Physical Science Chapter 1

Motion

Are You Moving ?

- You are sitting down, reading a book….
- Are you moving?
- Object is in motion when its distance from another object is changing.
- All depends on the "Point of Reference"
- Therefore object is in motion if it changes position relative to a reference point.

International System of Units

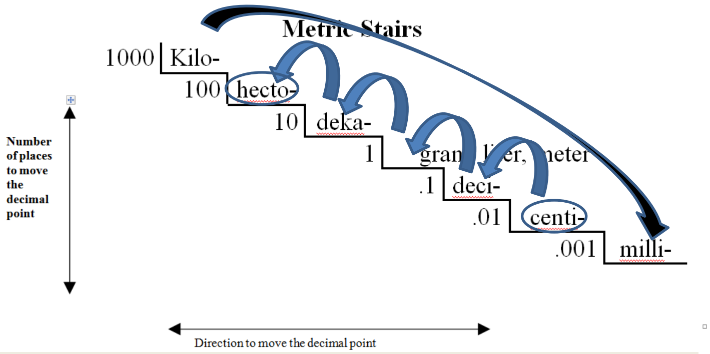
- "SI"
  - Based on the number 10
  - Distance (length) uses **meter** (about 39 inches)
  - Mass (how much matter) uses **gram** (a nickel is about 5 grams)
  - Volume (how much space)
    - Liquid volume – uses **liter** (a little more than a quart)
    - Solid volume – uses **cm^3** (about the size of a sugar cube)
    - **1 ml = 1 cm^3**
  - Weight (affect gravity has on object) uses **newton** (an apple weighs about 1 newton) (1 pound is about 4.4 newtons)
  - **Density = Mass / Volume** = grms / ml

To Amplify the Point

- Distances can be short or very long.
  - Basic metric unit of length is the meter.
  - Metric prefixes are based on the number 10.
  - 10 meters = 1 dekameter
  - 10 dekameters = 1 hectoliter
  - 10 hectoliters = 1 kilometer
  - Therefore : 1 kilometer =1000 meters
  - And…
  - There are 10 decimeters in a meter
  - There are 10 centimeters in a decimeter
  - There are 10 millimeter in a centimeter
  - Therefore: 1000 millimeters = 1 meter

Metric Stairs

- You should be comfortable with converting from [cm] to [m], [mm] to [km], and so on.



Convert: 1527 centigrams into hectograms: going four steps up means you move the decimal 4 places to the left. Therefore:

1527 centigrams = .1527 hectograms

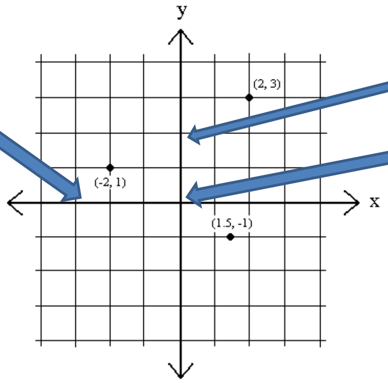
&

9.8712345 kg = (steps to the right) 9871234.5 mg

Graphing (x,y) coordinates

- A graph w/ points (2,3) , (-2,1) & (1.5, -1) plotted:

Remember:
a. the x axis is the horizontal axis



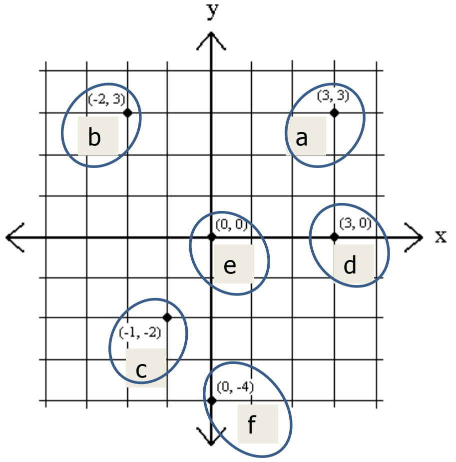
Remember:

b. The y axis is vertical axis

c. The origin is (0,0)

More Graphing!

- Graph the following points:
  a) (3, 3)
  b) (- 2, 3)
  c) (- 1, - 2)
  d) (3, 0)
  e) (0, 0)
  f) (0, - 4)

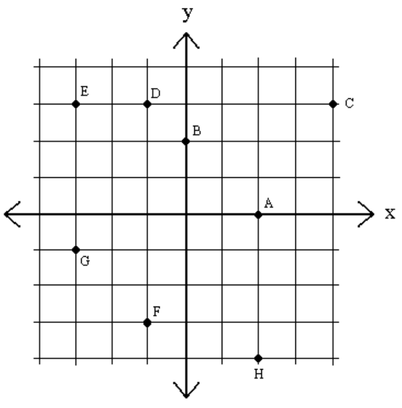


& Still More Graphing….

- What are the coordinates of these points?

Click for the answers…

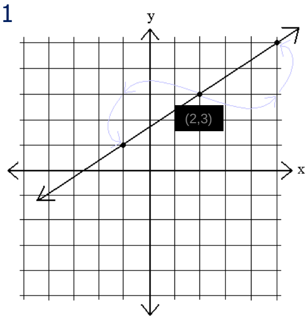
a. (2, 0)
b) (0, 2)
c) (4, 3)
d) (-1, 3)
e) (-3, 3)
f) (-1, 3)
g) (-3, -1)
h) (2, -4)



Graphing line slopes (rise/run)

- 1. Graph the line which passes through (2, 3) and has a slope of 2/3.
- 2. Graph the line which passes through (1, 1) and has a slope of -4. (remember - 4 = -4/1)

1



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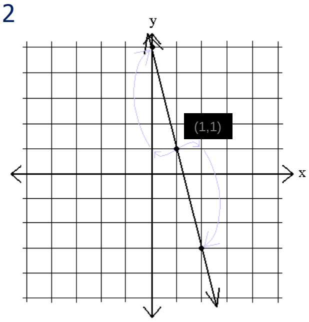
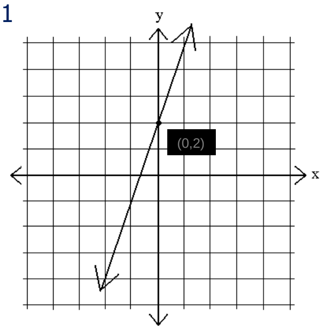


Graphing points & slope (rise/run)

- 1. Graph the line which passes through (0, 2) and has a slope of 3. (remember 3 can be written as 3/1)
- 2. Graph the line which passes through (- 1, 1) and has a slope of – 2/3.

1



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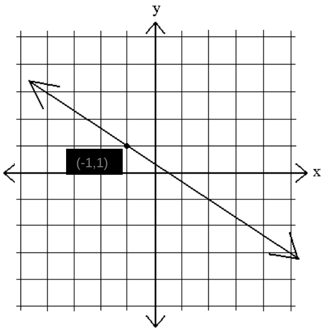


Working w/ Units

- Determining the correct units in a problem is just as important as getting the number correct.
- Remember we can "cancel" numerators & denominators to make the math easier:
- $$\frac{24 \times 6 \times 2 \times 9 \times 18}{12 \times 18 \times 3 \times 3 \times 24} = \frac{\cancel{24} \times \cancel{6}^{2} \times 2 \times \cancel{9} \times \cancel{18}}{\cancel{12} \times \cancel{18} \times \cancel{3} \times \cancel{3} \times \cancel{24}} = 4$$

We can do the same w/ units….

Multiplying & Dividing Units

- Do this problem:
  5 minutes x 3 feet = 15 minute feet
- Do this problem:
  $$\frac{12 \text{ miles}}{3 \text{ hours}} = 4 \frac{\text{miles}}{\text{hour}}$$
- Do this problem:

$$\frac{\text{mile} \times \text{week} \times \text{dollar} \times \text{bananas} \times \text{week} \times \text{newton} \times \text{week}}{\text{dollar} \times \text{newton} \times \text{mile} \times \text{bananas} \times \text{week} \times \text{kilogram} \times \text{week}} =$$

$$\frac{\cancel{\text{mile}} \times \cancel{\text{week}} \times \cancel{\text{dollar}} \times \cancel{\text{bananas}} \times \text{week} \times \cancel{\text{newton}} \times \cancel{\text{week}}}{\cancel{\text{dollar}} \times \cancel{\text{newton}} \times \cancel{\text{mile}} \times \cancel{\text{bananas}} \times \cancel{\text{week}} \times \text{kilogram} \times \cancel{\text{week}}} =$$

$$\frac{\text{Week}}{\text{kilogram}}$$

Speed = distance / time

- Formula: S=D/T
- What is the speed of a car that traveled 75 km in 1.5 hr?

  S = D / T = 75km / 1.5 hr = 50 km/hr
- Tells only a magnitude (how much)
  - Distance units include: inches (in), feet (ft), miles (mi),meters (m), kilometers (km), centimeters (cm), light year, etc.
  - Time units include minutes (min), seconds (sec), hours (hr), years (yr), etc.
  - Speed can be any distance unit divided by any time unit!!
  - Mi/hr, ft/sec, km/min

Velocity is speed with a direction

- **Written like:** 125 miles/hour east **or** 83 m/sec towards the house
- **What is the velocity of a jet that traveled 1623 mi North in 83 min?**

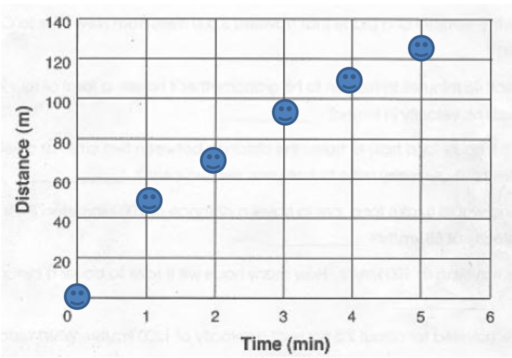
  V = D / T = 1623 mi / 83 min = 19.5 mi/min North

Average Speed or Average Velocity

- Average speed = total distance / total time

Time (min)	Distance (m)
0	0
1	50
2	75
3	90
4	110
5	125

What is the average speed after 2 minutes?
total distance is 75m, total time is 2 minutes.
S = D/T
S = 75m / 2min
S= 37.5 m/min



What is the average speed between 2 & 4 minutes?
total distance: 110m – 75m = 35m
total time: 4min – 2min = 2minutes total time

S = D/T
S = 35m / 2min
S= 17.5 m/min

Acceleration

- The change in speed or velocity over time
  - In scientific community, the symbol for “change” is the triangle: Δ
  - Change in velocity is found by subtracting the final speed from the initial speed

$$V_f - V_i = \Delta V$$

The formula for acceleration is:

$$A = \frac{V_f - V_i}{time} = \frac{\Delta V}{time}$$

Therefore the units for acceleration are going to be a

distance/time/time

Example

ft/min/sec

Acceleration

- For an object to accelerated it
  - Speed up (positive acceleration)
  - Slow down (negative acceleration a.k.a deceleration)
  - Change direction of travel

1


2


3


Each of these pictures depicts a type of acceleration:
1: the shuttle is speeding up every sec of the flight into orbit
2. the horse has come to a screeching halt (slowing down)
3. the baseball thrown to the batter is hit into the outfield (changed direction)

What's it mean?

- **What does a = 5 [m/sec²] mean?**
- If an object starts at rest, its ***velocity*** **increases by 5 [m/sec]** ***every second.***

Time (sec)	Acceleration	Velocity
0	5 m/sec^2	0 m/sec
1	5 m/sec^2	5 m/sec
2	5 m/sec^2	10 m/sec
3	5 m/sec^2	15 m/sec
4	5 m/sec^2	20 m/sec

Therefore, an object accelerating at 5m/sec^2 will be travelling at 20 m/sec after 4 seconds.

Acceleration Problems:

$$A = \frac{V_f - V_i}{\text{time}} = \frac{\Delta V}{\text{time}}$$

- Calculate acceleration for the following data:

Initial Velocity	Final Velocity	Time
20 km/hr	60 km/hr	10 s
50 m/s	150 m/s	5 s
25 km/hr	1200 km/hr	2 min

$$A = \frac{60\text{km/hr} - 20\text{ km/hr}}{10\text{ sec}} = \frac{4\text{ km/hr}}{\text{sec}}$$

$$A = \frac{150\text{km/sec} - 50\text{ km/sec}}{5\text{ sec}} = \frac{20\text{ km}}{\text{sec}^2}$$

$$A = \frac{1200\text{km/hr} - 25\text{ km/hr}}{2\text{ min}} = \frac{587.5\text{ km/hr}}{\text{min}}$$

Well, I checked for boo boos…
They should be fixed now…
Hopefully this works correctly…

cuz we're done w/ 1