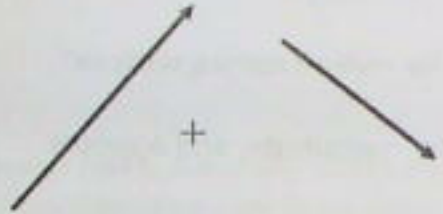
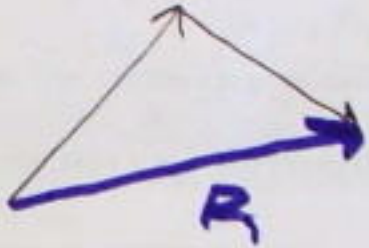
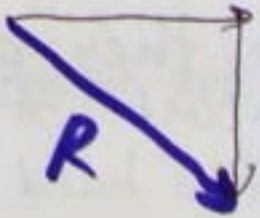
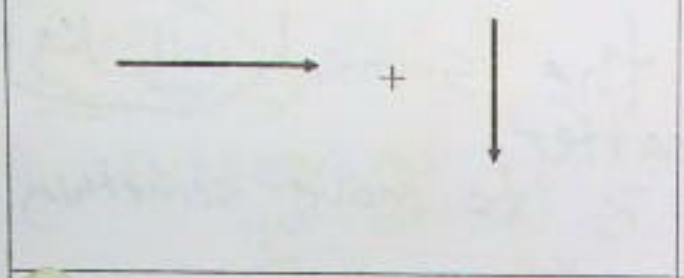
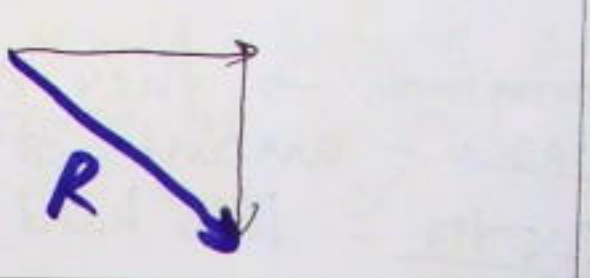
2. Forces Review

Add together the following sets of vectors

Separate Vectors	Vectors Added Together
	
	

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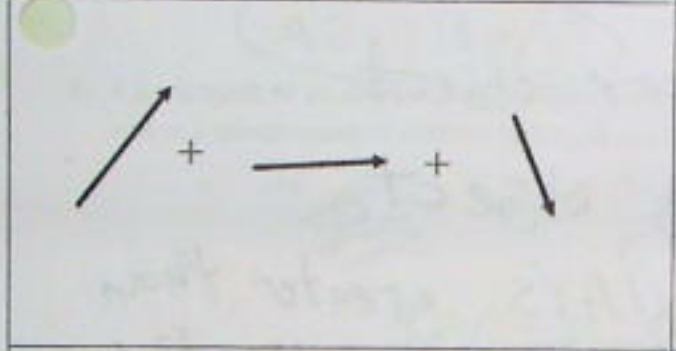

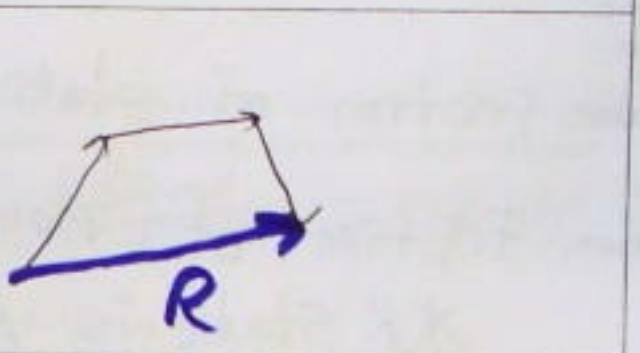
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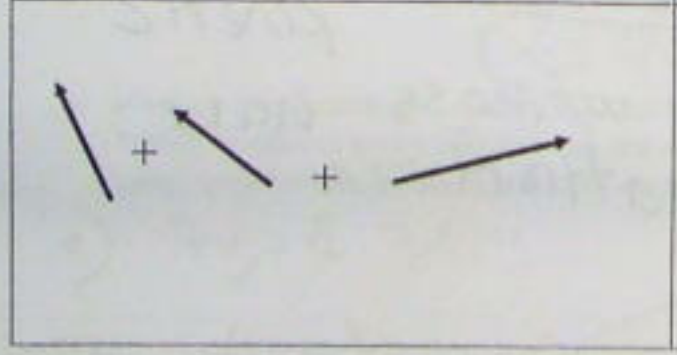
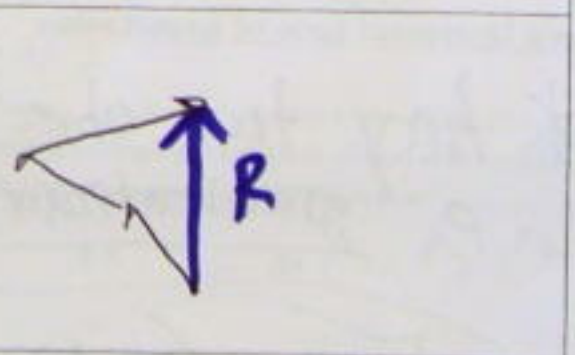



R

Mass versus Inertia → they are the same! (unit: kg)

Mass - amount of matter

Inertia - how hard it is to move something

Friction -

1) Static - Friction of stationary object

2) Kinetic - Friction of moving object

** static is ALWAYS greater than kinetic

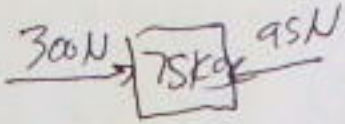
Newton's Universal Law of Gravitation

* Any two objects w/ mass have a gravitational attraction

$$F_g = \frac{G M_1 M_2}{r^2}$$

ple Problems

1) When a horizontal force of 300N is applied to a 75kg crate, it slides on a level floor opposed by a force of kinetic friction of 95N. What is the acceleration of the crate?



$f_{net} = 205N$

$F = ma$

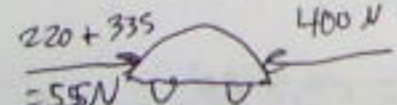
$205N = 75kg(a)$

$a = 2.73 m/s^2$

2) A stalled 1500 kg automobile is pushed toward a gas station by a man and a woman on a level road. The applied horizontal forces are 220N for the woman and 335N for the man.

a. If there is an effective force of friction of 400N on the car as it moves, what is its acceleration?

b. Once the car is moving appreciably, what would be an appropriate combined applied force by the man and woman to keep the car moving at constant velocity?



$f_{net} = 155N = ma$

$155N = 1500kg(a)$

$a = .103 m/s^2$

b) 400N - because it can move at constant speed if $f_{net} = 0$

3) A jet catapult on an aircraft carrier uniformly accelerates a plane with a mass of one metric ton (1000kg) from rest to a launch speed of 200mph (88.9m/s) in 2.00s. What is the magnitude of the net force on the plane?

$\Delta v = 88.9 m/s$ $= 44.5 m/s^2$

$F_{net} = 155N = ma$

$155N = 1500kg(a)$

$a = .103 m/s^2$

If $F_{net} = 0$

3) A jet catapult on an aircraft carrier uniformly accelerates a plane with a mass of one metric ton (1000kg) from rest to a launch speed of 200mph (88.9m/s) in 2.00s. What is the magnitude of the net force on the plane?

$a = \frac{\Delta v}{t} = \frac{88.9 m/s}{2s} = 44.5 m/s^2$

$F = Ma = 1000kg(44.5 m/s^2)$

$F = 44,450N$

4) In moving a 35.0kg desk from one side of a classroom to the other, a professor finds that a horizontal force of 275N is necessary to set the desk in motion and a force of 195N is necessary to keep it in motion with a constant speed. What are the coefficients of a) static and b) kinetic friction between the desk and the floor?

a) $f_F = \mu f_N = \mu Mg$

$275N = \mu(35kg)(9.81 m/s^2)$

$\mu_s = .8$

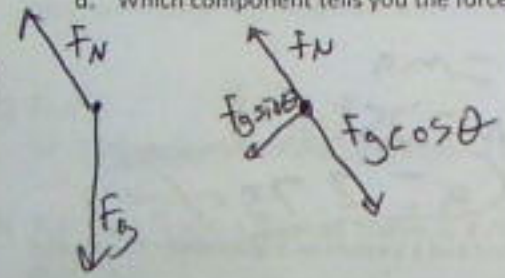
b) $195N = \mu(35kg)(9.8 \frac{m}{s^2})$

$\mu = .57$

5) A 10kg packing crate is placed on a 20° frictionless incline plane.

a. Draw a free body diagram of the crate, and break the weight (force of gravity) into its components.
b. What is the weight of the crate?
c. Which component tells you the *normal force* on the crate? Calculate it.
d. Which component tells you the force which accelerates the crate? Calculate it.

a)



b) $f_g = mg$

$= 10\text{kg}(9.8\text{N/s}^2)$

$f_g = 98.1\text{ N}$

c) perpendicular

$f_{g\perp} = mg\cos\theta$

$= 10\text{kg}(9.8\text{N/s}^2)\cos 20°$

$f_{g\perp} = 92.2\text{ N}$

don't forget degree symbol is a unit!

d) Parallel

$f_{g\parallel} = mg\sin\theta$

$= 98.1\text{N}\sin 20°$

$f_{g\parallel} = 33.6\text{N}$

$F_{g1} = 92.2\ N$

degree symbol is a unit!!

6) What is the acceleration due to gravity on the top of Mt. Everest? The summit is about 8800m above sea level (Report to 3 significant figures). Note that the radius of the earth at sea level is 6.37×10^6m.

$F_g = ma = \frac{GM_1M_2}{r^2}$

$a = \frac{GM}{r^2}$

$= \frac{6.67 \times 10^{-11} \frac{N m^2}{kg^2} (5.98 \times 10^{24} kg)}{(8800m + 6.37 \times 10^6 m)^2}$

$a = 9.80\ m/s^2$

7) The Earth exerts a gravitational force of about 2×10^{20}N on the Moon. Compared to this force, The Moon's gravitational force exerted on the Earth is:

a. Greater b. Less c. Equal

Explain why: Newton's 3rd Law!!