving and $F = F_f$ then $a = 0$ (v = const)

Static Friction

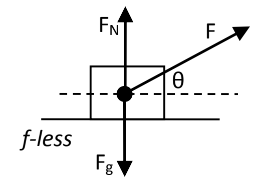
Pushes as hard as it needs to in order to stop motion - until it reaches a maximum, at which point the object slides

ex. object held motionless by friction or cars turning corners

Kinetic Friction

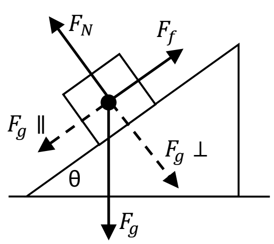
Object is sliding along a surface

ex. Block pulled along table, skis sliding on snow, skidding tires.



$F_{net} = F\cos\theta$
$F_N \neq F_g$
Must accelerate

Forces on Inclines



$F_g \parallel = F_g \sin\theta$
$F_g \perp = F_g \cos\theta$

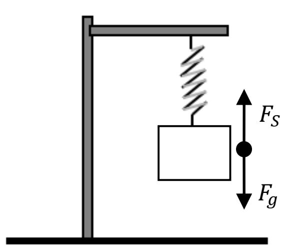
F_N always = $F_g \perp$

In order to NOT slide...
$F_g \parallel$ must be ≤ max static F_f

If sliding and...
$F_g \parallel = F_f$ → slides with v = const
$F_g \parallel > F_f$ → accel along plane

If θ increases:
$F_g \parallel$ increases
$F_g \perp$ decreases causing
F_N to decrease causing
F_f to decrease

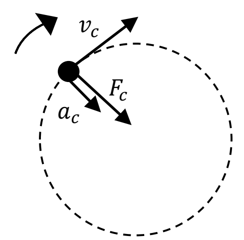
Spring Force



System is in equilibrium
$F_S = F_g$

F = kx

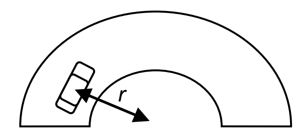
Circular Motion



$$F_c = ma_c \qquad a_c = \frac{v^2}{r}$$

Objects move in circular paths when pulled toward the center of the path by a force.

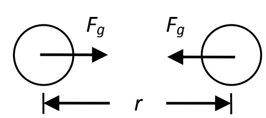
Centripetal Force Systems
Gravitational : $F_g = F_c$
Mass on a String : $F_T = F_C$
Car Turning a Corner : F_f (static)= F_c



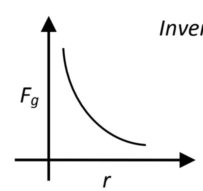
When an object turns a corner...
F_C is the force you NEED
F_f is the force you HAVE

If you are told that an object DOES make a turn then set $F_C = F_f$

Universal Gravitation



$$F_g = \frac{Gm_1m_2}{r^2}$$



Inverse square relationship between F_g and r

Double r → $\frac{1}{4}F_g$

Triple r → $\frac{1}{9}F_g$

Halve r → $4F_g$

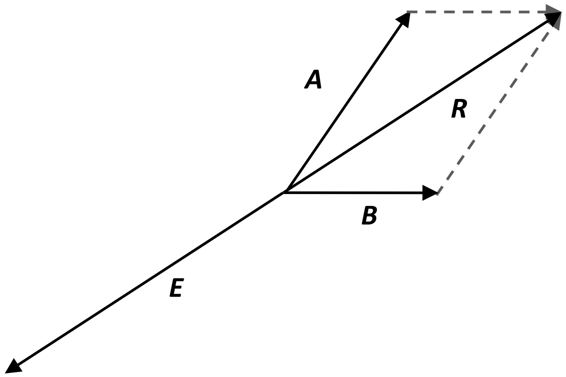
vectors - magnitude and direction
acceleration
force

scalars - magnitude only
coefficient of friction
spring constant
gravitational field strength
mass

Adding Vectors

Adding ***A*** and ***B*** gives resultant ***R***

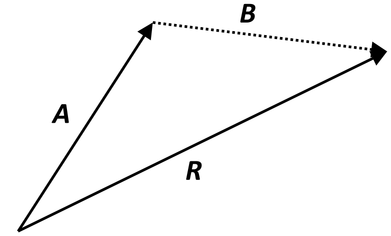
The equilibrant for the system of vectors ***A*** and ***B*** would be ***E***



Finding a Missing Component

Adding ***A*** and ***B*** gives resultant ***R***

To find the missing vector, complete the triangle between ***A*** and ***R***



Changing Angles