Name: _____ Date: _____

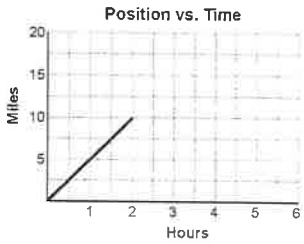
CONTENT 4.2

4.2 Analyzing Graphs of Motion With Numbers

READ

Speed can be calculated from position-time graphs and distance can be calculated from speed-time graphs. Both calculations rely on the familiar speed equation: $v = d/t$.

This graph shows position and time for a sailboat starting from its home port as it sailed to a distant island. By studying the line, you can see that the sailboat traveled 10 miles in 2 hours.



EXAMPLES

- **Calculating speed from a position-time graph**

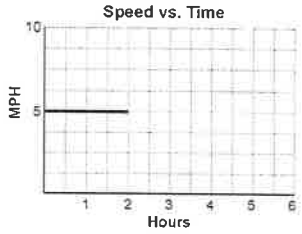
The speed equation allows us to calculate that the boat's speed during this time was 5 miles per hour.

$v = d/t$

$v = 10 \text{ miles}/2 \text{ hours}$

$v = 5 \text{ miles/hour}$, read as 5 miles per hour

This result can now be transferred to a speed-time graph. Remember that this speed was measured during the first two hours.

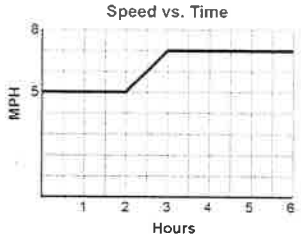


The line showing the boat's speed is horizontal because the speed was constant during the two-hour period.

- **Calculating distance from a speed-time graph**

Here is the speed-time graph of the same sailboat later in the voyage. Between the second and third hours, the wind freshened and the sailboat gradually increased its speed to 7 miles per hour. The speed remained 7 miles per hour to the end of the voyage.

How far did the sailboat go during the six-hour trip? We will first calculate the distance traveled between the third and sixth hours.



3. Stories for you to tell as graphs

Read each of the following stories. Then sketch in the line for a position-time graph and a speed-time graph.

1. "Little Red Riding Hood." Graph Red Riding Hood's movements.
   Data:
   - Little Red Riding Hood set out for Grandmother's cottage at a good walking pace.
   - She stopped briefly to talk to the wolf.
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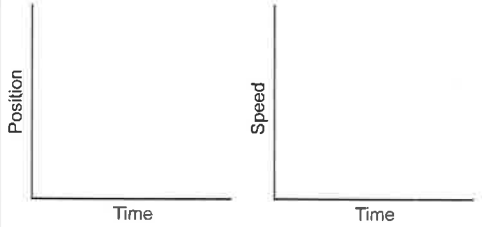

2. The Tortoise and the Hare. Use two lines to graph both the tortoise and the hare.
   Data:
   - The tortoise and the hare began their race from the combined start-finish line.
   - Quickly outdistancing the tortoise, the hare ran off at a moderate speed.
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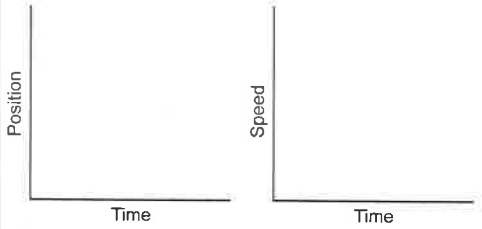
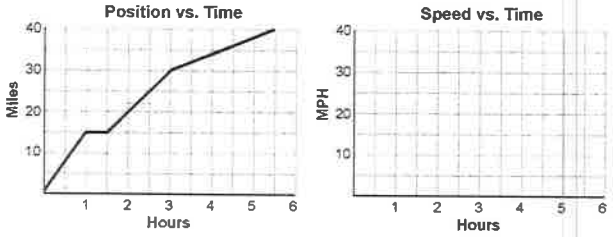


CONTENT 4.2

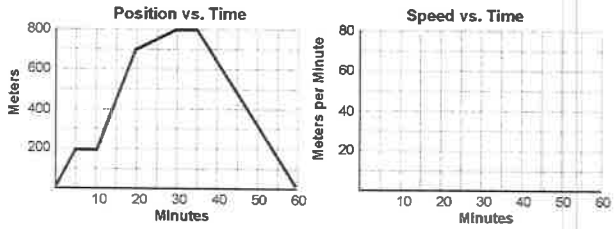
PRACTICE

1. For each position-time graph, calculate and plot speed on the speed-time graph to the right.

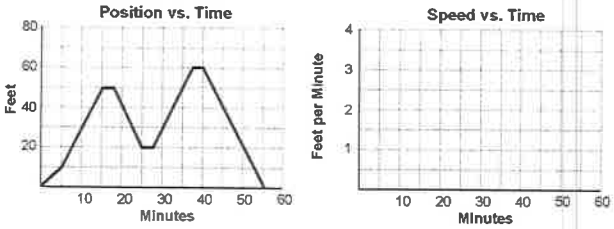
   a. The bicycle trip through hilly country



   b. A walk in the park



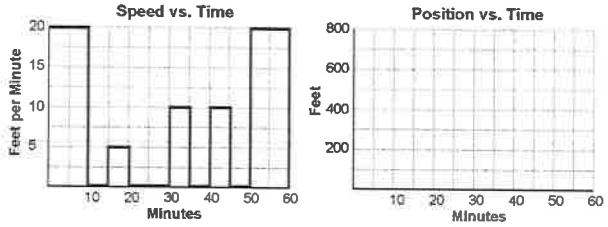
   c. Strolling up and down the supermarket aisles



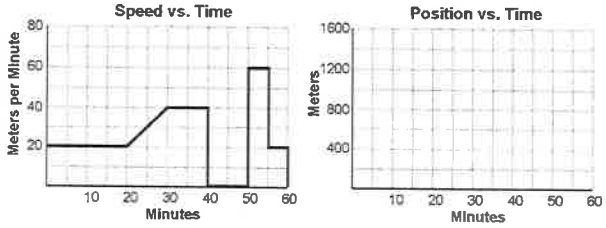
CONTENT 4.2

2. For each speed-time graph, calculate and plot the distance on the position-time graph to the right. For this practice, assume that movement is always away from the starting position.

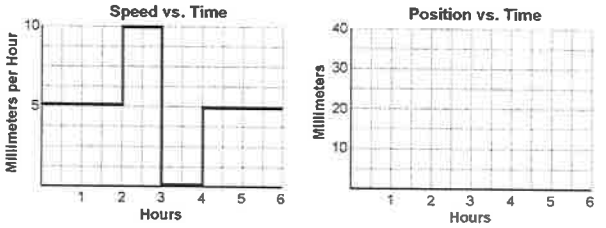
   a. The honey bee among the flowers



   b. Rover runs the street



   c. The amoeba



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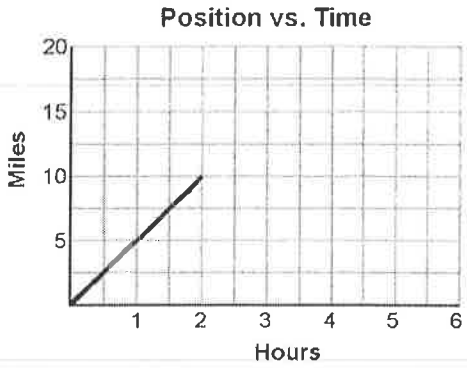

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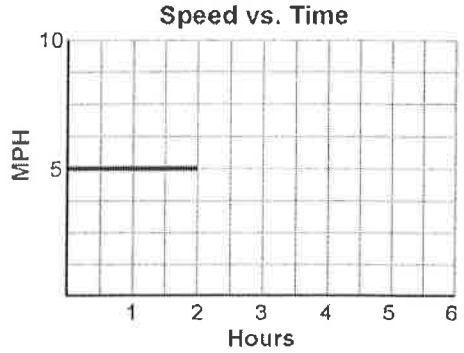

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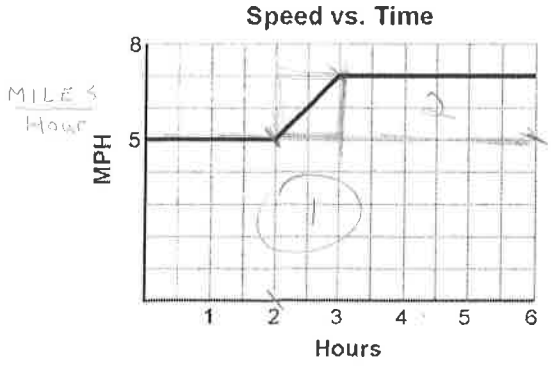

AREA = L × W

$S = \frac{d}{t}$ $d = S \times t$

① 5 mph × 6 Hr = 30 miles

② 2 mph × 3 Hr = 6 miles

③ $\frac{1}{2}$(2 mph × 1 hr) = 1 mile

37 miles

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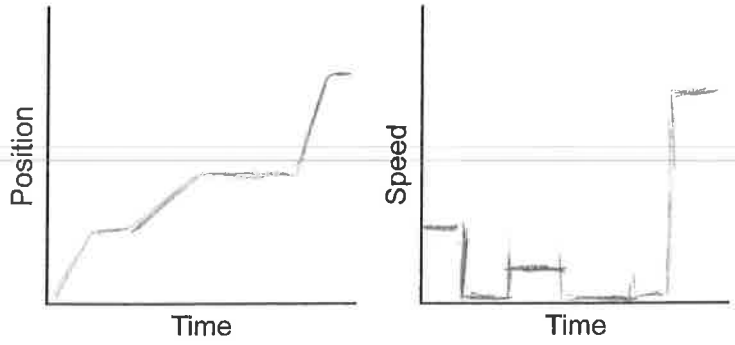

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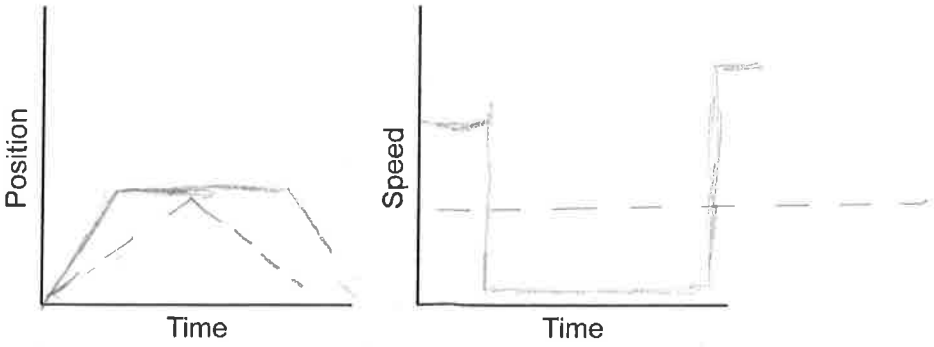
Tortoise - - -
Hare ——



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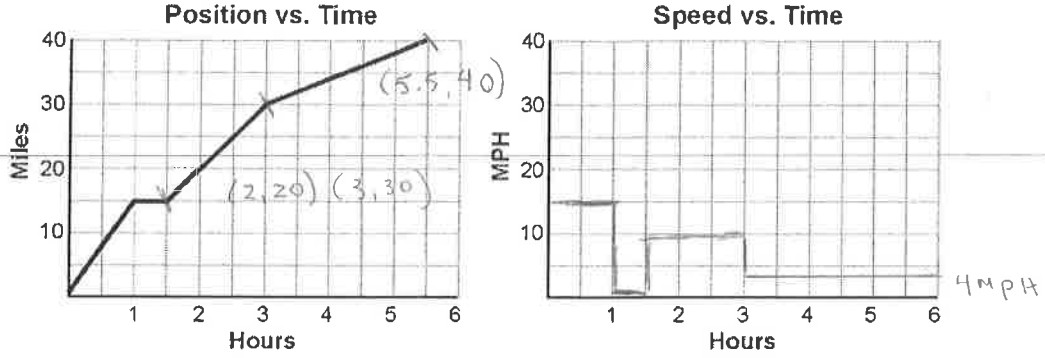

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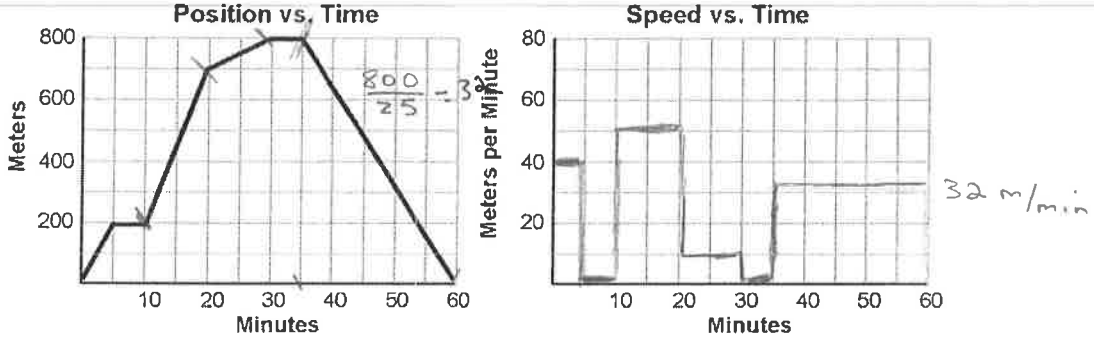

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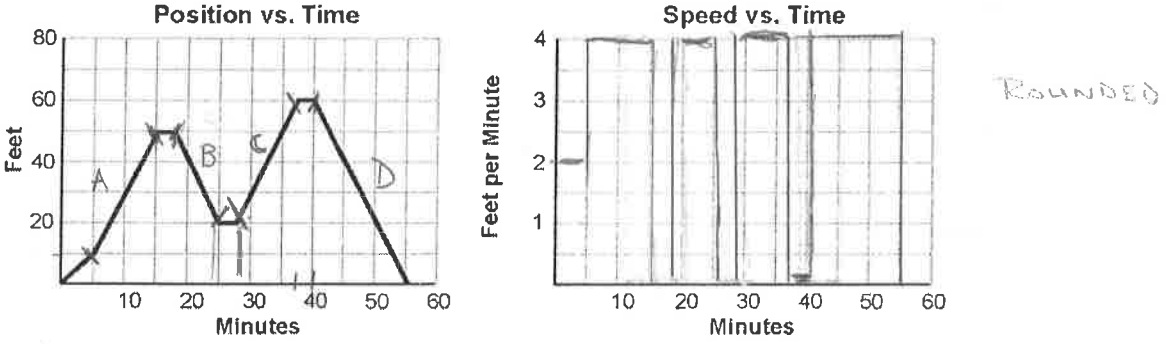

A
(5, 10) (15, 50)

B
(18, 50) (25, 20)

C
(28, 20) (37, 60)

D
(40, 60) (55, 0)

MOST STUDENTS ROUNDED

CONTENT 4.2

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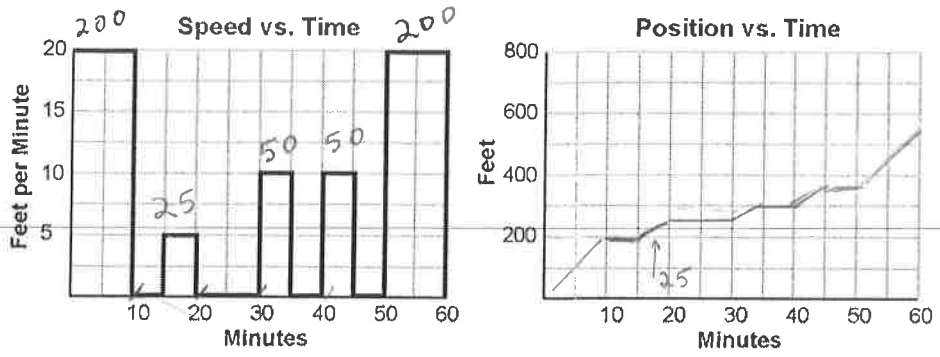

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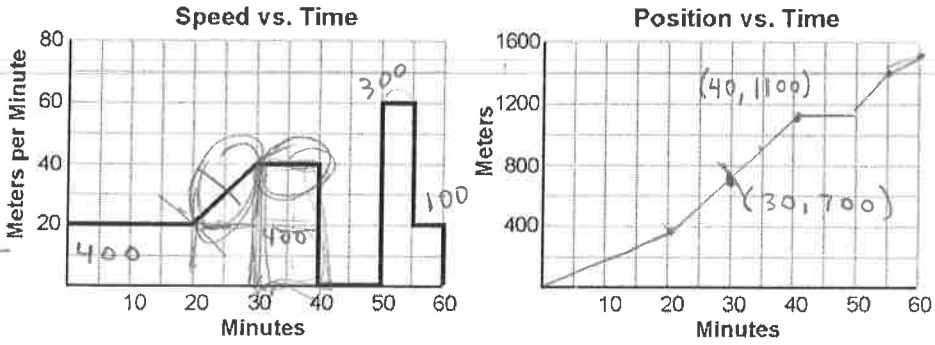

A 20 x 10 = 200
B ½ 20 x 10 = 100
300

   c. The amoeba