Unit 1 Review

SCIENTIFIC NOTATION

Example

Number less than 1

0.000001052

Number greater than 10:

9604000000

SCIENTIFIC NOTATION

- ***Step 1:*** Move the decimal point so that you have a number that is between 1 and 10.

1.052

↑ .

For numbers where a decimal is *present*, all of the zeroes to the left of the first non-zero number from the left drop into the *Pacific* Ocean

9.604

↑

For numbers where a decimal is *absent*, all of the zeroes to the right of the first non-zero number from the right drop into the *Atlantic* Ocean

SCIENTIFIC NOTATION

- ***Step 2:*** Count the number of decimal places moved in Step 1.

0.000001052

-6 .

9604000000

9

If the decimal point is moved to the right, the count is negative.

If the decimal point was moved to the left, the count is positive.

SCIENTIFIC NOTATION

- *Step 3:* Write the number from ***Step 1*** times 10 with a power of the number determined by ***Step 2***.

From Step 1: 1.052

From Step 2: -6

1.052×10^{-6}

From Step 1: 9.604

From Step 2: 9

9.604×10^{9}

SCIENTIFIC NOTATION

- For all numbers between 1 and 10 (including 1 but not including 10) are written as that number times 10^0. For example, 1.023 = 1.023×10^0 in scientific notation.

How to use this device:

1. Look at the problem. Look at the unit that has a number. On the device put your pencil on that unit.

2. Move to new unit, counting jumps and noticing the direction of the jump.

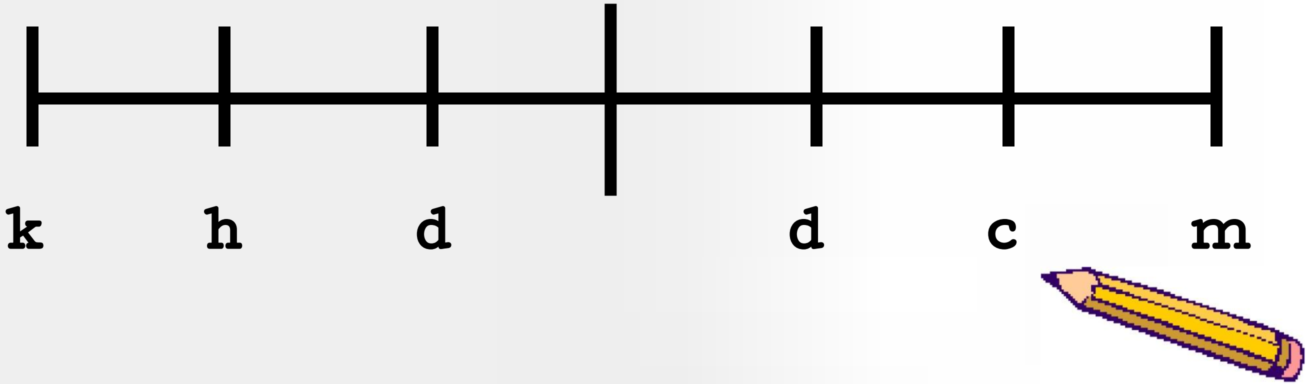
3. Move decimal in original number the same # of spaces and in the same direction.

Example #1:

(1) Look at the problem. 56 cm = _____ mm

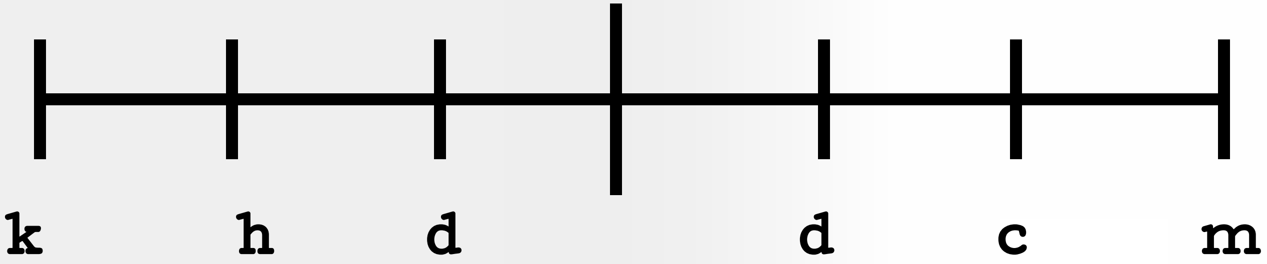
Look at the unit that has a number. 56 cm

On the device put your pencil on <u>that</u> unit.



Example #1:

2. **Move to new unit, counting jumps and noticing the direction of the jump!**



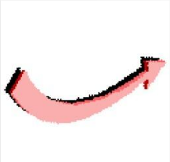
One jump to the right!

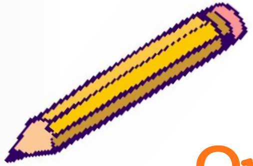
Example #1:

3. Move decimal in original number the same # of spaces and in the same direction.

56 cm = _____ mm

56.0.





One jump to the right!

Move decimal one jump to the right.
Add a zero as a placeholder.

Example #1:

56 cm = ______ mm

56cm = 560 mm

Independent Variable:

Dependent Variable:

Calculation Corner: Unit Conversion

Step 1: Find the conversion factor needed

Conversion factors are written as fractions.

Factor can be written two ways.

1 foot = 12 inches

Calculation Corner: Unit Conversion

1 foot = 12 inches

$$\frac{\text{1 foot}}{\text{12 inches}} = 1$$

Conversion Factor Example

1 foot = 12 inches

$$\frac{\text{1 foot}}{\text{12 inches}} = 1$$

$$\frac{\text{12 inches}}{\text{1 foot}} = 1$$

Calculation Corner: Unit Conversion

$$\frac{\text{1 foot}}{\text{12 inches}} \qquad \frac{\text{12 inches}}{\text{1 foot}}$$

Step 2: Determine which unit goes on top and which goes on the bottom.

Calculation Corner: Unit Conversion

$$\frac{\text{1 foot}}{\text{12 inches}} \qquad \frac{\text{12 inches}}{\text{1 foot}}$$

Step 2: Units MUST be opposite of each other.

Step 3: Solve

$$\left(\text{3 feet}\right)\left(\frac{\text{12 inches}}{\text{1 foot}}\right) = \text{36 inches}$$

How many feet is 39.37 inches?

equality: 1 ft = 12 in

applicable conversion factors:

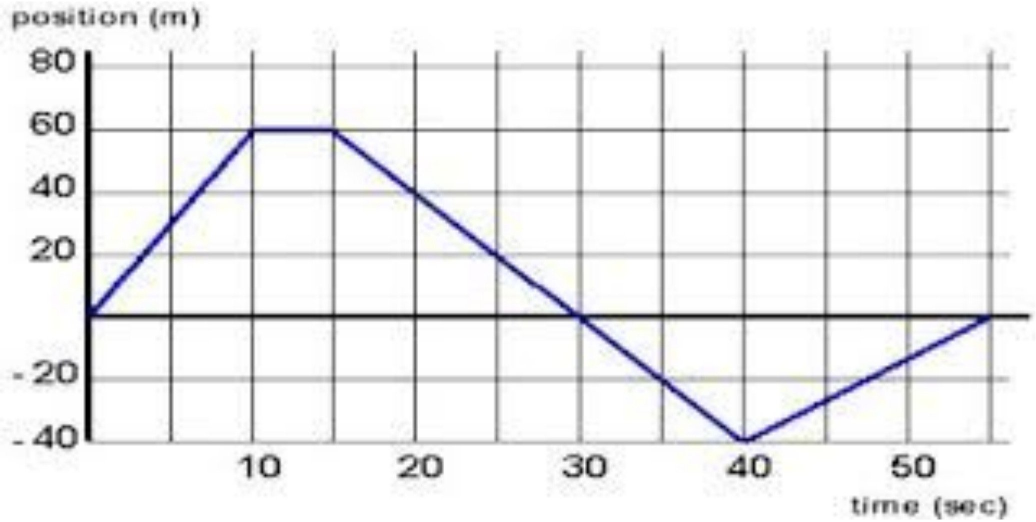
$$\frac{1\ \text{ft}}{12\ \text{in}} \quad \text{or} \quad \frac{12\ \text{in}}{1\ \text{ft}}$$

$$X\ \text{ft} = 39.37\ \text{in} \left(\frac{1\ \text{ft}}{12\ \text{in}}\right) = 3.28\ \text{ft}$$

Again, the units must cancel.

Unit 2 Review

Position Vs. Time Graphs

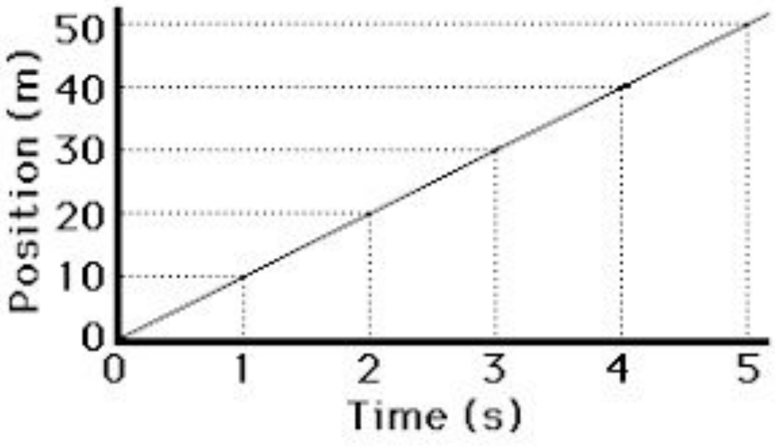


Sloped Line: Constant Velocity

Flat Horizontal Line: Stopped

Negative Slope - Returning back to original position.

Calculating velocity from Position vs. Time Graph



Velocity = Displacement / Time

Determine the velocity from 0-5 seconds.

Displacement = 50m-0m

Time = 5 seconds

Velocity = 50m/5s

10m/s

Unit 3 Review

Accelerated Motion

Acceleration

- Average acceleration of an object is the change in its velocity divided by the change in time.
- Stated mathematically, the definition of average acceleration a_{av} is

$$a_{av} = \frac{\text{change in velocity}}{\text{change in time}} = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{\Delta t}$$

Acceleration

- The dimensions of average acceleration are the dimensions of velocity per time or (meters per second) per second. That is,

$$\frac{\text{meters per second}}{\text{second}} = \frac{\text{m/s}}{\text{s}} = \frac{\text{m}}{\text{s}^2}$$

- Written symbolically as m/s^2, the units of average acceleration are expressed as "meters per second squared."

E = Equation

$$a = \frac{(Vf - Vi)}{t}$$

$$t = \frac{(Vf - Vi)}{a}$$

$$Vf = at + Vi$$

$$Vi = Vf - at$$

Example:

1. car accelerates from 50m/s to 100m/s in 10 seconds.
   a. What is the initial velocity? 50m/s

   b. What is the final velocity? 100m/s

   c. What is the time? 10 s

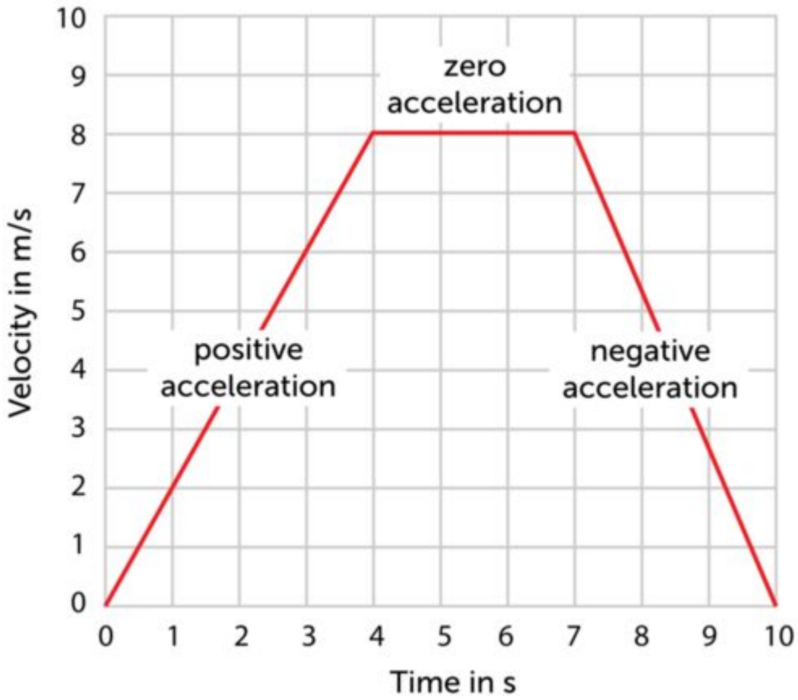
   d. What is the acceleration? (SHOW WORK)

   $\frac{(100-50 m/s)}{10 s} = 5\ m/s2$

Free Fall

- The acceleration produced by gravity at the Earth's surface is denoted with the symbol *g*.
- In our calculations we will use $g = -9.8\ m/s^2$;

Velocity vs. Time Graph



Straight sloped line = Constant acceleration

Flat line = no acceleration or constant velocity

On a Velocity vs. Time graph, the area under the line or curve is equal to the object's displacement.

Unit 4 Review

Vectors and Relative Motion

Scalar

A **SCALAR** is ANY quantity in physics that has MAGNITUDE, but NOT a direction associated with it.

Magnitude – A numerical value with units.

Scalar Example	**Magnitude**
Speed	20 m/s
Distance	10 m
Age	15 years
Heat	1000 calories

Vector

A **VECTOR** is ANY quantity in physics that has BOTH MAGNITUDE and DIRECTION.

$$\vec{v}, \vec{x}, \vec{a}, \vec{F}$$

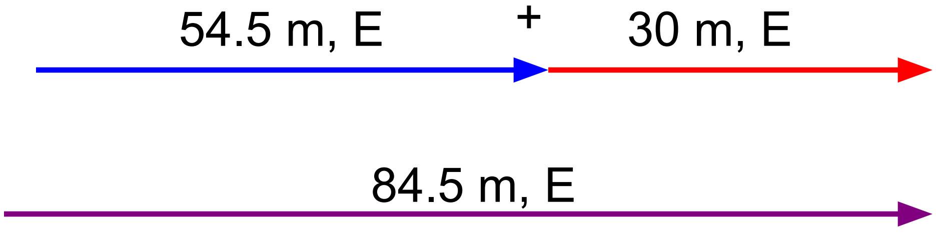
Vector	Magnitude & Direction
Velocity	20 m/s, N
Acceleration	10 m/s/s, E
Force	5 N, West

Vectors are typically illustrated by drawing an ARROW above the symbol. The arrow is used to convey direction and magnitude.

Applications of Vectors

VECTOR ADDITION – If 2 similar vectors point in the SAME direction, add them.

- **Example: A man walks 54.5 meters east, then another 30 meters east. Calculate his displacement relative to where he started?**

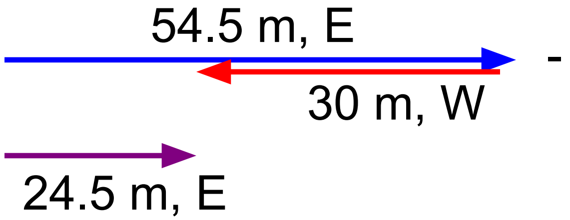


Notice that the SIZE of the arrow conveys MAGNITUDE and the way it was drawn conveys DIRECTION.

Applications of Vectors

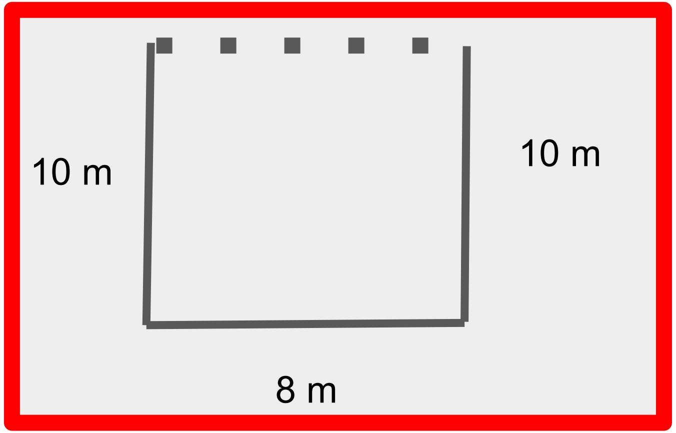
VECTOR SUBTRACTION - If 2 vectors are going in opposite directions, you **SUBTRACT.**

- **Example: A man walks 54.5 meters east, then 30 meters west. Calculate his displacement relative to where he started?**



Adding Vectors- that aren't triangles

Example Problem:



A man walks 10 m South, 8 meters East, and then 10 meters North. What is the man's final displacement?

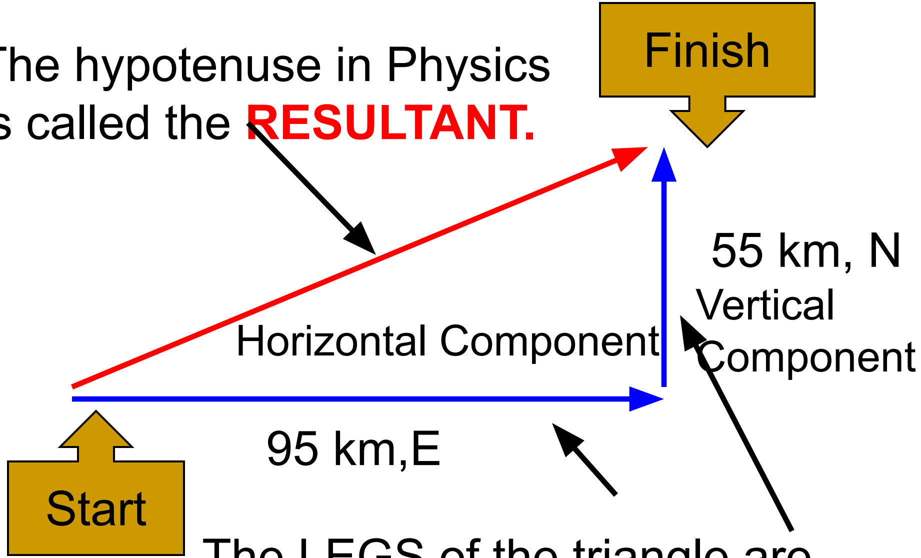
- Displacement is your change in position.
- How far away is the man from where he started? Remember always include a direction.
  - 8 m East

Non-Collinear Vectors

When 2 vectors are perpendicular, you must use the Pythagorean theorem.

A man walks 95 km, East then 55 km, north. Calculate his RESULTANT DISPLACEMENT.

The hypotenuse in Physics is called the **RESULTANT.**

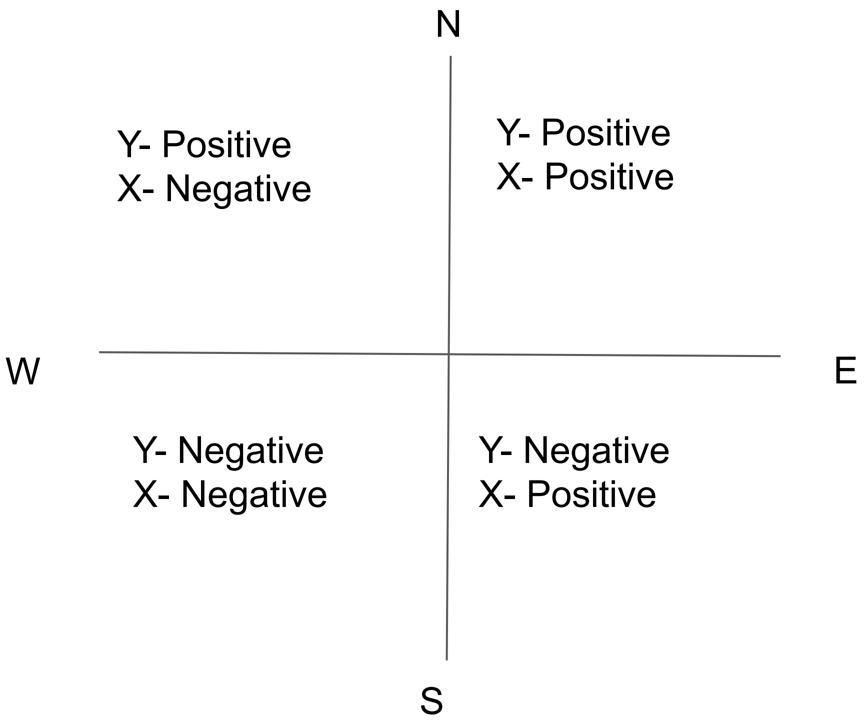


The LEGS of the triangle are called the COMPONENTS

$$c^2 = a^2 + b^2 \rightarrow c = \sqrt{a^2 + b^2}$$

$$c = \text{Resultant} = \sqrt{95^2 + 55^2}$$

$$c = \sqrt{12050} = 109.8\ km$$


N
Y- Positive
X- Negative
Y- Positive
X- Positive
W
E
Y- Negative
X- Negative
Y- Negative
X- Positive
S

Unit 6 Review

Newton’s laws

Newton's Laws of Motion

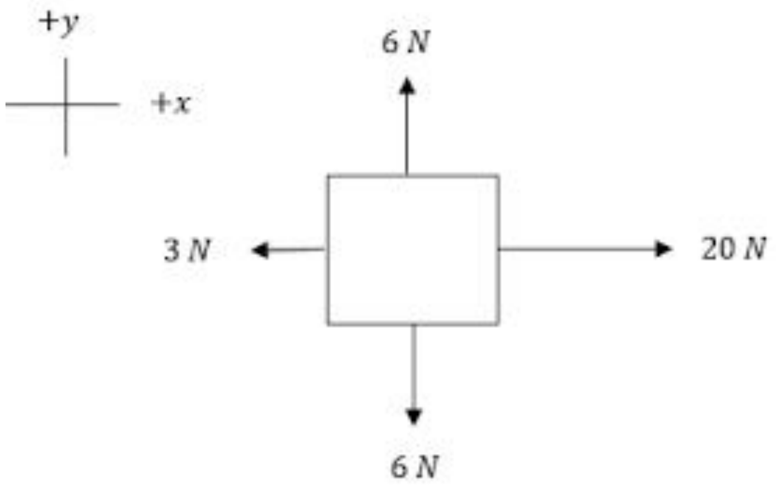
1. An object in motion tends to stay in motion and an object at rest tends to stay at rest unless acted upon by an unbalanced force.
2. Force equals mass times acceleration (F = ma).
3. For every action there is an equal and opposite reaction.

Words	What They Mean	The forces should…
"at rest" or "constant velocity"	No acceleration	Be balanced Cancel one another out $F_{net}=0$
"accelerating" "speeding up" "slowing down"	Accelerating	Unbalanced Some of the forces cancel o all of them $F_{net}=ma$

Determine if the following is balanced or unbalanced:

- Book sitting on a table
- A car accelerating down the road
- A car traveling at constant speed down the road.

Calculating Net Force

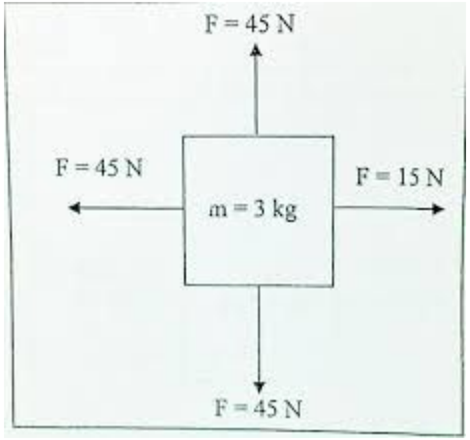


Horizontal Component (X)	Vertical Component (Y)
Right (positive) 20 N	Up (positive) 6 N
Left -3N	Down -6 N
Difference 17 N	Difference 0N

Net Force: 17 N Right

Your Turn

Left = Negative
Down = Negative

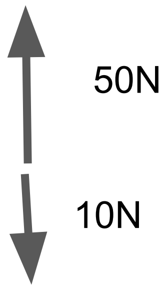


Horizontal Component (X)	Vertical Component (Y)
Right 15 N	Up 45N
Left -45 N	Down -45 N
Difference -30 N	Difference 0 N

Net Force = 30 N Left

Example Problem

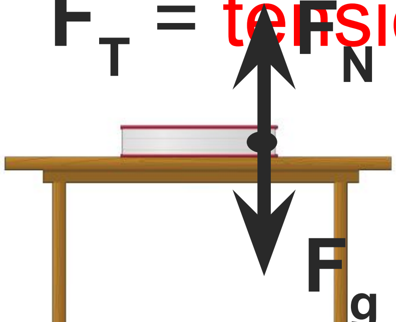
A balloon is flying through the air. It has a weight of 10N, and an upward lift of 50N, what is the net force on the balloon?



Net Force: 50N-10N = 40 N up

Common Forces

- F_g = weight → downward
- F_N = normal → perpendicular to surface
- F_f = friction (includes air) → opposite to motion
- F_p = push/pull
- F_T = tension in string



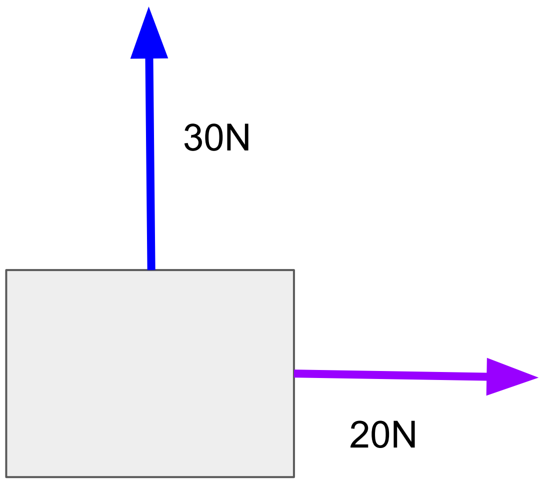
Unit 7 Review

Friction and Forces in 2D

Forces

Forces that are in equilibrium, must be equal in magnitude and opposite in direction.

Forces in Two-Dimensions

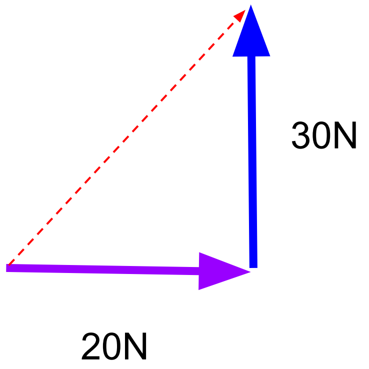


A box is being pushed East with a force of 20N, and is also being pushed North with a force of 30N.

- Since one force is in the x-direction and one is in the y-direction, we cannot simply add or subtract them.

- So what do we do?

Solving for the Resultant Force



The pythagorean theorem can be used to solve for the resultant force.

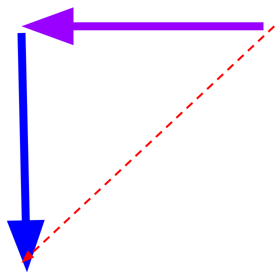
$$c^2 = a^2 + b^2$$

$$C = \sqrt{(20^2 + 30^2)}$$

C = 36.1 N North East

Learning Check

A box is being pushed West with a force of 15N, and is also being pushed South with a force of 10N.



$c^2 = a^2 + b^2$

$C = (10^2 + 15^2)$

C= 18.02 N South West

Friction

$F_f = (F_N)(\mu)$

μ = coefficient of friction

F_N = Normal Force

Example of Friction

You are push a 60kg box down the hall. If the coefficient of friction is 0.2, what is the frictional force?

Step 1- Find Normal Force = (m)(g)

(60kg)(9.8m/s^2) = 588N

Step 2- Solve for Friction

588N(0.2)= 118N