Motion
• ________________ is the continuing change of position of a body ________________ to some other body.
  Ex. You are driving along in your car. You are in motion ________________, but not with respect ________________.
• Uniform motion is the simplest type (it is the motion of an object in a ________________).
• One must distinguish between the two terms below:
  ________________ ➔ rate of motion
  ________________ ➔ rate of motion with a direction

Distance, Position, and Displacement
1. Distance ➔ length of path traveled by an object from location A to location B. There is ________________ required (_____________).

   symbol ➔ Home SI unit ➔ metre
   School

   ➔ consider Peter which must go to school as shown. Peter travels a distance of 5 km which can be written as: d = ___________
   Note: ________________

2. Position ➔ the location of an object ________________. Direction must be specified (_____________).

   symbol ➔ SI unit ➔ metre

   ex. The position of the school is $\Delta d = 5 \text{ km [E]}$ of Peter’s home.
   Note 3 things: a) a size or magnitude (5km) b) a direction ([E]) c) a reference point (home)

3. Displacement ➔ is the change of ________________ and the ________________ (vector).

   symbol ➔ SI unit ➔ metre

   ➔ you do not need to mention a ________________.

   Ex. Displacement = $\Delta \Delta d = 5 \text{ km [E]}$
**Vectors**

 Scalar ➔ units of measurement that involve ____________________________
 (_____________________________________________).

 Vector ➔ a physical quantity having both ____________________________
 (_____________________________________________).

**Vector Addition – Head to Tail Method**

 - To add vectors, draw the ____________________________ vector at the
   __________________________________ vector.

 - Draw the _____________________ vector from the _____________ of the first vector to the _____________ of the second vector.

 - The resultant vector is the __________ of the first vectors.

**Sample Problem A** ➔ A helicopter takes off from a point A and flies due east 30. km and then lands. If the helicopter takes off again and flies 40. km in a straight line, how far is it from its original position?

 We _____________________________ information, so let’s consider the possibilities.

 1) If the second displacement is in the same direction as the first, the displacement would be:

 2) If the second displacement is opposite in direction, the helicopter would be 10 km west of its original position.

 3) If the helicopter went due north after landing, the problem gets tougher.
• R represents the _______________________________ (the displacement of
the helicopter). Use your ruler to find __________.
• We can also use a protractor to find the direction that the helicopter went. When
you measure this angle, we find it is _______.
• Therefore resultant is: ___________________

Sample Problem B ➔ A man walks 6 blocks east and then 8 blocks south. What is the
resultant displacement? (Solve using the vector addition method)

Sample Problem C ➔ A boy delivering papers covers his route by traveling 3 blocks
west, 4 blocks north, then 6 blocks east. Find his final displacement.

Vector Addition – Mathematical Methods
■ If two vectors are at right angles to each other, R can be calculated using the
Pythagorean Theorem, and the direction can be determined using a trigonometric
function (sine, cosine, and tangent), rather than using your protractor.
__________________________________________________.

Sample Problem 1 ➔ A pilot is flying north at a speed of 80 km/h however the wind is
blowing at 40 km/h from west to east. Determine the velocity of the plane
mathematically.
To find magnitude, we use:
Sample Problem 2 ➔ A boat crosses a river at a velocity of 26.3 km/h [S]. If the river is flowing a velocity of 5.6 km/h [W], what is the resultant velocity of the boat? If the boat travels at this velocity for 15 minutes, what is the displacement of the boat?

Graphing Rules
1) Identify the independent and the dependent variables.
   a) Independent is the variable that the experimenter changes (usually time) and is always plotted on the x-axis.
   b) Dependent variable is the variable that changes as a result of the experiment and is always plotted on the y-axis.
2) Label each axis with the name of the variable and the unit.
3) Title your graph (“A Graph of Dependent vs. Independent”) y vs x
4) Include your name, date, class, and period on the top right hand corner of your graph.
5) Choose your scale carefully and make your graph as large as possible.
6) It is NOT necessary that the graph always go through the origin.
7) Make sure to use a best fit line if the graph is linear. Use a smooth (free-hand) curve if the graph is a curved one.
8) Calculate the slope (linear graph only).

Examples

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Assignment

Distance-Time Graphs for Uniform Motion
Sample Problem 1 ➔ If we prepare a table to show the position of a car at 5 second intervals, then we can plot a graph.
The distance-time graph for uniform speed is a straight line which has the same slope all along its path.
1. How far would the car travel during a 20. second interval?
2. How far would it travel between the 25 s and 50. s interval?
3. How long would it take the car to travel 450 m?

Sample Problem 2 ➔ the motion of two cars A and B is represented by the following graph. What can we learn about the motion of the cars from the graph?

Calculate the slope for both graphs.

You should notice that the units are in ____________, therefore the slope is telling us the __________________________________________________________________________.

Also notice, __________________________________________________________________________.

- What can you conclude from this graph?
  1. Vehicles __________________________________________________________________________.
  2. Vehicles __________________________________________________________________________.
  3. Vehicles __________________________________________________________________________.
  4. Vehicles end at ______________________________________________________________________.
  5. Distance is __________________________________________________________________________.
**Speed and Direction**

What observations can you make from this graph?

________________________________________________

Calculate slope of the 3 intervals: A-C.

Interval A ➔

Interval B ➔

Interval C ➔

*We see that the ___________________________ indicating that it is traveling in the _______________________. The object has ___________________ to its original starting position at a ________________________.

**Speed Calculations**

\[
\text{Speed} = \frac{\text{distance traveled}}{\text{interval of time}} \quad \text{OR} \quad v = \frac{d}{t}
\]

Problems: Let us suppose that a car is traveling at 20. m/s.

1) What would be the position of the car after 5.0 s?

2) Calculate the time required to travel 140 m.

3) Light travels at a rate of 3.00 \times 10^8 \text{ m/s}. If Regina is 265 km away, how long will it take to get there?

4) A large ship uses its sonar to find the depth of the water. If sound in water travels at 1482 \text{ m/s}, what is the depth of water when it takes 0.25 s for the detector to receive the signal?
Velocity Calculations

Velocity = \text{Change in displacement} \quad \text{OR} \quad v = \frac{\Delta d}{\Delta t} \\
\text{interval of time}

1. Calculate the velocity of a car that travels 556 kilometres northeast in 3.4 hours. Leave your answer in kilometres per hour.

2. Which object has a greater velocity, a ball rolling down a 3.4 metre hill in six seconds or a fish swimming upstream and covering 5.4 metres in 0.4 minutes?

3. If a projectile flies north 387 metres in 5.8 seconds, what is its velocity?

4. Calculate the velocity of a mountain climber if that climber is moving northeast at a pace of 1.6 km in 1.4 hours?