

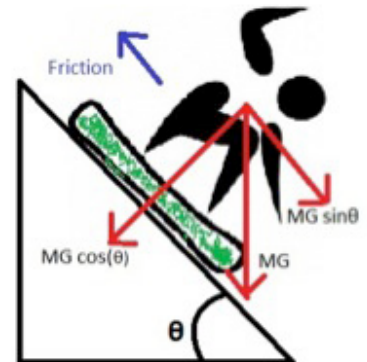
# Shell Tutorial Center

## Newton's Second Law

### force = mass x acceleration

Forces which need to be considered in these problems include weight, normal force, friction, and any other pushes or pulls on the object. If the object is on a slanted plane then the normal force,  $N$ , will not equal the weight.

$$\begin{aligned}\sum F &= m \cdot a \\ W &= m \cdot g \\ f &= \mu \cdot N\end{aligned}$$



Note: If  $a = 0$ , then  $\sum F = 0$  and  $f$  (friction) always opposes motion.

1. Write equations for x and y directions.

$$\sum F_y = N - W \cdot \cos\theta - 0$$

$$\sum F_x = m \cdot a_x = W \cdot \sin\theta - f$$

2. Solve for the normal force,  $N$ .

$$N = W \cdot \cos\theta$$

3. Find the frictional force.

$$f = \mu \cdot N \quad (\text{Note } \mu \text{ depends upon the surface and will be given})$$

4. Solve for the acceleration.

$$\sum F_x = m \cdot a_x = W \cdot \sin\theta - \mu \cdot W \cdot \cos\theta$$

$$a_x = \frac{W \cdot \sin\theta - \mu \cdot W \cdot \cos\theta}{m} = G(\sin\theta - \mu \cdot \cos\theta)$$

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