

Working Toward a New Vision of Mathematics: Learning Math through Applications

AMATYC
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Least Common Multiple and Greatest Common Factor

1. Stephani is organizing a class trip to Florida. She has 14 parent chaperones and 35 students. She wants to create equal sized groups of parents and students so all are in a group.

- 1a) What is the greatest number of groups she can make?
- 1b) How many students are in each group?
- 1c) How many parents are in each group?

2. Caroline is organizing an after school tutoring program. She has 12 tutor volunteers and 52 students who want to be tutored. She wants to create equal sized groups of volunteers and students so all are in a group.

- 2a) What is the greatest number of groups she can make?
- 2b) How many students are in each group?
- 2c) How many volunteers are in each group?

3. Bob is buying paper plates and napkins for the math department end-of-semester celebration. Plates come in packages of 8, while napkins come in packages of 12. Bob hates to waste money, so he wants to have an equal number of plates and napkins, even if it means he saves some for the next party.

What is the least number of packages of plates and napkins that Bob has to buy to have an equal number of plates and napkins?

3a) Least number of packages of plates:

3b) Least number of packages of napkins:

There are fifty people planning to come to the party. How many packages of plates and napkins will Bob have to buy to have enough for everyone and still have an equal number of plates and napkins?

3c) Number of packages of plates:

3d) Number of packages of napkins:

Proportions

1. Mark's two cats eat 3 cans of cat food a day. Suppose Mark decides to buy 6 more cats for a total of 8 cats. How many cans of cat food per day will they eat?

2. A recipe for orange juice calls for 3 quarts of concentrate for every 5 quarts of water. If you have 9 quarts of concentrate, how many quarts of water are required?

Evaluating Expressions

1. Joshua plans to set up a hot dog cart in the park. He pays \$50 for the cart which includes the hot dogs and all supplies. He charges one dollar for each hot dog that he sells.

1. What will Joshua's profit be after he has sold 60 hot dogs?
2. What will Joshua's profit be after he has sold 80 hot dogs?
3. What will Joshua's profit be after he has sold 100 hot dogs?

Define a variable for the number of hot dogs Joshua has sold and use this variable to write an expression for Joshua's profit.

Quantity Name	The number of hot dogs Joshua has sold	Joshua's Profit
Unit		
Question 1		
Question 2		
Question 2		
Expression		

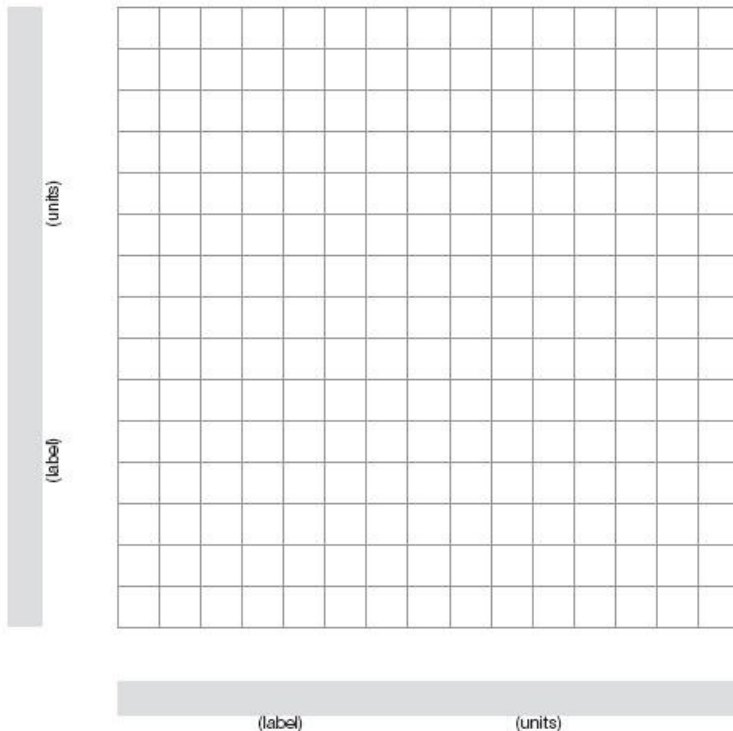
Solving Linear Equations

1. Kevin loves movies. He currently owns 34 DVD's. Every week he buys one new DVD.
 1. How many DVD's will Kevin own in 10 weeks?
 2. In how many weeks will Kevin own 50 DVD's?
 3. In how many weeks will Kevin own 62 DVD's?
 4. How many DVD's will Kevin own in one year?

Define a variable for the time in weeks and use this variable to write an expression for the number of DVD's that Kevin owns.

Quantity Name		
Unit		
Expression		
Question 1		
Question 2		
Question 3		
Question 4		

Graph the relation and determine the number of DVD's Kevin will own in 20 weeks.

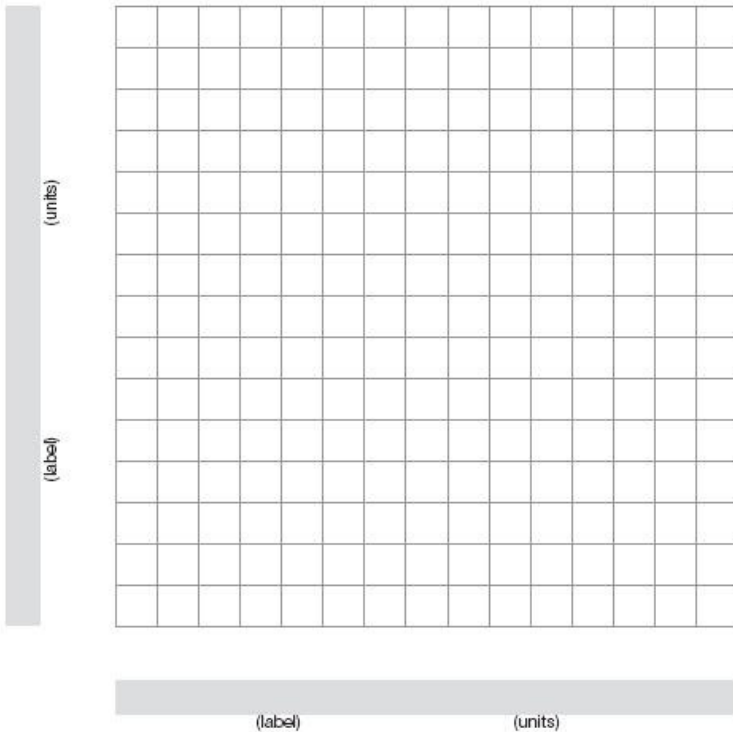


2. Your favorite aunt sent you a \$100 iTunes gift card for your birthday. Each song you download onto your ipod costs \$1.49.

- 1) How much will you have left on the gift card if you download 20 songs?
- 2) How much will you have left if you download 45 songs?
- 3) How many songs did you download if you have \$10.60 left on the card?

Quantity	Name		
Unit			
Expression			
1			
2			
3			

Graph the relation and determine the number of songs you can download with the \$100 gift card.



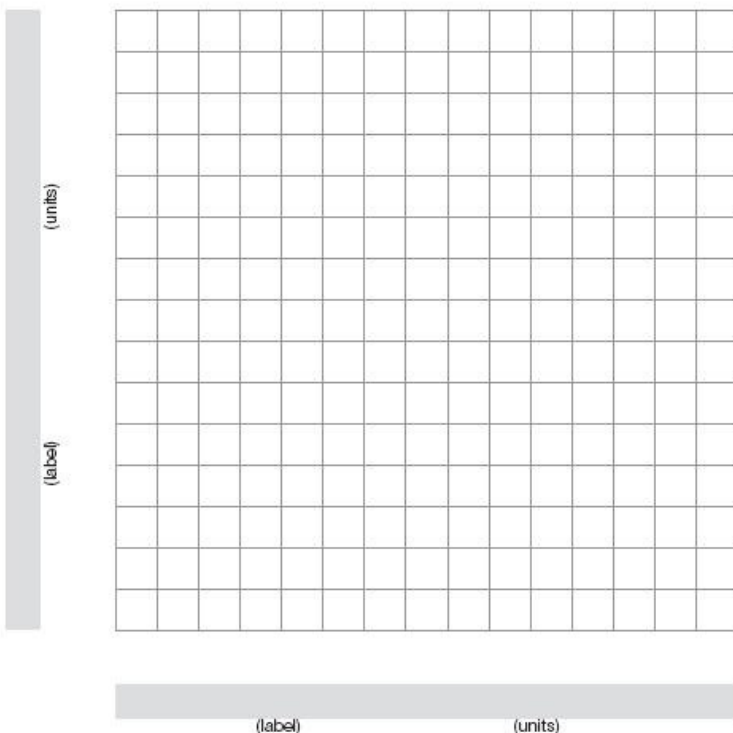
Identify a point on the graph that is not in the table. Explain the meaning of that point in the context of the problem.

3. Vera has 200 megabytes of disk space remaining on her computer. Vera has a subscription to an online music service. Each song that she downloads uses 5 megabytes of disk space.
1. How much disk space remains on Vera's computer if she downloads five songs?
 2. How much disk space remains on Vera's computer if she downloads eight songs?
 3. How many songs had Vera downloaded if 100 megabytes of disk space remain on her computer?
 4. How many songs can Vera download before she has used all her computer's disk space?

Define a variable for the number of songs that Vera downloads and use this variable to write an expression for the amount of disk space that remains on her computer.

Quantity Name		
Unit		
Expression		
Question 1		
Question 2		
Question 3		
Question 4		

Graph the relation and determine the number of songs Vera can download if 50 megabytes of disk space remain on her computer.



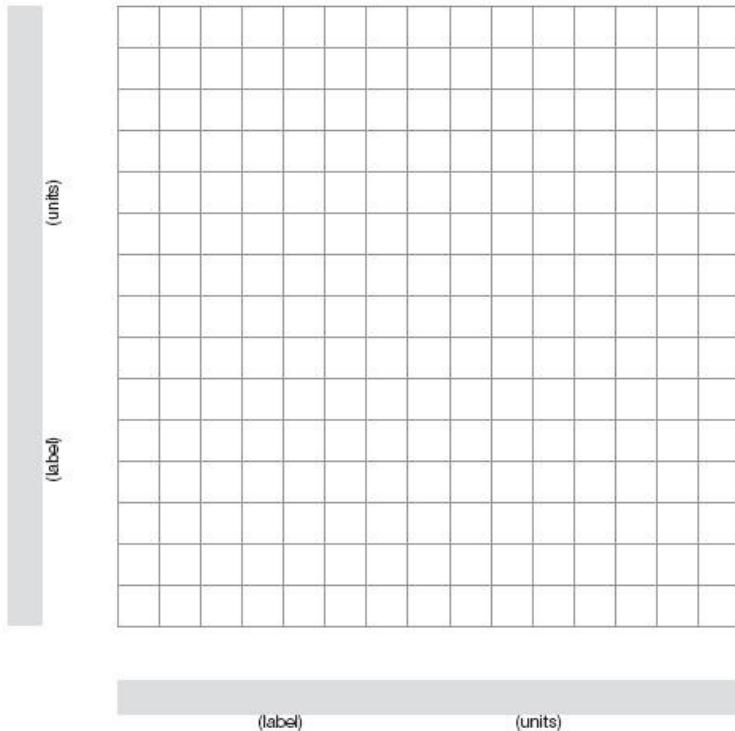
Linear Equations in Two Variables

1. You have saved \$20 to spend on video games. You plan to spend \$4 each week playing them.

To write an expression, define a variable for the time spent playing video games and use this variable to write a rule for your money.

Quantity Name		
Unit		
Expression		

Graph. Label the independent and dependent axes and choose appropriate bounds and intervals.

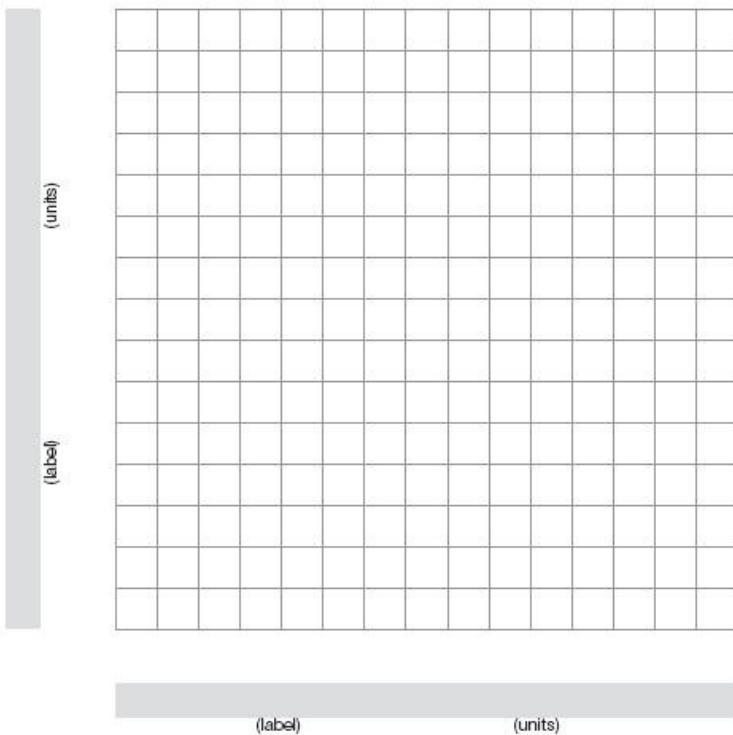


2. During the summer of 1993, record rainfalls were recorded in the Midwestern states. For every inch of rainfall in St. Louis, Missouri, the Mississippi River was estimated to rise 6 inches. On July 15th, its depth was 35 feet.

To write an expression, define a variable for the amount of rainfall since July 15th, in inches, and use this variable to write a rule for the depth of the Mississippi River, in feet.

Quantity Name		
Unit		
Expression		

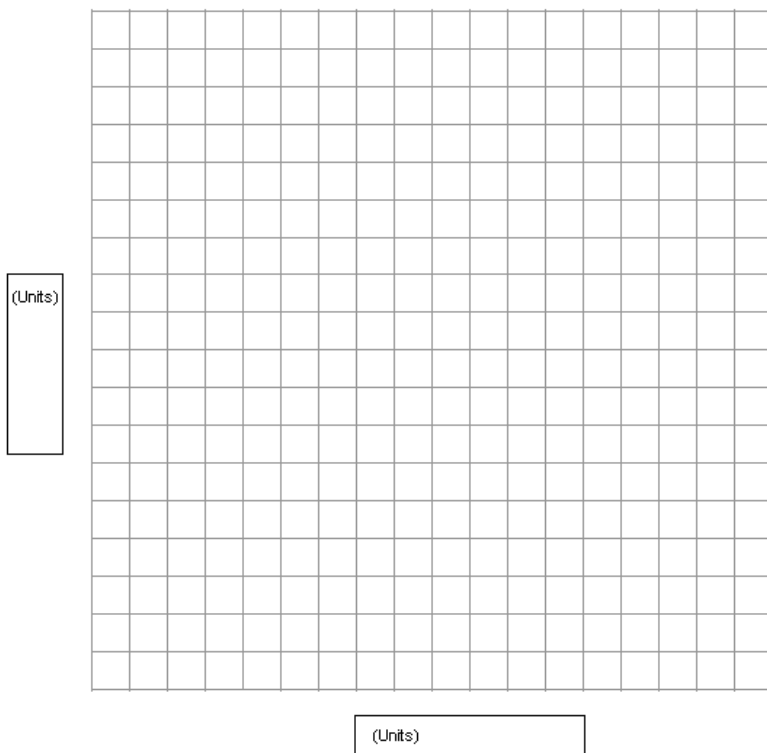
Graph. Label the independent and dependent axes and choose appropriate bounds and intervals.



3. Phillip buys a flash drive for his computer. On average, he adds files that take up 3 megabytes each day. After 16 days, he has 80 megabytes of memory remaining on the flash drive.

Find the equation, in slope-intercept form, of the line that represents the amount of memory remaining after x days.

Graph the line represented. Label the independent and dependent axes and choose appropriate bounds and intervals. Then draw the line.



4. At the beginning of the summer Molly decided to add a little money into her savings account every week. After seven weeks her account had \$175. At the end of 15 weeks her account had \$375. Assume that she put the same amount of money into her account every week and will continue to do so. Find the equation, in slope-intercept form, of the line that represents the amount of money in Molly's savings account after x days.

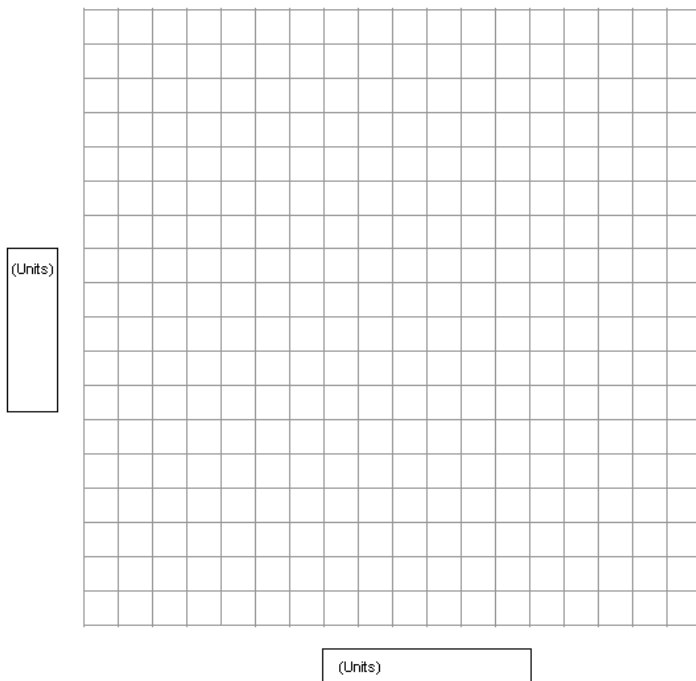
Systems of Linear Equations

1. We run a company that produces small paper-based products – badges, decals, etc. – for events such as the Olympics. To produce each item costs us \$2. We also pay an initial start-up cost for production of \$175, regardless of the number of products that we produce. We plan to sell each item for \$3.
 - a. What is our initial cost of production? What is our initial income?
 - b. How much would the cost be, in dollars, to produce 50 items? What is our income if we sell 50 items?
 - c. If our income was \$630, how many products did we sell?
 - d. How many products must we produce if we want our income from this product to be equal to our production cost?

To write an expression, define a variable for the number of products and use this variable to write rules for the cost of production and the income from products.

Quantity Name	Number of products	Cost of making product	Income from sales
Unit			
Expression			
Question a			
Question b			
Question c			
Question d			

Now graph the points as indicated from questions a, b, c and d. Label the independent and dependent axes and choose appropriate bounds and intervals. Then draw the lines.



Label for First Equation: _____

Label for Second Equation: _____

Point of Intersection: (_____, _____)

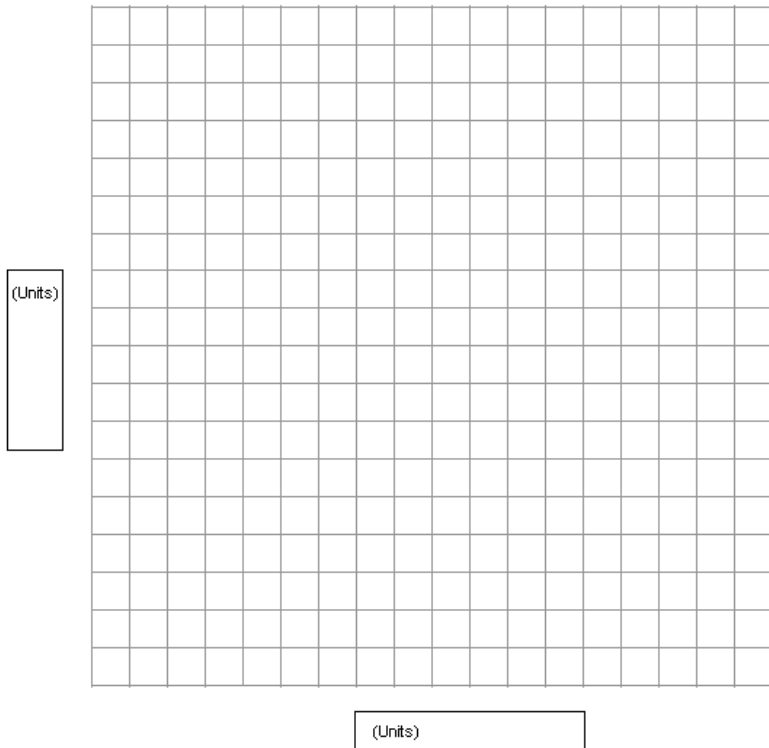
Y= _____

Y= _____

2. You are offered two summer jobs. The first job, camp counselor pays \$200 up front and \$8.00 per hour. The second job, a cashier at a sporting goods store, pays \$10 per hour.
- How much would you make at each job if you worked 15 hours?
 - How many hours did you work as a counselor if you were paid \$400? What would you have made as a cashier for the same number of hours?
 - How many hours would you have to work to earn the same amount of money for each job?

Quantity Name	Number of Hours Worked	Pay for Counselor Job	Pay for Cashier Job
Unit			
Expression			
a			
b			
c			

Now graph the points as indicated from questions a, b and c. Label the independent and dependent axes and choose appropriate bounds and intervals. Then draw the lines.



Label for First Equation: _____
 Label for Second Equation: _____
 Point of Intersection: (_____, _____)

Y= _____
 Y= _____

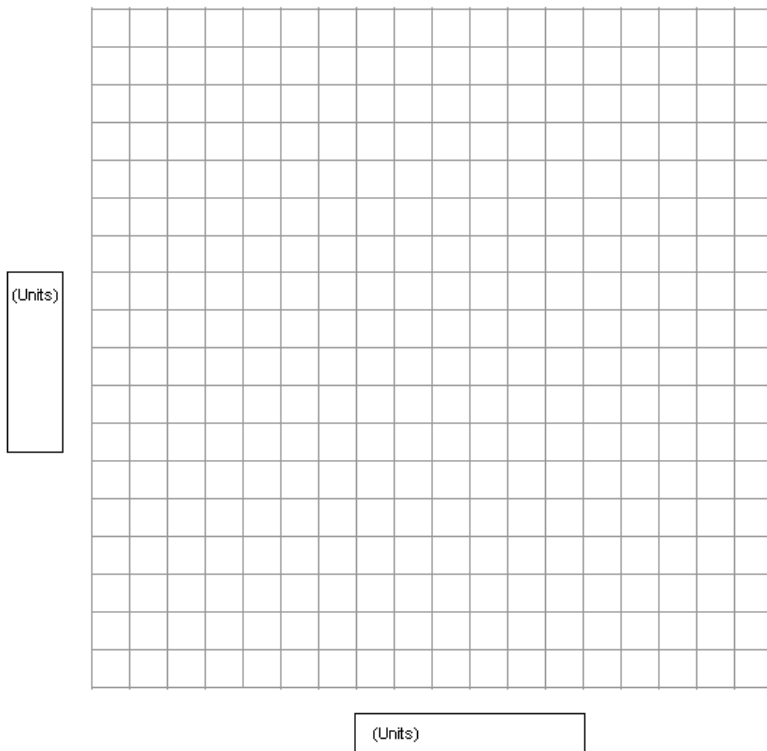
3. Alex went on iTunes to investigate buying the new Black-Eyed Peas album, The E. N. D (The Energy Never Dies). He found that he could download the entire album for \$10.99 or he could download individual songs for \$1.29 each.

Write an equation for the cost to download the entire album and another for the cost of downloading individual songs.

- How much will Alex spend if he downloads 5 songs?
- How many songs did Alex download if his cost was \$11.61?
- How many songs does Alex have to buy for the cost of the album to equal the costs for buying individual songs?

Quantity Name	Number of Songs Purchased	Total Cost for Songs	Cost for Album
Unit			
Expression			
a			
b			
c			

Now graph the points as indicated from questions a, b and c. Label the independent and dependent axes and choose appropriate bounds and intervals. Then draw the lines.

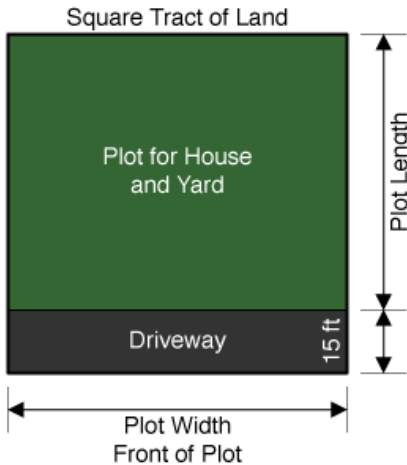


Label for First Equation: _____
 Label for Second Equation: _____
 Point of Intersection: (_____, _____)

Y= _____
 Y= _____

Quadratic Functions

1. A development and construction company is developing a large suburban area of land into a housing community. They are dividing up the land into square tracts for each home. Because the developers want to build houses of different sizes to appeal to both small and large families, they need to consider various plot sizes.



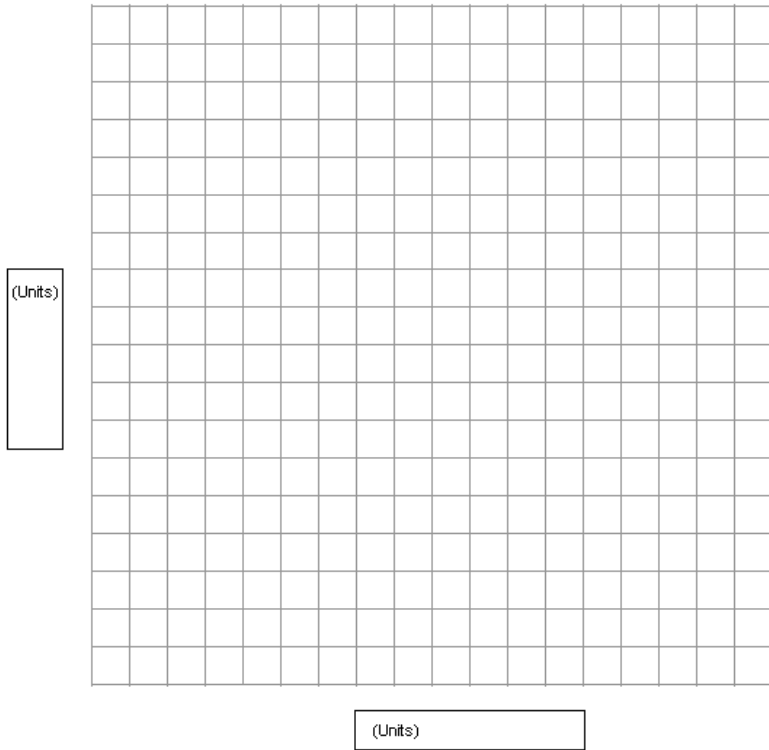
Although the developers will be building houses on different sized plots, they have decided that all of the homes will have a fifteen-foot driveway built along the front of the house. This driveway will make the length of the plot for the house and yard, 15 feet shorter than its width. (See figure above)

Since the width of these plots will equal the width of the square tract, define a variable for the width of the plot, and use it to write expressions for the length and area of the plot.

- a. For the smallest home in the community, the developers have decided to make the width of the plot 50 feet. What will be the length and area of the plot for this house and yard?
- b. If the developers are planning to build a medium sized house that has a plot width of 80 feet, what will be the length and area of the plot for this house and yard?
- c. For some of the largest homes, the developers want the plot to have a length of 85 feet. What will the width and area of these plots?

Quantity Name			
Unit			
Expression			
Question a			
Question b			
Question c			
Question d			
Question e			

Now graph the points as indicated from questions a, b and c. Label the independent and dependent axes and choose appropriate bounds and intervals. Then draw the curve.

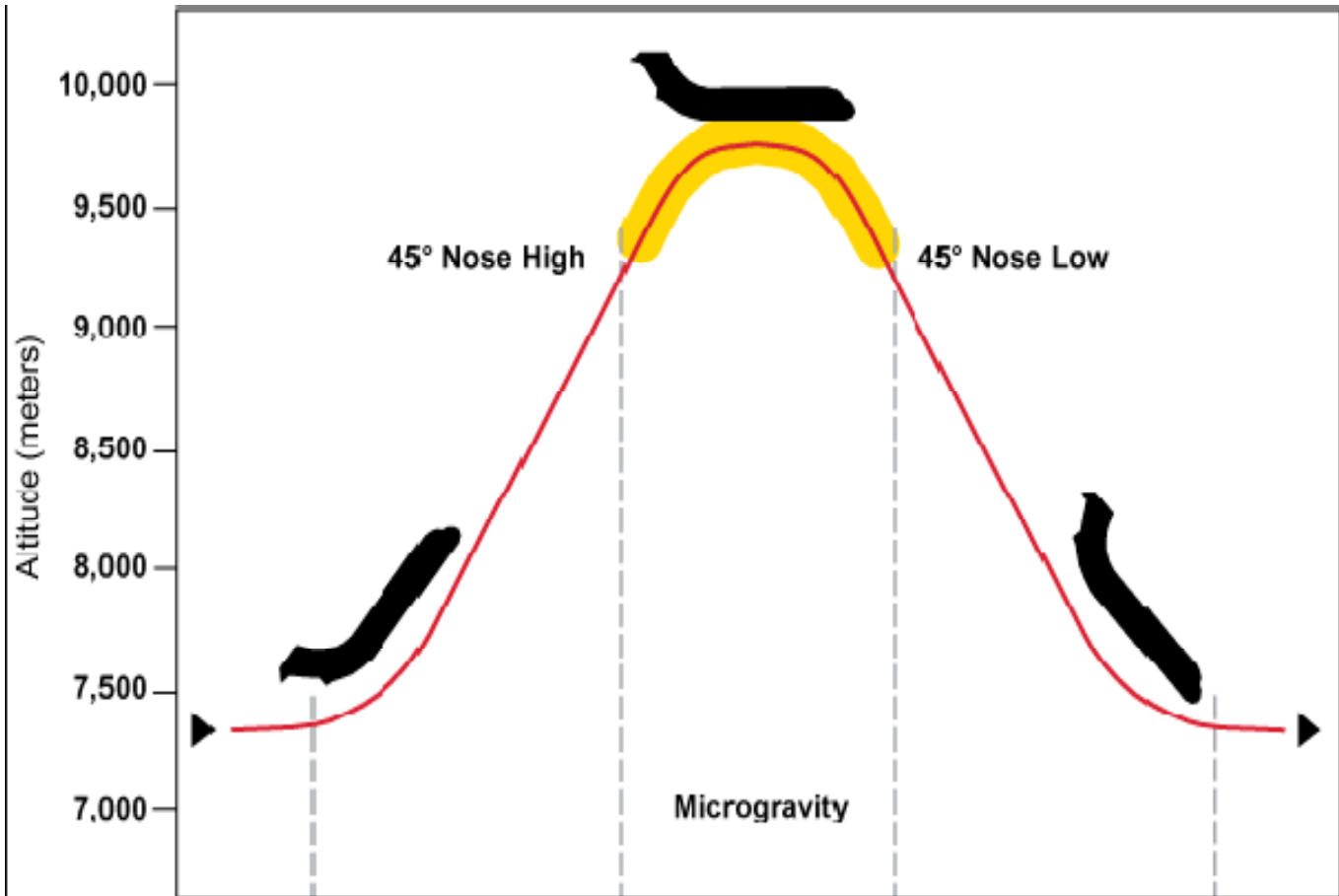


From the graph above determine the following.

- d. If the architect proposes a house design that requires the area of the plot to be 5950 square feet, what width and length must the developers make the plot?
- e. If the architect proposes another house that requires the area of the plot to be 7600 square feet, what dimensions must developers make the plot?

Quadratic Functions

2. Astronauts must be able to work in zero-gravity conditions on missions in space. To help astronauts train to work in weightlessness without the expense of travelling out of Earth's atmosphere, a specially modified jet, typically a C-9, can be flown in a parabolic path to simulate weightlessness. The function $y(t) = -4.9t^2 + 87.21t + 9144$ describes the altitude (y), in meters, of the plane in relation to the time (t), in seconds, after it started the parabolic maneuver. We will use this function to analyze the parabolic flight of the C-9.



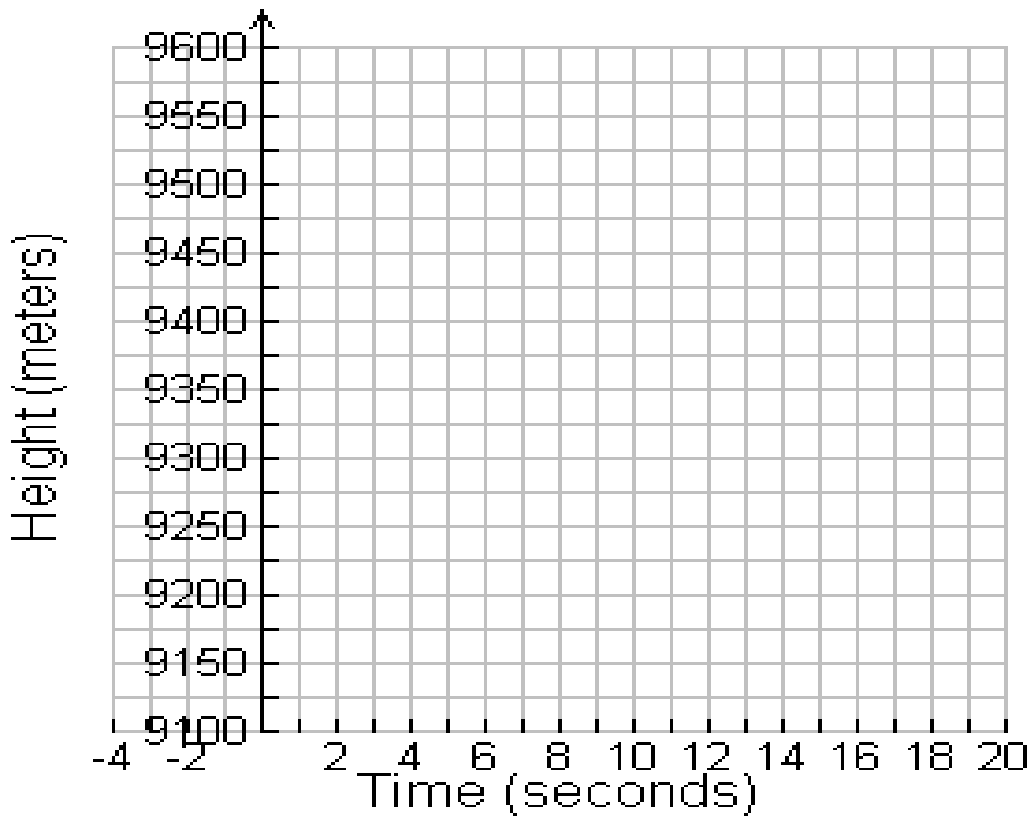
http://humanresearch.jsc.nasa.gov/education/downloads/AL_ED_C9_FINAL.pdf

Fill in the chart.

- a) When does the plane start its parabolic maneuver?
- b) How high is the plane after 2 seconds?
- c) How high is the plane after 6 seconds?
- d) How high is the plane after 8 seconds?
- e) How high is the plane after 10 seconds?
- f) How high is the plane after 14 seconds?
- g) How high is the plane after 18 seconds?

ASTRONAUT'S FLGHT		
Quantity	Time	Height of Plane
Units	seconds	meters
Expression	t	$y(t) = -4.9t^2 + 87.21t + 9144$
a)		
b)		
c)		
d)		
e)		
f)		
g)		

Plot the points to see the graph.



h) About how long does the plane stay in its parabolic maneuver?

i) What is the approximate maximum height of the plane?

j) We can determine the time at which the plane will achieve its maximum height with the vertex formula, $t = \frac{-b}{2a}$. Find the time using this formula, and then find the resulting maximum height.