WHAT IS FORCE?

Standard 8-5.5

Analyze the resulting effect of balanced and unbalanced forces on an object's motion in terms of magnitude and direction

WHAT IS FORCE?

A force is a push or a pull!

When one object pushes or pulls another object, you say that the first object is exerting force on the second object.

Examples:

**You exert a force on a pen when you write

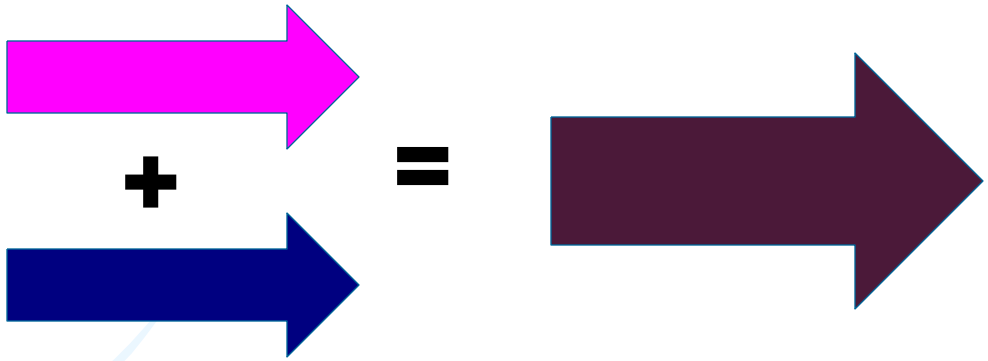
** On a book when you lift it

** On a ball when you throw it

** On a nail when you hammer it into a piece of wood

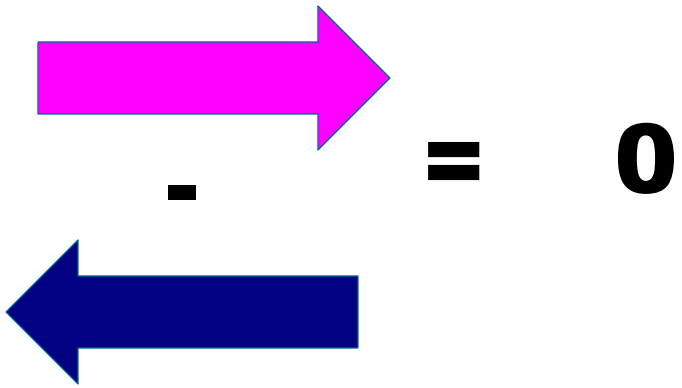
Skill Practice – Have student push a desk. Exerting a force on the desk causes it to move. Have two students push the desk in the same direction.

When two people exert a force on the object, in the same direction, the total force is the <u>SUM</u> of both forces exerted.



Skill Practice – Have one student push a desk one way and have another student push it the opposite way. (preferably same force in each direction)

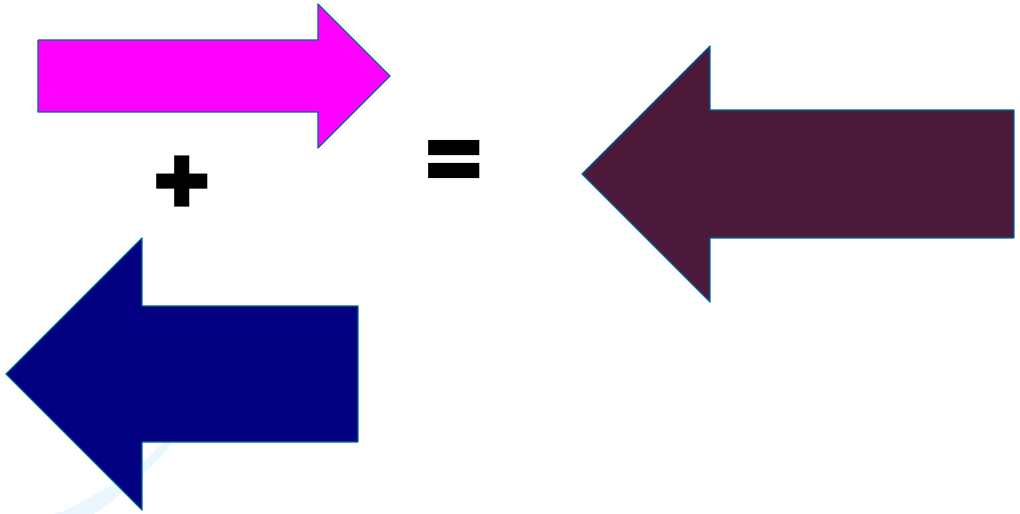
When two people exert a force on the object, in the opposite direction, the total force is the <u>DIFFERENCE</u> of both forces exerted. If the force is the same, then they can cancel out each other.



<u>Net Force:</u> The overall force on an object after all the forces are added together.

When there is a net force acting on an object, the force is said to be unbalanced.

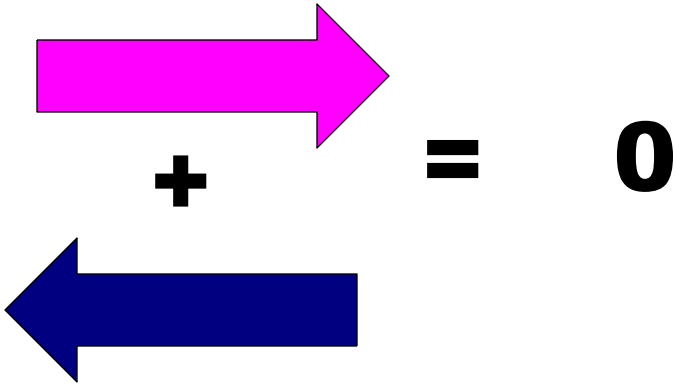
An unbalanced force can cause an object to start moving, stop moving, or change direction. An unbalanced force acting on an object will change the object's motion.



An unbalanced force will cause an object to accelerate. The object will accelerate in the direction of the GREATER force.

Equal forces acting on one object in opposite directions are called **Balanced forces.**

Balanced forces (equal) acting on an object will not change the object's motion.



The net force is zero

CHECK FOR UNDERSTANDING

What makes an arrow fly through the air to its target?

What makes a long jumper thud to a stop?

What will make a soccer ball change direction?

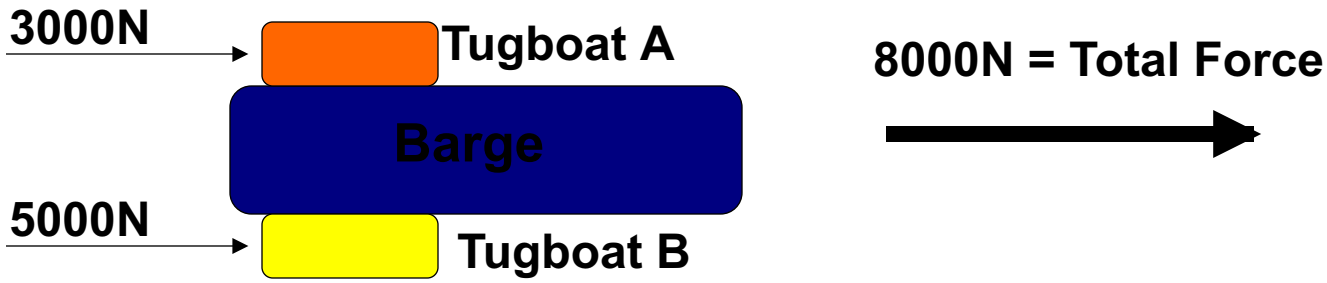
If two kids are playing tug of war but the center is not moving they have _____ force.

If one of the kids in the tug of war game pulls harder than the other then you have an _____ force.

Which force will cause change in motion – balanced or unbalanced?

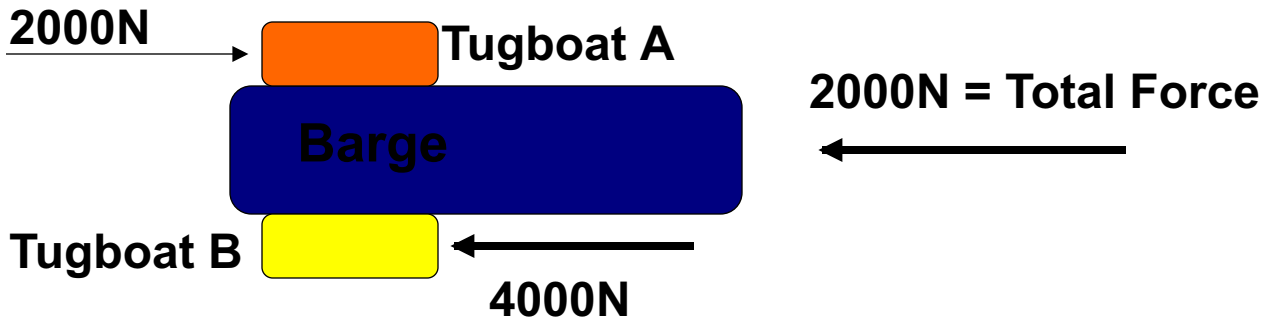
Example #1

- Two tugboats are moving a barge. Tugboat A exerts a force of 3000 newtons on the barge. Tugboat B exerts a force of 5000 newtons in the same direction. What is the combined force on the barge?



Example #2

- Now suppose that Tugboat A exerts a force of 2000 newtons on the barge and Tugboat B exerts a force of 4000 newtons in the opposite direction. What is the combined force on the barge?



Forces

- Friction and gravity are two types of forces we encounter everyday.

Which Lands First?

- Do you think a quarter will fall more quickly than a dime? More quickly than a nickel?

- ***In your notes, record your predictions.***

Which Lands First?

- ***Step #1***: Place a dime, nickel, and a quarter along the edge of the desk.
- ***Step #2***: Place a ruler behind the coins. Line it up with the edge of the desk.
- ***Step #3***: Keeping the ruler parallel to the edge of the desk, push all three coins over the edge at the same time. Observe any time difference when the coins land.
- **Step #4:** Repeat steps 1-3 and note any differences.

Which Lands First?

- Now, which do you think will fall first:
  - A pencil or a book?
- What type of force is acting on the falling objects?

Gravity

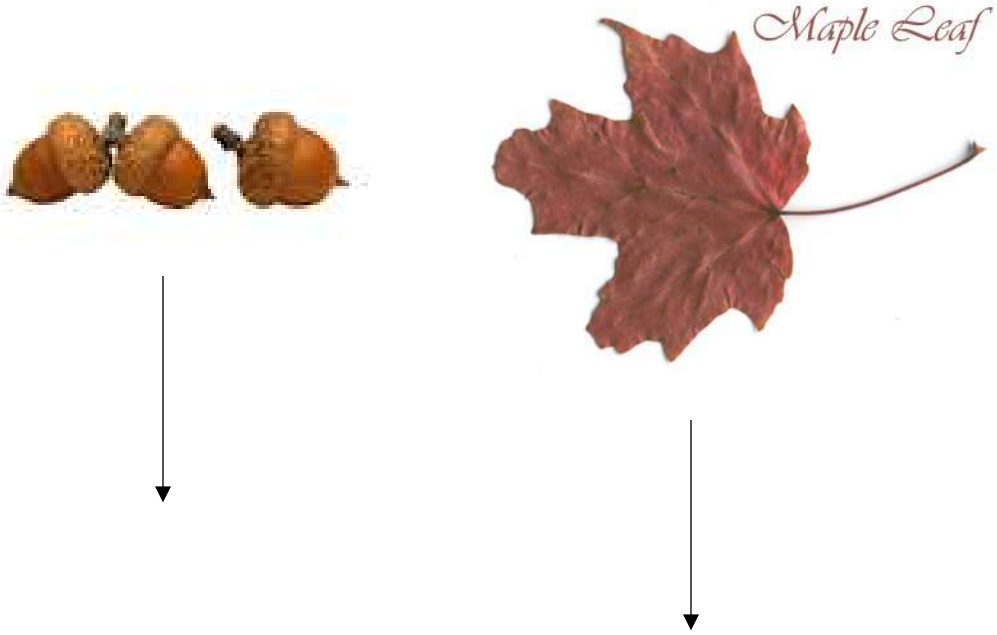
- ***Gravity*** – is the force that acts to pull objects straight towards the center of the Earth.
  - An objects speed increases as it falls.
- ***Free Fall*** – When the only force acting on a falling object is gravity, the object is said to be in free fall.

Gravity

- An object in free fall accelerates as it falls.

- In free fall, gravity is the only force acting on the object so it accelerates.
  - The rate at which objects accelerate is 9.8m/s/s.
  - This means that for every second an object is falling, its velocity increases by 9.8m/s.
- ALL objects in free fall accelerate at the same rate.

- Despite the fact that all objects are supposed to fall at the same rate, we know that this is not always the case.
- For example, let's think about the following example:
  - An maple leaf and an acorn falling.



Do they fall at the same speed?

What causes the speed to be different?

Friction

- ***Friction*** is the force that one surface exerts on another when the two rub against each other.

- The type of friction shown in the previous example is *air resistance*.

- The greater the surface area of an object, the greater the air resistance.

Gravity pulling the acorn down.

Air resistance working against the acorn is less than the leaf

Gravity pulling the leaf down.

Air resistance working against gravity is greater for the leaf.

In this situation, the acorn falls faster because it has less surface area and therefore, less air resistance.

Friction

- Friction acts in a direction opposite to the object's direction of motion.
- Without friction an object would continue to move at a constant speed forever.
- *Example:*
  - *Let's push a book across the desk.*
  - *In your notes, predict what will cause the book to stop.*

Friction

- Friction is increased by the amount of surface area the object has in contact with the surface.
  - For example, tires with more surface area have better traction on the road.

- Friction causes objects to slow down or stop.

Is Friction Useful?

- Friction allows you to walk across the floor.
  - Without friction your shoes would simply slide across the floor.
- Friction allows you to strike a match.
  - It is the friction that cause the flame to ignite.

How could friction not be useful?

- Tires wear out over time because of the friction between the tire and the road.

- Gears inside machines wear down because of the friction between parts.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