

## Distance vs Displacement

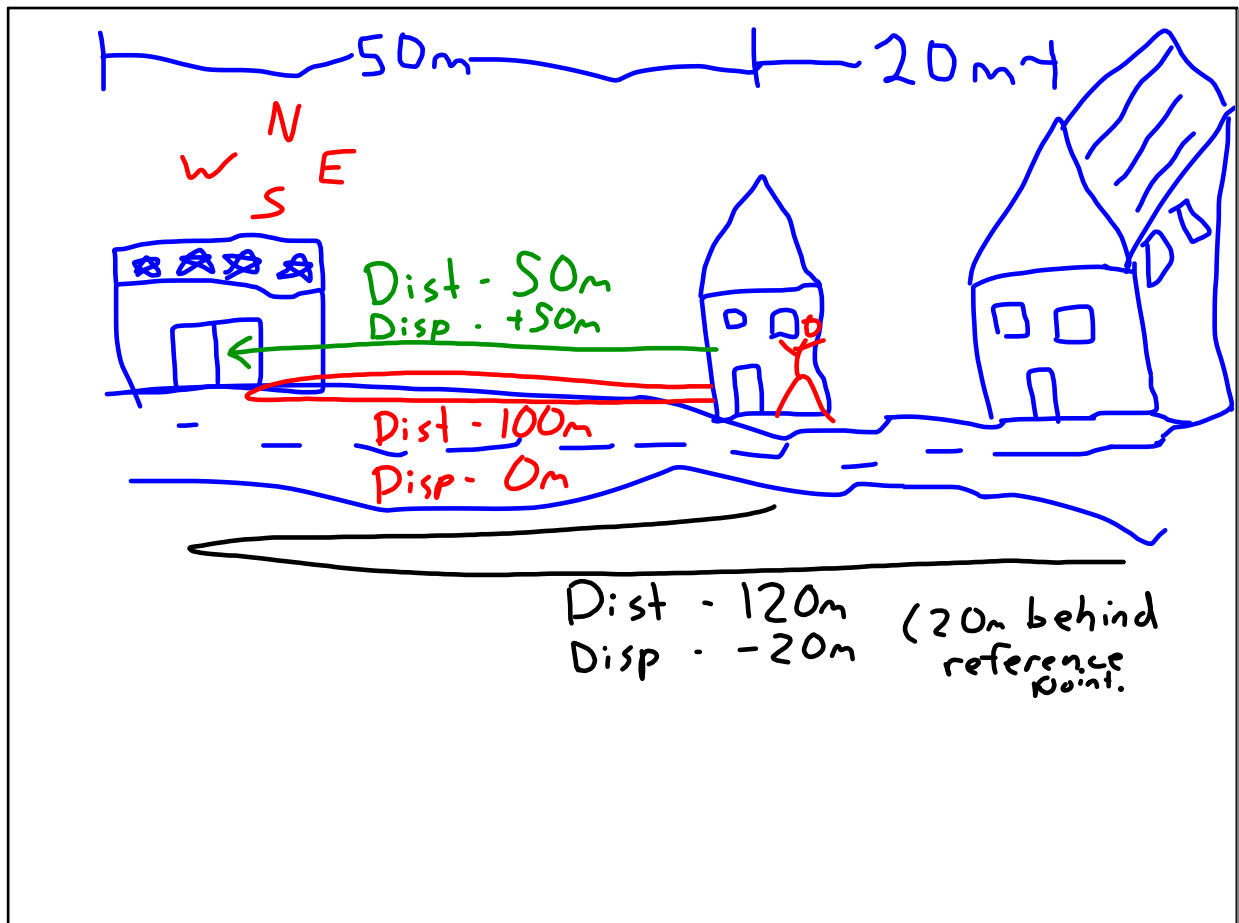
Distance- How much ground you have covered.

(scalar)

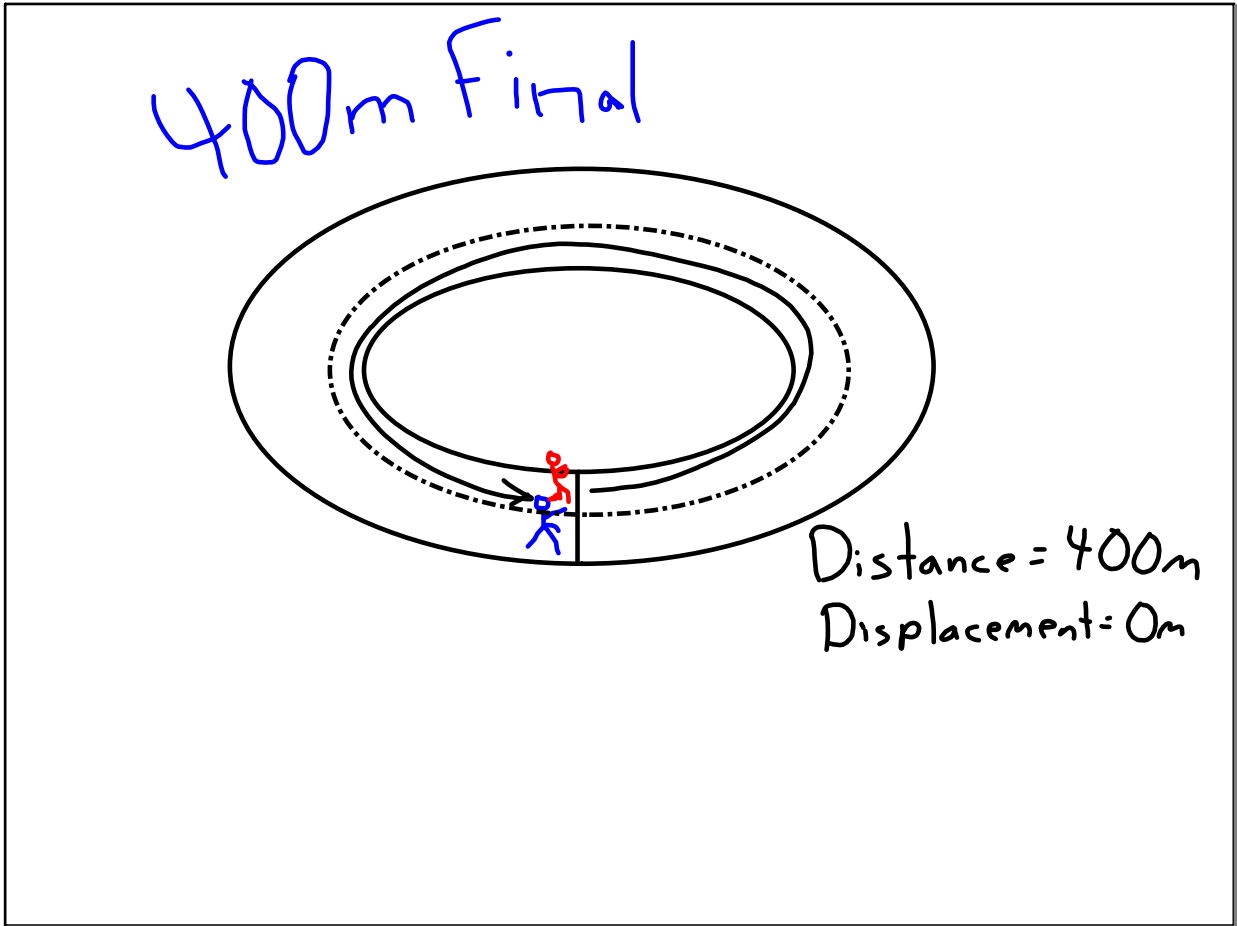
Displacement- How much your overall position has changed (including direction)

(vector)

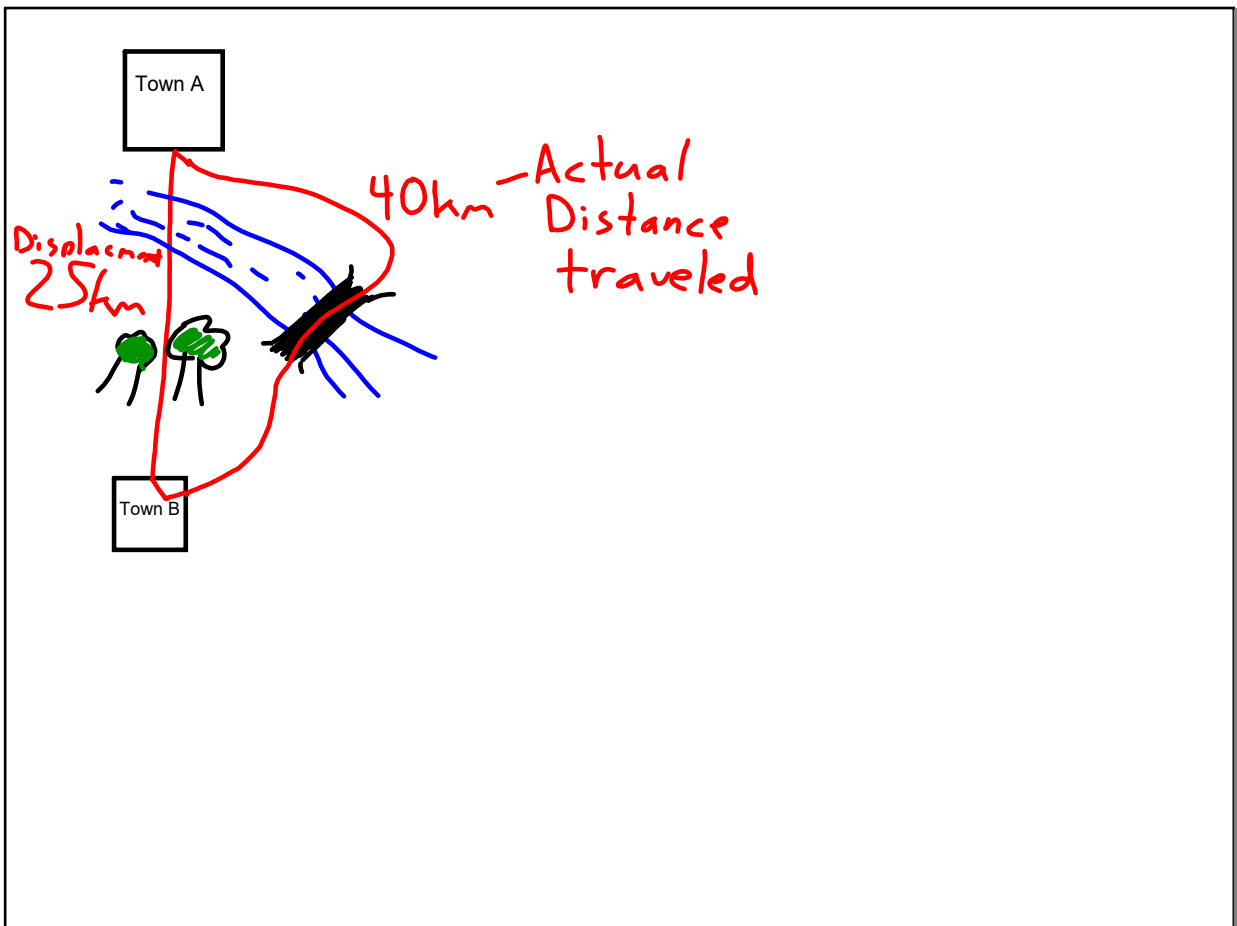
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Feb 18-8:22 PM



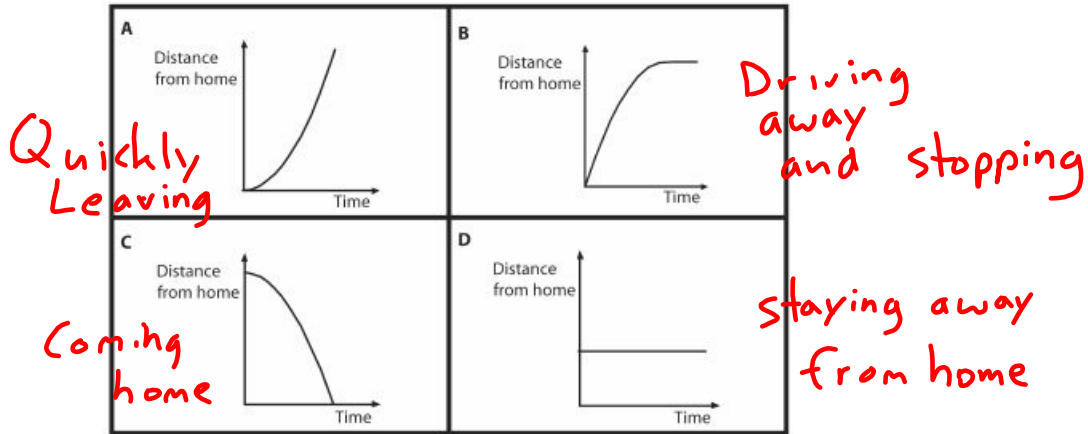
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## Distance/ Displacement Vs Time Graphs

Graphs are used to present quantitative information visually.

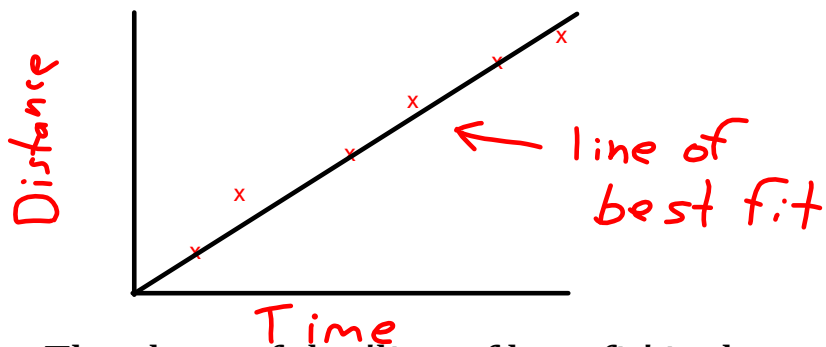


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Time is always on the x-axis (horizontal).  
distance or displacement is always along the y-axis (vertical).

independent  
 dependent

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The slope of the 'line of best fit' is the average speed of the object.

Slope - a measurement of how steep a line is

However, we can calculate the different slopes to see change in speeds.

The steeper the line, the greater the speed.

A horizontal line means the object is stopped.

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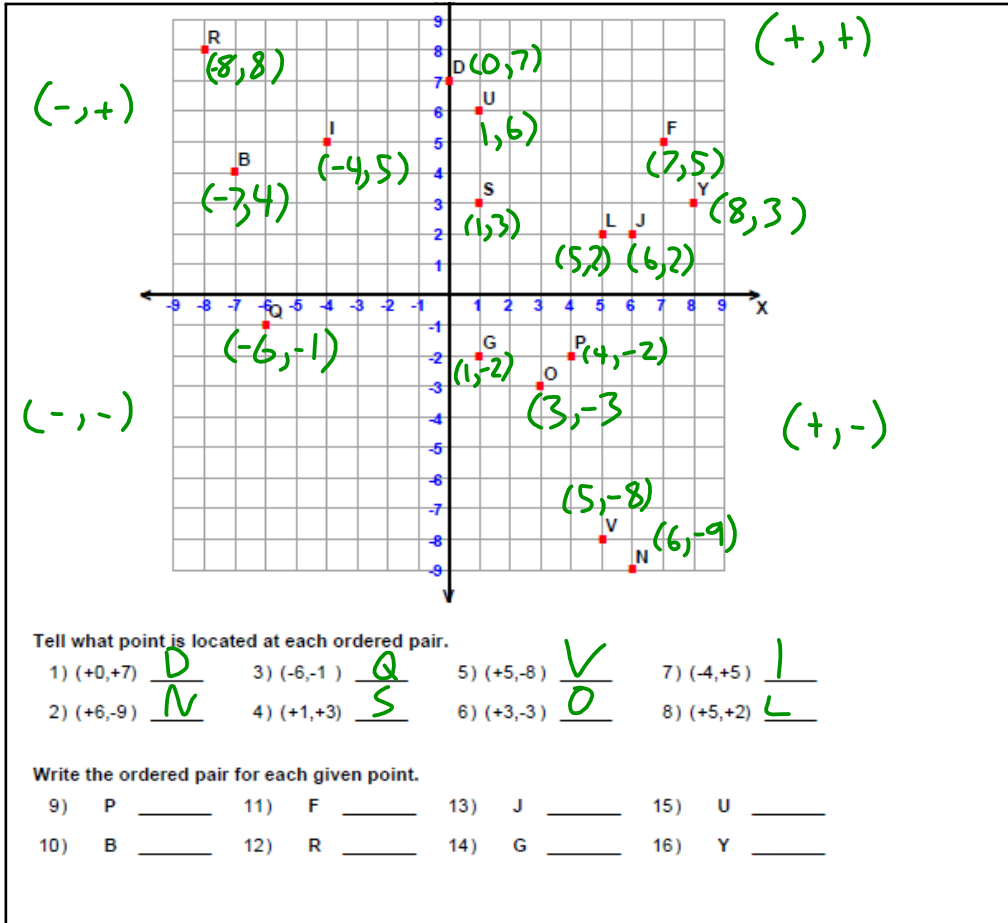
Formula for slope:

$$m = \frac{\overset{\text{Rise}}{y_2 - y_1}}{\underset{\text{Run}}{x_2 - x_1}} = \frac{\Delta d}{\Delta t}$$

$m = \text{slope}$

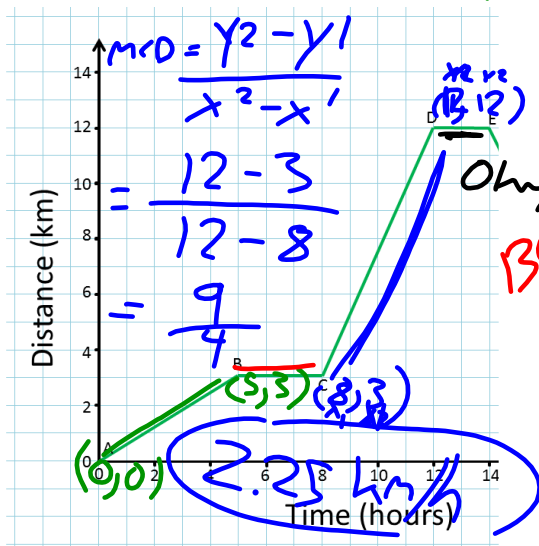
$(x_1, y_1)$  and  $(x_2, y_2)$  are points

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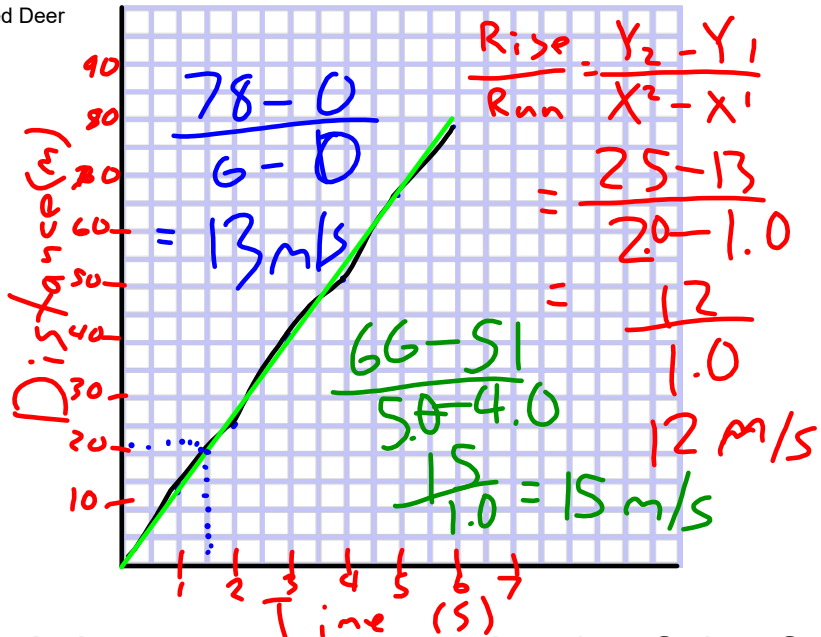
### Example 1



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Example 2: A Running White-Tailed Deer

Time (s)	Distance (m)
0 $x_1$	0 $y_1$
1.0 $x_1'$	13 $y_1'$
2.0 $x_2$	25 $y_2$
3.0	40
4.0 $x_1'$	51 $y_1'$
5.0 $x_2$	66 $y_2$
6.0 $x_2$	78 $y_2$



What is the deer's instantaneous speed at 1.5s? 4.5s?

$1.5s = 12 m/s$        $4.5s = 15 m/s$

What is the deer's average speed?

$V_{av} = 13 m/s$

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Example 3

Time (sec)	Breaststroke Distance (m)	Freestyle Distance (m)
$y_1$ 0.0 $x_1'$	0.0 $y_1'$	0.0 $y_1'$
5.0	7.5	9.5
10.0	15.1	18.5
15.0	22.7	27.0
20.0	30.5	35.5
$x_2$ 25.0 $x_2$	36.5 $y_2$	45.0 $y_2$

What is the swimmer's average speed while doing the breaststroke? The freestyle?

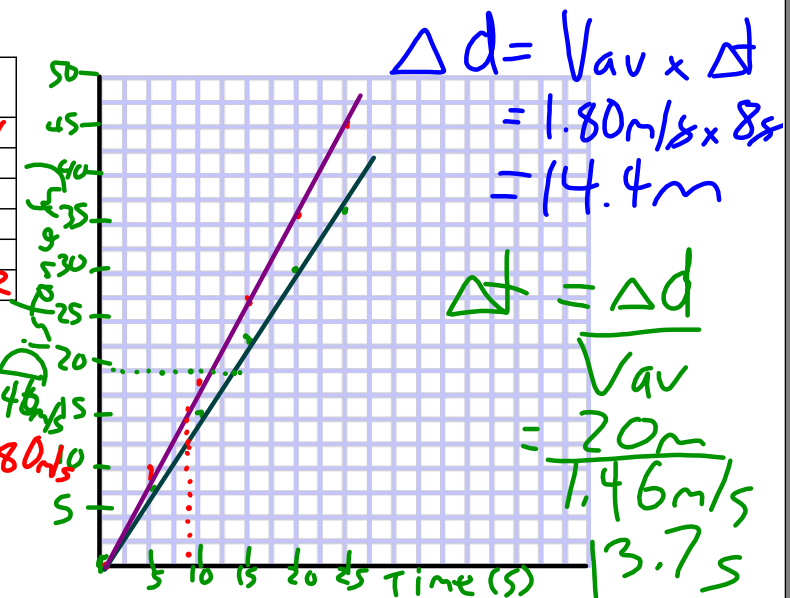
$\frac{36.5 - 0.0}{25.0 - 0.0} = \frac{36.5}{25.0} = 1.46 m/s$   
 $\frac{45.0 - 0.0}{25.0 - 0.0} = \frac{45.0}{25.0} = 1.80 m/s$

How far had the freestyle swimmer gone after 8 seconds?

$14.4 m$

How long did it take the breaststroke swimmer to travel 20 m?

$13.7 s$

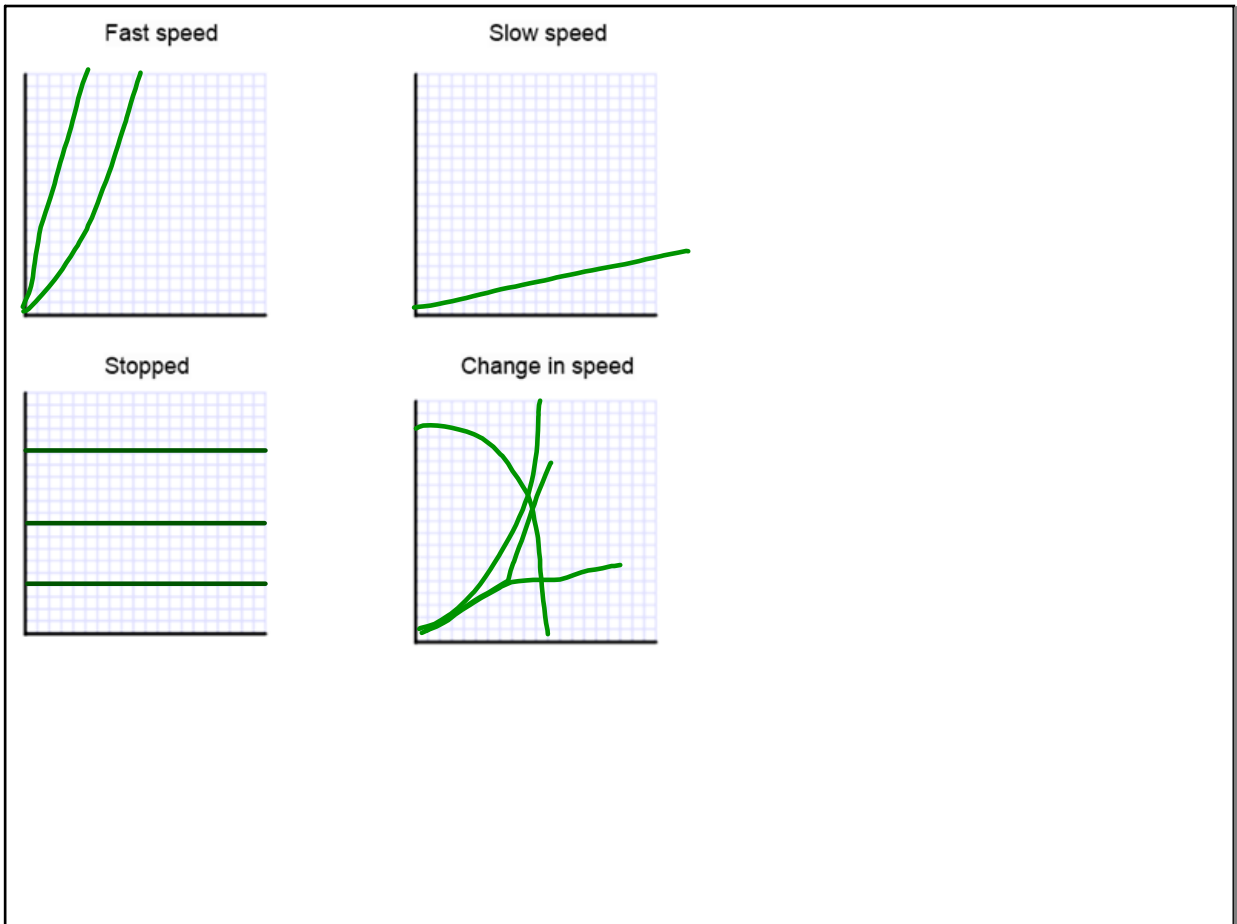


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Recap:

- \* Horizontal line means= *stopped*
- \* Steeper = *moving faster*
- \* Less steep = *moving slower*
- \* Slope of line of best fit = *average speed*
- \* Long line = *constant speed for a long time/distance*
- \* Short line = *constant speed for a short time or distance*

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A tour boat leaving from Fredericton travelled down river. The following table shows how the boat travelled.

Graph this data.  $\frac{y_2 - y_1}{x_2 - x_1} = \frac{26.4 - 0}{5} = 5.3 \text{ km/h}$   
 a. What was the boat's average speed?  $5.3 \text{ km/h}$

Time (h)	Distance (km)
0.0 $x_1$	0.0 $y_1$
1.0	4.4 $> 4.4$
2.0	10.9 $> 6.5$
3.0	15.2 $> 4.3$
4.0	19.8 $> 4.6$
5.0 $x_2$	26.4 $> 6.6$ $y_2$

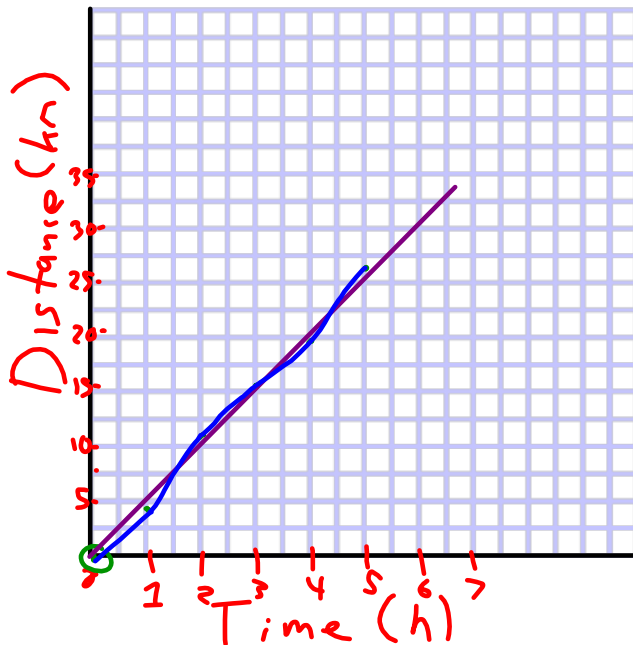
b. Between which two hours was its speed the greatest?  
 $4 - 5 \text{ h}$

c. How far did the boat travel after 3.5 hours?  
 $d = V_{av} \times \Delta t$

d. How long did it take for the boat to travel 7.0 km?  
 $5.3 \text{ km/h} \times 3.5 \text{ h}$   
 $18.55 \text{ km/h}$   
 $\rightarrow 19 \text{ km/h}$

$$\Delta t = \frac{\Delta d}{V_{av}} = \frac{7.0 \text{ km}}{5.3 \text{ km/h}} = 1.3 \text{ h}$$

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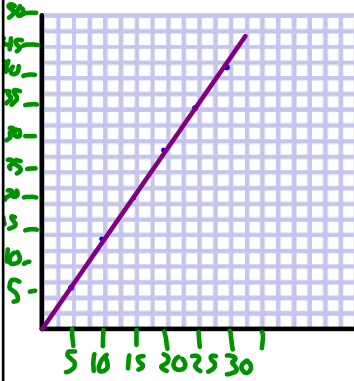


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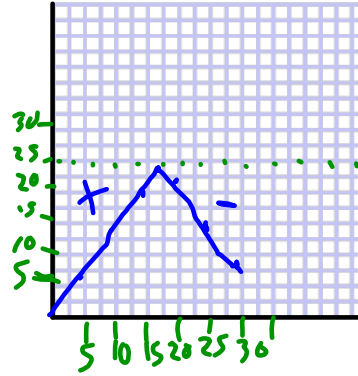
# Swimming in a Pool

Distance vs Time



Time (s)	Distance (m)
5.0	7.0
10.0	14.0
15.0	21.0
20.0	28.0 <sup>22m</sup>
25.0	35.0 <sup>15m</sup>
30.0	42.0 <sup>8m</sup>

Displacement vs Time Pool is 25m long



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The graph for a journey is shown.

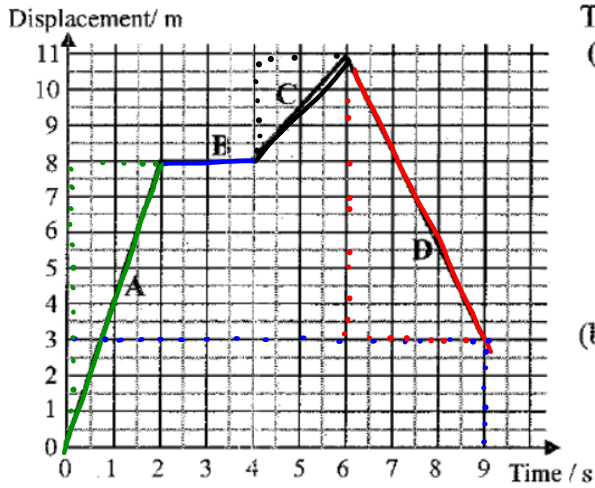
(a) Calculate the velocity for each section.

A  $\frac{3m}{2s} = +1.5m/s$   
 B  $\frac{0m}{2s} = 0m/s$   
 C  $\frac{6m}{1s} = +6m/s$   
 D  $\frac{2m}{4s} = +0.5m/s$

(b) At what time is the moving object 6 m from the start? 4.5s

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2.



The graph for a journey is shown.

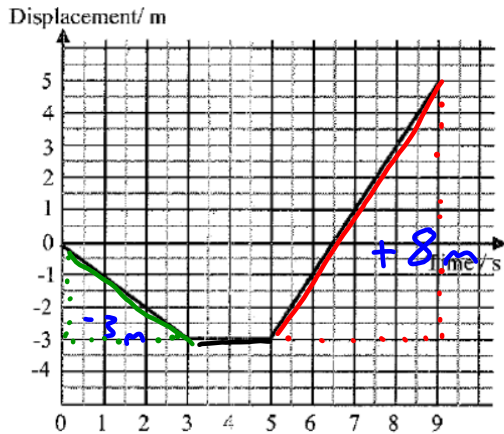
(a) Calculate the velocity for each section.

A  $\frac{8\text{m}}{2\text{s}} = +4\text{m/s}$   
 B  $\frac{0\text{m}}{2\text{s}} = 0\text{m/s}$   
 C  $\frac{3\text{m}}{2\text{s}} = +1.5\text{m/s}$   
 D  $\frac{-8\text{m}}{3\text{s}} = -2.7\text{m/s}$

(b) How far from the starting position is the moving object after 9s? 3m

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3.



The graph for a journey is shown.

(a) Calculate the velocity for each section.

0-3s  $\frac{-3\text{m}}{3\text{s}} = -1\text{m/s}$   
 3-5s  $\frac{0\text{m}}{2\text{s}} = 0\text{m/s}$   
 5-9s  $\frac{8\text{m}}{4\text{s}} = +2\text{m/s}$

(b) What distance has been travelled in 9 s?

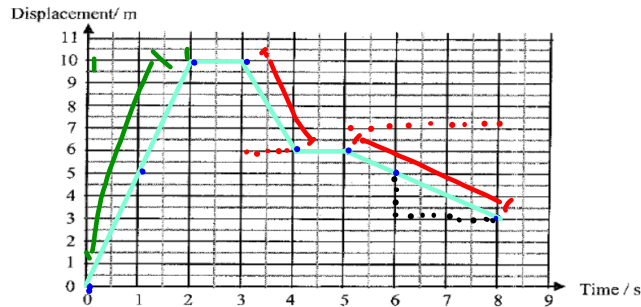
11m

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4. A journey was recorded by the following displacement-time data.

Displacement from start (m)	0	5	10	10	6	6	5	4	3
Time from start (s)	0	1	2	3	4	5	6	7	8

(a) Graph this journey data on the grid below.

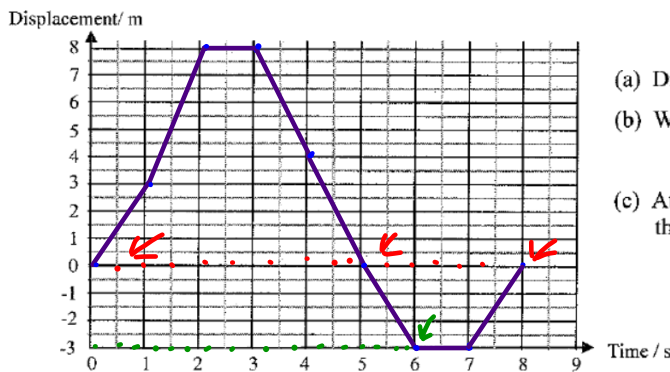


- (b) At what times is the object moving away from the start position? 0-2s  
 (c) At what times is the object moving towards the start position? 3-4s + 5-8s  
 (d) Calculate the velocity during time 6-8 s.  $-\frac{3m}{2s} = -1.5m/s$

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5. A journey is recorded by the following displacement-time data.

Displacement from start (m)	0	3	8	8	4	0	-3	-3	0
Time from start (s)	0	1	2	3	4	5	6	7	8



- (a) Draw the graph.  
 (b) Where is the object at time 6s  
-3m  
 (c) At what times is the object at the starting positions?  
0s, 5s, 8s

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