Name: ____________________________________ Date: __________________

LINEAR MODELING
COMMON CORE ALGEBRA II

In Common Core Algebra I, you used linear functions to model any process that had a constant rate at which one variable changes with respect to the other, or a constant slope. In this lesson we will review many of the facets of this type of modeling.

***Exercise* #1:** Dia was driving away from New York City at a constant speed of 58 miles per hour. He started 45 miles away.

(a) Write a linear function that gives Dia's distance, D, from New York City as a function of the number of hours, h, he has been driving.

(b) If Dia's destination is 270 miles away from New York City, algebraically determine to the nearest tenth of an hour how long it will take Dia to reach his destination.

In *Exercise* #1, it is clear from the context what both the slope and the y-intercept of this linear model are. Although this is often the case when constructing a linear model, sometimes the slope and a point are known, in which case, the point slope form of the a line is more appropriate.

***Exercise* #2:** Edelyn is trying to model her cell-phone plan. She knows that it has a fixed cost, per month, along with a \$0.15 charge per call she makes. In her last month's bill, she was charged \$12.80 for making 52 calls.

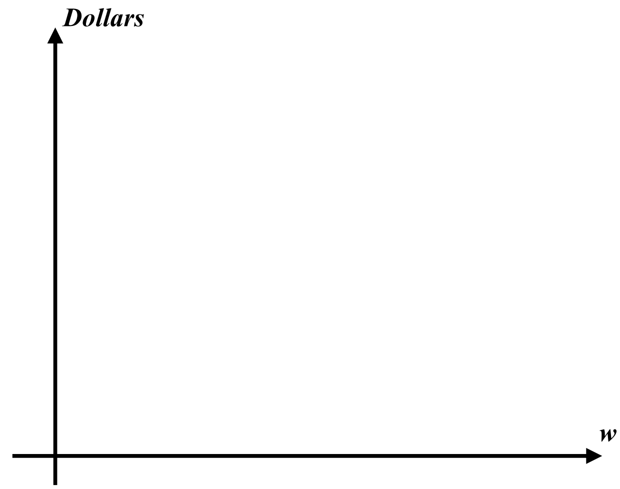
(a) Create a linear model, in point-slope form, for the amount Edelyn must pay, P, per month given the number of phone calls she makes, c.

(b) How much is Edelyn's fixed cost? In other words, how much would she have to pay for making zero phone calls?

Many times linear models have been constructed and we are asked only to work with these models. Models in the real world can be messy and it is often convenient to use our graphing calculators to plot and investigate their behavior.

***Exercise* #3:** A factory produces widgets (generic objects of no particular use). The cost, C, in dollars to produce w widgets is given by the equation $C = 0.18w + 20.64$. Each widget sells for 26 cents. Thus, the revenue gained, R, from selling these widgets is given by $R = 0.26w$.

(a) Use your graphing calculator to sketch and label each of these linear functions for the interval $0 \leq w \leq 500$. Be sure to label your y-axis with its scale.

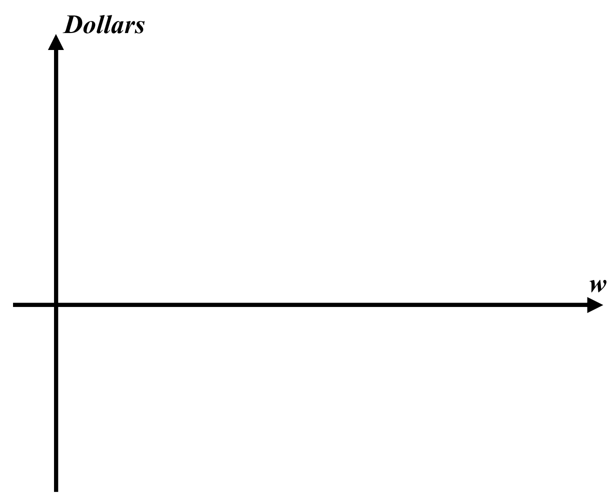


(b) Use your calculator's **INTERSECT** command to determine the number of widgets, w, that must be produced for the revenue to equal the cost.

(c) If profit is defined as the revenue minus the cost, create an equation in terms of w for the profit, P.

(d) Using your graphing calculator, sketch a graph of the profit over the interval $0 \leq w \leq 1000$. Use a **TABLE** on your calculator to determine an appropriate **WINDOW** for viewing. Label the x and y intercepts of this line on the graph.

(e) What is the minimum number of widgets that must be sold in order for the profit to reach at least \$40? Illustrate this on your graph.



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LINEAR MODELING
COMMON CORE ALGEBRA II HOMEWORK

APPLICATIONS

1. Which of the following would model the distance, D, a driver is from Chicago if they are heading *towards* the city at 58 miles per hour and started 256 miles away?

(1) $D=256t+58$ (3) $D=58t+256$

(2) $D=256-58t$ (4) $D=58-256t$

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2. The cost, C, of producing x-bikes is given by $C=22x+132$. The revenue gained from selling x-bikes is given by $R=350x$. If the profit, P, is defined as $P=R-C$, then which of the following is an equation for P in terms of x?

(1) $P=328x-132$ (3) $P=328x+132$

(2) $P=372x+132$ (4) $P=372x-132$

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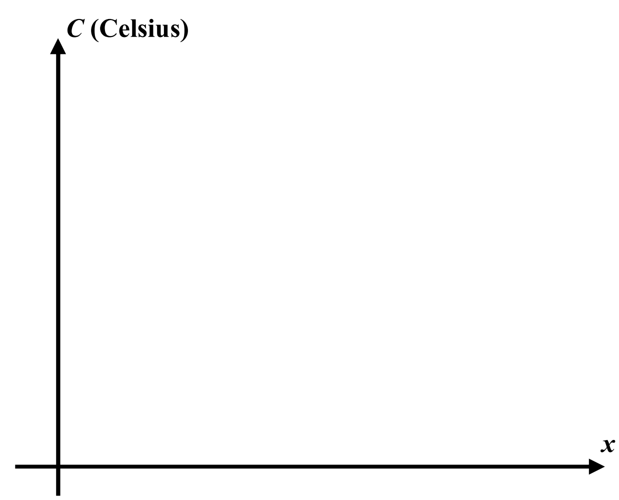
3. The average temperature of the planet is expected to rise at an average rate of 0.04 degrees Celsius per year due to global warming. The average temperature in the year 2000 was 14.71 degrees Celsius. The average Celsius temperature, C, is given by $C=14.71+0.04x$, where x represents the number of years since 2000.

(a) What will be the average temperature in the year 2100?

(b) Algebraically determine the number of years, x, it will take for the temperature, C, to reach 20 degrees Celsius. Round to the nearest year.

(c) Sketch a graph of the average yearly temperature below for the interval $0 \le x \le 200$. Be sure to label your y-axis scale as well as two points on the line (the y-intercept and one additional point).



(d) What does this model project to be the average global temperature in 2200?

4. Fabio is driving west away from Albany and towards Buffalo along Interstate 90 at a constant rate of speed of 62 miles per hour. After driving for 1.5 hours, Fabio is 221 miles from Albany.

(a) Write a linear model for the distance, D, that Fabio is away from Albany as a function of the number of hours, h, that he has been driving. Write your model in point-slope form, $D - D_1 = m(h - h_1)$.

(b) Rewrite this model in slope-intercept form, $D = mh + b$.

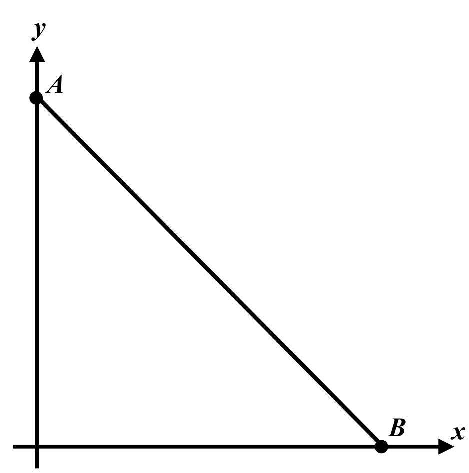
(c) How far was Fabio from Albany when he started his trip?

(d) If the total distance from Albany to Buffalo is 290 miles, determine how long it takes for Fabio to reach Buffalo. Round your answer to the nearest tenth of an hour.

5. A particular rocket taking off from the Earth's surface uses fuel at a constant rate of 12.5 gallons per minute. The rocket initially contains 225 gallons of fuel.

(a) Determine a linear model, in $y = ax + b$ form, for the amount of fuel the rocket has remaining, y, as a function of the number of minutes, x.

(b) Below is a general sketch of what the graph of your model should look like. Using your calculator, determine the x and y intercepts of this model and label them on the graph at points A and B respectively.



(c) The rocket must still contain 50 gallons of fuel when it hits the stratosphere. What is the maximum number of minutes the rocket can take to hit the stratosphere? Show this point on your graph by also graphing the horizontal line $y = 50$ and showing the intersection point.