Speed and Velocity

Lesson 2

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How do you calculate speed?

How do you describe velocity?

How do you graph motion?

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I. How do you calculate speed

A. The speed equation

Speed of an object is the distance the object moves per unit of time

*speed is a type of rate

(rate = amount of something that occurs or

changes on one unit)

* to calculate speed, divide the distance the

object travels by the amount of time it

takes to travel that distance

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* Speed = $\dfrac{\text{distance}}{\text{time}}$

* distance is measured in meters

time is measured in seconds

SI Unit - meters/sec or m/s

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B. Average speed

Runners in a race don't travel at the same speed. They may run faster or slower during one point of the run

Since they don't travel at a constant speed, they don't have a constant speed to measure. We can calculate their average speed throughout the race

Average speed is the total distance divided by the total time

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$$\text{Avg. speed} = \frac{\text{total distance}}{\text{total time}}$$

ex. athletes in a triathlon swim, run and bike. Their average speed is recorded

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Leg 1 Swimming
Total distance: 3.0 km
Triathlete A's total time: 0.8 h
Triathlete B's total time: 1.0 h
Triathlete A's average speed =

Triathlete B's average speed =

Leg 2 Biking
Total distance: 50.0 km
Triathlete A's total time: 3.0 h
Triathlete B's total time: 2.5 h
Triathlete A's average speed =

Triathlete B's average speed =

Leg 3 Running
Total distance: 12.0 km
Triathlete A's total time: 1.2 h
Triathlete B's total time: 1.0 h

Use the data from all three legs to solve for each triathlete's average speed

Total distance =	
Triathlete A's total time =	
Triathlete A's average speed =	
Triathlete B's total time =	
Triathlete B's average speed =	

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C. Instantaneous speed

Is the speed an object is moving at a given time

ex. Triathlete A passes triathlete B on the track. At that moment triathlete A's insantaneous speed is greater than B's

Don't confuse instantaneous speed and average speed

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II. How do you describe velocity?

A. To describe an object's motion, you need to know more than just speed. You need to know its direction

When you know both speed and direction of an object's motion, you know its velocity

   * velocity = speed + direction

     ex. 25 km/h eastward

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velocity = $\dfrac{distance}{time}$ + direction

At times, describing velocity of objects can be very important.

        ex. airplanes and air traffic controllers

            stunt pilots

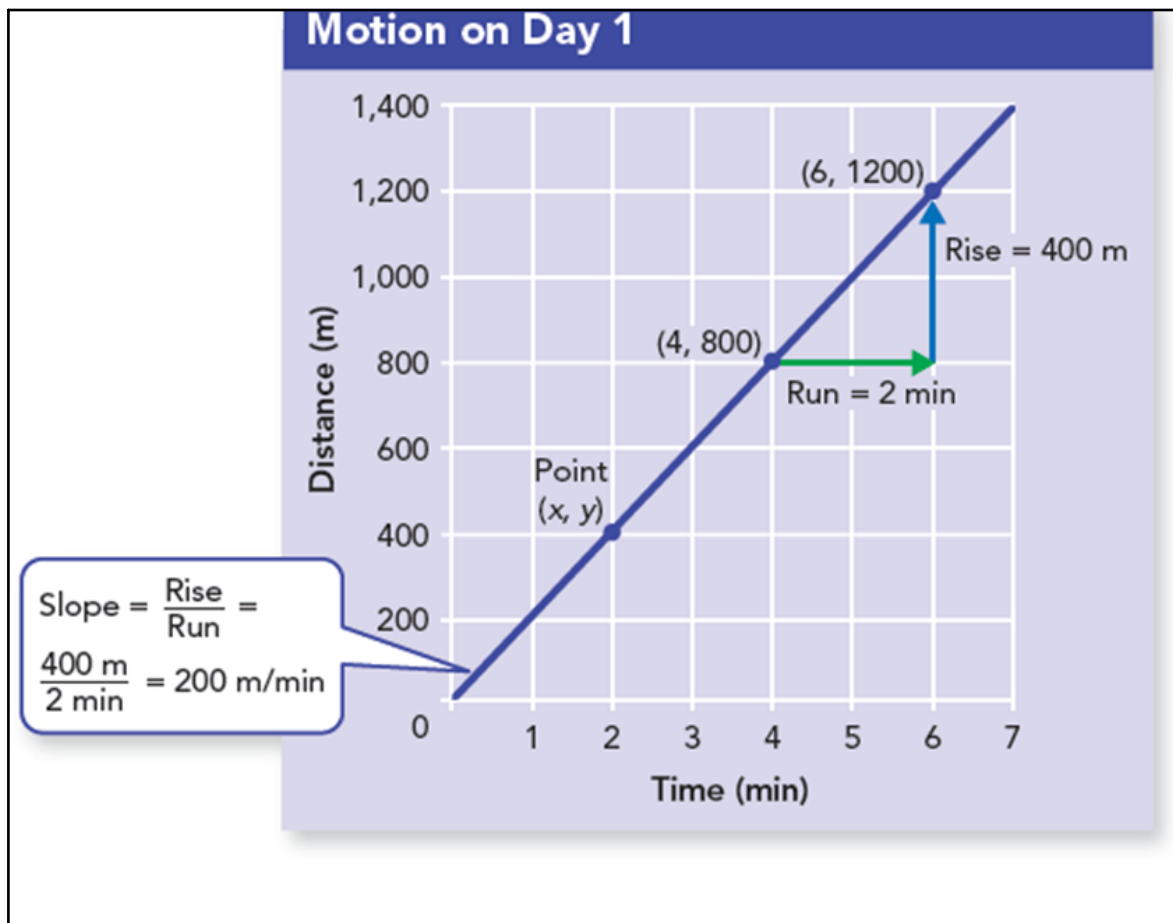Apr 5-1:16 PM

III. How do you graph motion?

A. You can show the motion of an object on a line graph in which you plot the distance vs. time

    * time is on the x axis (horizontal)

    * distance is on the y axis (vertical)

    * a point on the line represents the distance traveled at a given time

    * (x,y) or (time, distance)

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Steepness of a line is called slope

　　* tells how fast one variable changes over

　　　the other

　　* rate of change

　　* slope on a distance vs. time graph is the

　　　speed

　　* steeper slope= greater speed

　　* straight line = constant slope

B. Calculating Slope

You can calculate slope by dividing rise over run

　　* rise = vertical difference between 2 points

　　* run = horizontal difference

slope = $\dfrac{\text{rise}}{\text{run}}$

C. Different Slope

Most objects don't move at a constant speed

*Steepness of the slope can tell you the

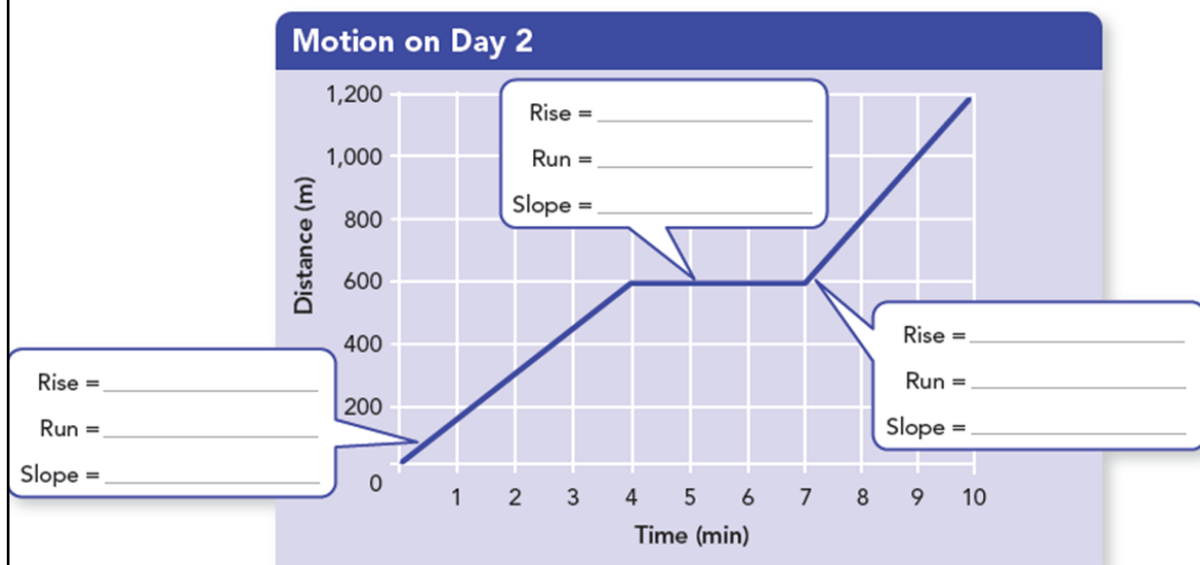rate of speed during a segment

Steep = faster

flat = constant

gradual = slow

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Changing Speed
The graph shows how the speed of a jogger varies during her second day of training. What are the rise, the run, and the slope for each segment of the graph?

Motion on Day 2

Rise = _____
Run = _____
Slope = _____

Rise = _____
Run = _____
Slope = _____

Rise = _____
Run = _____
Slope = _____

Distance (m): 0, 200, 400, 600, 800, 1,000, 1,200

Time (min): 1 2 3 4 5 6 7 8 9 10

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