

Gravity

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Four Theories of Gravity

1. Gravity causes objects near Earth's surface to accelerate. An object near Earth's surface that is allowed to move or fall freely will accelerate toward the center of the Earth at a rate of 9.8 m/s^2 .
2. Gravity is a force produced by the Earth on objects near its surface. $F_G = mg$ downward.
3. Gravity is a force between any two objects with mass. This is called Newton's law of universal gravitation.
4. Gravity is the curvature of space-time. This is Einstein's general theory of relativity.

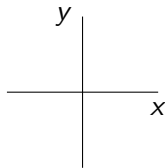
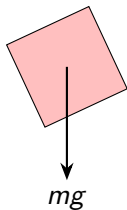
Mass vs. Weight

- ▶ *Weight* is the force that Earth's gravity exerts on objects near its surface.
- ▶ Since weight is a force, the SI unit is the Newton (N). People also use pounds as a unit of force to measure weight.

An object with mass m has

$$\text{weight} = F_G = mg.$$

If gravity is the only force acting, then Newton's second law reduces to the projectile motion we did before.



In the x direction:

$$F_{\text{net},x} = ma_x$$

$$0 = ma_x$$

$$a_x = 0$$

In the y direction:

$$F_{\text{net},y} = ma_y$$

$$-mg = ma_y$$

$$a_y = -g$$