Name: $\qquad$

## LINEAR MODELS

Date: $\qquad$ Hr : $\qquad$
Writing Motion Equations

1) Answer the following questions using the position vs. time graph of a runner in a race shown below. Be sure to show all work (formula, substitution, answer w/ unit).

a) According to the statistics in the box, the $y$-intercept is -1.000 . What are the units and meaning of this value?
b) According to the statistics above the graph, the slope is 3.00 . What are the units and meaning of this value?
c) Write the equation for the position of the runner in the race in the form $\mathrm{y}=\mathrm{mx}+\mathrm{b}$. (Put actual numbers in for $m$ and $b$ ).
d) In your equation for part c , what do the y and the x stand for?
y : $\qquad$ x : $\qquad$
e) Use your equation in part c to find the position of the runner at a time of 8 seconds. Show your work; put units on your answer. Circle your final result.
2) This is a graph of a toy tractor moving in a classroom. Answer the following.

a) The y-intercept is given in the box. What is the value of this y-intercept, and what are the units and meaning of this value?
b) The slope is also given in the box. What is the value of this slope, and what are the units and meaning of this value?
c) Write the equation for the position of the toy tractor in the form $\mathrm{y}=\mathrm{mx}+\mathrm{b}$. (Put actual numbers in for $m$ and $b$ ).
d) In your equation for part c , what do the y and the x stand for?
y : $\qquad$ x : $\qquad$
e) Use your equation in part c to find the position of the toy tractor at a time of 5 seconds. Show your work; put units on your answer. Circle your final result.
3) The following graph depicts two runners at the start of a practice run. Assume distances on the yaxis are in feet. Answer the following.

a) The y-intercept for each runner is given in the boxes. What is the value of this y-intercept for each runner, and what are the units and meaning of this value?

| Runner A | Runner B |
| :--- | :--- |
|  |  |
|  |  |

b) Which runner got a head start? How much of a head start? Explain how you know.
c) The slope for each runner is given in the boxes. What is the value of this slope for each runner, and what are the units and meaning of this value?

| Runner A | Runner B |
| :--- | :--- |
|  |  |
|  |  |

d) Which runner was going faster? $\qquad$ How do you know this from the graph? $\qquad$

How do you know which runner is faster from the slope value? $\qquad$
e) Write the equation for the position of each runner in the form $y=m x+b$. (Put actual numbers in for $m$ and $b$ ).

| Runner A |  |
| :---: | :---: |
|  |  |
|  |  |

f) What is happening where the lines intersect at $\mathrm{t}=5$ seconds? Explain.
4) Suppose there are 6 toy cars and they all travel at a constant speed. Their equations are given below, where $y$ represents position (or distance) in feet and $x$ represents time in seconds.

Since these relationships represent distance vs. time, the slope and intercept will mean:

Slope: $\qquad$ $y$-intercept: $\qquad$

| Car A: | $y=9 x-1$ | Car D: | $y=5 x$ |
| :--- | :--- | :--- | :--- |
| Car B: | $y=2 x+1$ | Car E: | $y=-2 x+4$ |
| Car C: | $y=-3 x+8$ | Car F: | $y=4 x-5$ |

a) List all cars that got a head start (that is, they had a starting position greater than 0 feet). Which had the largest head start and where did it start?
b) List all cars that had to start behind the start line (that is, they had a starting position less than 0 feet) Which car had to start the farthest back and how far back was it?
c) Did any cars start right at the start line? Which ones and how do you know?
d) List all cars that are traveling forward in the positive direction. How can you tell from their equations?
e) List all cars that are traveling backward in the negative direction. How can you tell from their equations?
f) Which two cars are traveling at the same speed? Are they both going in the same direction?
g) Which car is traveling the fastest? How do you know from the equation?
h) Suppose you let each car travel for 5 seconds. Use each equation above to figure out the position of each car. Show your work and circle your final answer for each car below:

| Car A: | Car D: |
| :--- | :--- |
| Car B: | Car E: |
| Car C: | Car F: |

5) Let's see if you can use the slope and intercept ideas from the motion graphs for a different situation. Suppose you are given the following graph relating the height of a tree vs. its age.

a) According to the statistics in the box, the y-intercept is 0 . What are the units and meaning of this value?
b) According to the statistics above the graph, the slope is 0.75 . What are the units and meaning of this value?
c) Write the equation for the height of the tree in the form $y=m x+b$. (Put actual numbers in for $m$ and b).
d) In your equation for part c , what do the y and the x stand for?
y : $\qquad$ x : $\qquad$
e) Use your equation in part c to find the height of the tree when it is 100 years old. Show your work; put units on your answer. Circle your final result.
f) If your equation for part c was changed so that it had a negative slope, what would that mean about the redwood tree? Would it make sense in this situation? Explain.
