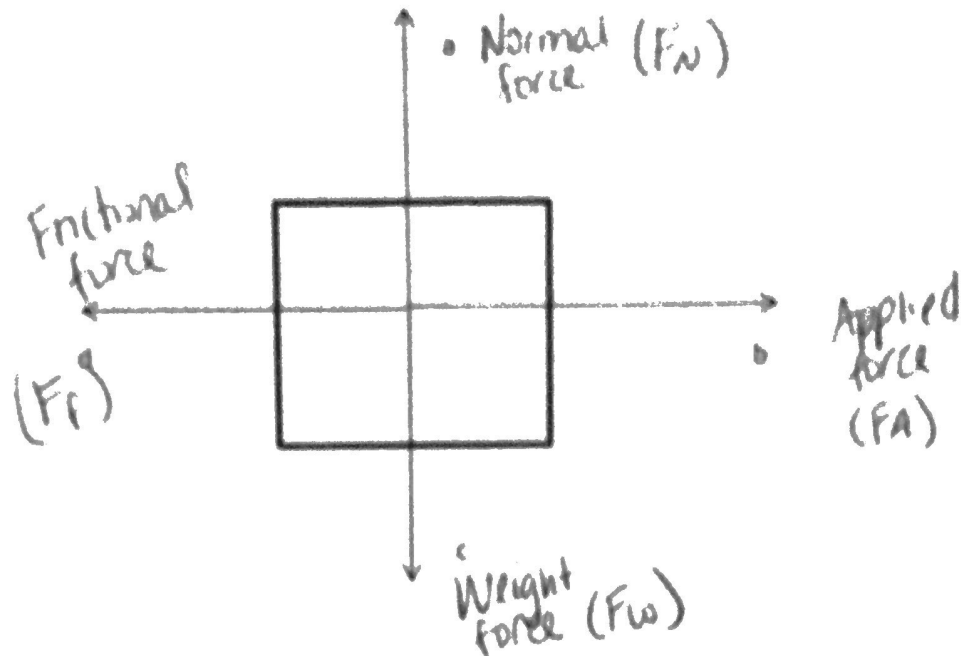


REVIEW FOR NEWTON'S LAWS TEST

Free body diagrams

1. Label the following parts of a free body diagram: Weight, Normal force, Frictional force, applied force



2. Remember the formula $F_f = \mu F_n$, using this formula, answer the following questions:

F_f = frictional force and is measured in N

μ = coefficient of friction (no unit)

F_n = normal force and is measured in N

On a level surface, F_n is equal to the objects weight

a. A 12 kg box is sitting on a level surface. You push it across the floor. The kinetic friction acting against your exerted force is 73 N. What is the coefficient of friction?

Formula(s): $F_w = mg$ $F_f = \mu F_n$	Plug in numbers: $F_w = (12 \text{ kg})(9.8) = 117.6$ 73 N $73 \text{ N} = \mu (117.6)$ $\frac{73}{117.6} = \frac{\mu}{117.6}$	Answer: <u>.62</u>
--	--	-----------------------

b. You're pushing a box on a level surface whose coefficient of friction is 0.27 and the force of kinetic friction is 122N. What is the weight of the object you are pushing?

Formula(s): $F_f = \mu F_n$ $F_n = F_w$	Plug in numbers: $\frac{122 \text{ N}}{.27} = \frac{.27 (F_n)}{.27}$ $F_n = 451.9 \text{ N}$	Answer: <u>451.9 N</u>
---	--	---------------------------

Forces on an incline:

4 steps to take to find an object's acceleration traveling down an incline.

1. Find the object's weight ($F_w = mg$)

2. Break down the F_w into perpendicular and parallel components

3. The angle of the ramp equals the angle of the right triangle you just made from F_w .

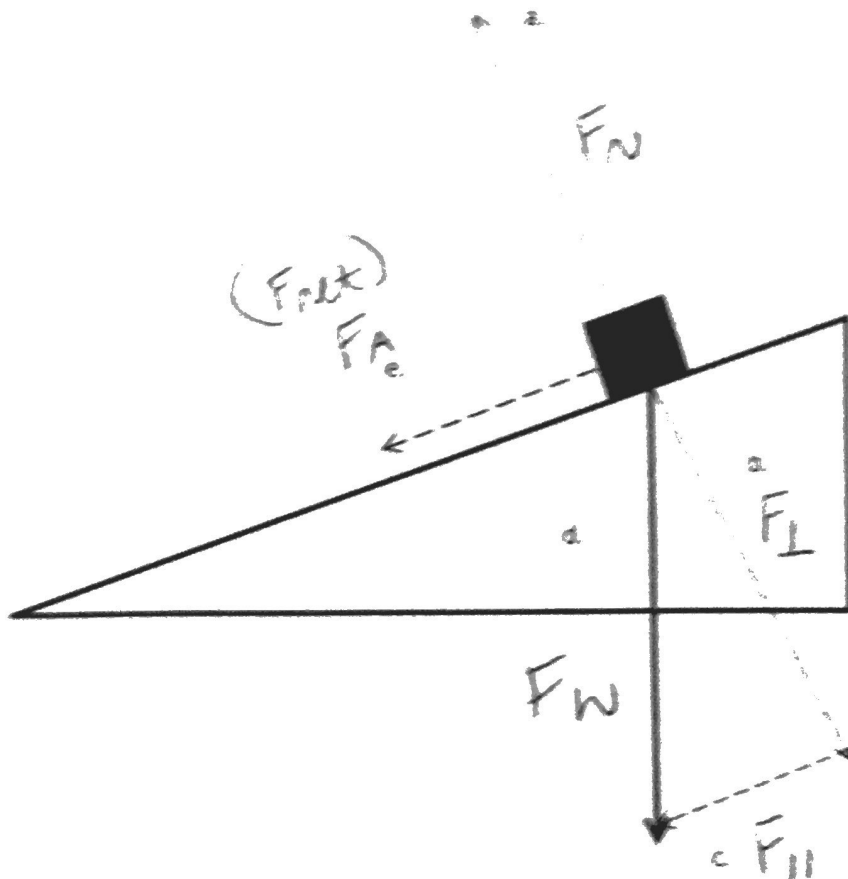
4. Use cosine and sine to find the magnitude of the component vectors.

The perpendicular force is equal to the normal force

The parallel force is equal to the applied force

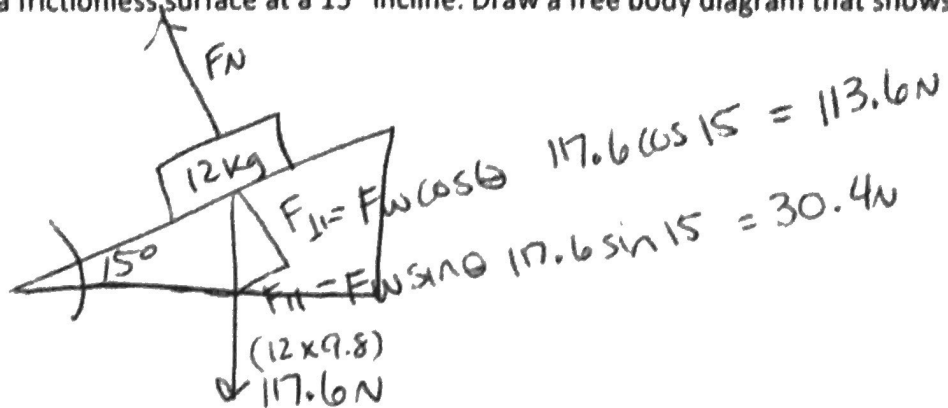
Label the following parts of the free body diagram:

Weight, Perpendicular force, Parallel force, Net force, Normal force



Example:

A 12kg box is resting on a frictionless surface at a 15° incline. Draw a free body diagram that shows all forces acting on the box.



Weight: 117.6 N

Perpendicular force: 113.6 N

Parallel force: 30.4 N

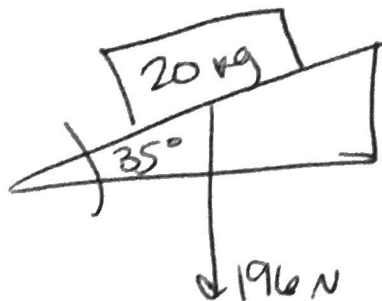
Normal force: 113.6 N

Acceleration: 2.5 m/s^2

$$F_{\text{net}} = 30.4 \text{ N}$$

$$F_{\text{net}} = ma$$
$$\frac{30.4}{12} = \frac{12(a)}{12}$$

A 20kg bike is resting on a frictionless surface at a 35° incline. Draw a free body diagram that shows all forces acting on the bike.



Weight: $20 \times 9.8 = 196 \text{ N}$

Perpendicular force: $196 \cos 35 = 160.6 \text{ N}$

Parallel force: $196 \sin 35 = 112.4 \text{ N}$

Normal force: 160.6 N

Acceleration: 5.6 m/s^2

$$F_{\text{net}} = 112.4$$

$$F_{\text{net}} = ma$$
$$\frac{112.4}{20} = \frac{20(a)}{20}$$