

I'm Sick of Lecturing, but What Else Can I Do?

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Families of Functions

Linear

Quadratic

Cubic

Quartic

Rational

Exponential

Logarithmic

Formulas

$$y = 2x + 5$$

$$2x + 3y = 6$$

$$4x - 5y - 9 = 0$$

$$y = 2$$

$$y = 2x^2 + 5$$

$$y = 2x^2 - 6x + 5$$

$$3x^2 - 2y = -7$$

$$x^2 - y = 0$$

$$y = 2x^3 - 8$$

$$y = x^3$$

$$y = \frac{1}{3}x^3 - 45$$

$$x^3 - y = 9$$

$$y = \frac{2x - 7}{x + 1}$$

$$y = \frac{1}{x}$$

$$y = x^{-3}$$

$$y = (2x + 5)^{-4}$$

$$y = 2e^x - 6$$

$$y = \frac{e^x}{2}$$

$$y = 1 - e^{0.11x}$$

$$y = 2000e^{0.04x}$$

$$-0.01 = \ln(x + 8)$$

$$\log_2(5x + 7) = 5$$

$$\log x + \log(x - 12) = 3$$

$$\ln(x + 4) + \ln(x - 2) = \ln 7$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$y - y_1 = m(x - x_1)$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$SA = 2\pi r^2 + 2\pi rh$$

$$x^4 - 9x^3 + 22x^2 + 28x - 120 = 0$$

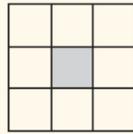
$$x^4 - 16 = 0$$

$$x^2(x^2 - 1) = 0$$

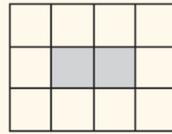
$$(x^2 - 1)^2 = 0$$

Fig. 4 The Garden Pattern task

Study the pattern below of forming a row of black squares surrounded by white squares. As you answer the questions, record any patterns you notice.



Step 1



Step 2

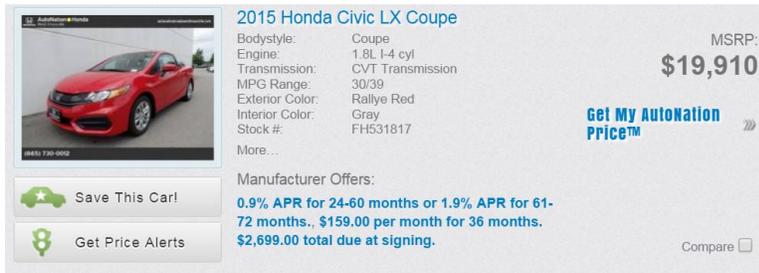


Step 3

- Assume the pattern continues, and draw the next step in the pattern.
- How many white squares will be in the 5th step?
- If there are 7 black squares in a row, how many white squares will there be?
- How many white squares will surround 50 black squares?
- How many black squares will be in the row if there are 100 white squares surrounding them?
- How many black squares will be in the row if there are 71 white squares surrounding them?
- Generalize the number of white and black squares for any step (write a rule, make an equation, state a fact using a step, and so on).

ADAPTED FROM FRIEL, RACHLIN, AND DOYLE 2001

Car Loans



2015 Honda Civic LX Coupe MSRP: **\$19,910**

Bodystyle: Coupe
Engine: 1.8L I-4 cyl
Transmission: CVT Transmission
MPG Range: 30/39
Exterior Color: Rallye Red
Interior Color: Gray
Stock #: FH531817
More...

Manufacturer Offers:
0.9% APR for 24-60 months or 1.9% APR for 61-72 months.. \$159.00 per month for 36 months. \$2,699.00 total due at signing.

Get My Automation Price™

Save This Car! | Get Price Alerts | Compare

- Using the given advertisement, identify the
 - Make/model of car: _____
 - Price of car: _____
- Find an auto loan by shopping online. ([Link to Bankrate.com](http://www.bankrate.com)) Select **PURCHASE** and the **LOAN TYPE** you want.
 - Length of loan: _____
 - Interest rate: _____
- Calculate your monthly payment. Show formula and numbers used in the calculation.
Monthly payment: _____ (keep in mind that this number does not include car insurance, maintenance, or gasoline)
- Calculate the total amount paid over the life of the loan: _____
- Now suppose you want to buy this same car, but you started saving for it five years ago. You just put the money aside in a cookie jar under your bed. How much money would you have needed to save per month for the last five years to accumulate enough money to buy the car without a loan?
Monthly savings needed: _____
- What if you had been saving for the past five years by making monthly deposits in a mutual fund that effectively paid 5% interest on your investment? How much money would you have needed to invest per month for the last five years to accumulate enough money to buy the car? Use the savings plan formula where A is the price of your car. Solve for the PMT. Show formula and calculations used.
Monthly savings needed: _____
- Compare taking out a loan to buy a car versus saving in advance to buy a car. Which would you do and why?

Patterns and Two-Step Equations

1. Jim is concerned that the grass he cuts is growing too slowly and he will not be mowing enough yards to earn school money. He finds that the grass measures 2 inches when he cuts it and grows at a rate of $\frac{1}{8}$ inch per day. Complete the table to answer the following questions.

Quantity name		
Unit		
Expression		
Question 1c		
Question 1d		
Question 1e		
Question 1f		

- 1a) What are the quantity names and units for this problem?
- 1b) Define a variable for the time, and use this variable to write a rule for the length of the grass.
- 1c) What will be the height of the grass 4 days after it is cut?
- 1d) What will be the height of the grass 2 weeks after it is cut?
- 1e) In how many days after it is cut will the grass be 3 inches tall?
- 1f) In how many weeks after it is cut will the grass be 1 foot?
2. Kay is driving from Phoenix to Knoxville with her two boys to visit her mother. The distance is 1820 miles. She is driving an average of 70 mph for 8 hours a day. Complete the table to answer the following questions.

Quantity name		
Unit		
Expression		
Question 2c		
Question 2d		
Question 2e		
Question 2f		

- 2a) If Kay wants to calculate her remaining distance based on how many hours she has driven, what are the quantity names and units for this problem?
- 2b) Define a variable for the time, and use this variable to write a rule for the remaining distance Kay has left to drive.
- 2c) What will be the remaining distance after Kay has driven for 6 hours?
- 2d) What will be the remaining distance after Kay drives for 2 days at 8 hours a day?
- 2e) How many hours has Kay been on the road if she has 630 miles left to go?
- 2f) How many days will she need to drive to reach her destination?

3. A Fortune 500 company has assumed a 3.5 million dollar debt during the recent economic downfall and is continuing to assume more debt at a rate of \$25,000 per month as they struggle to stay in business. Complete the table to answer the following questions. Represent the amount of debt as a negative number.

Quantity name		
Unit		
Expression		
Question 3c		
Question 3d		
Question 3e		
Question 3f		

- 3a) What are the quantity names and units for this problem?
- 3b) Define a variable for the time, and use this variable to write a rule for the amount of debt the company has assumed.
- 3c) How much debt will the company have after 6 months?
- 3d) If the company continues to assume more debt at this rate, what will their amount of debt reach after two years?
- 3e) How many more months of debt has the company accumulated if their debt has reached \$3,875,000?
- 3f) If the company has been accumulating their debt at this rate for several months now, how long ago did they begin going into debt?

MATH 1830: 1.P Writing Equations of Lines

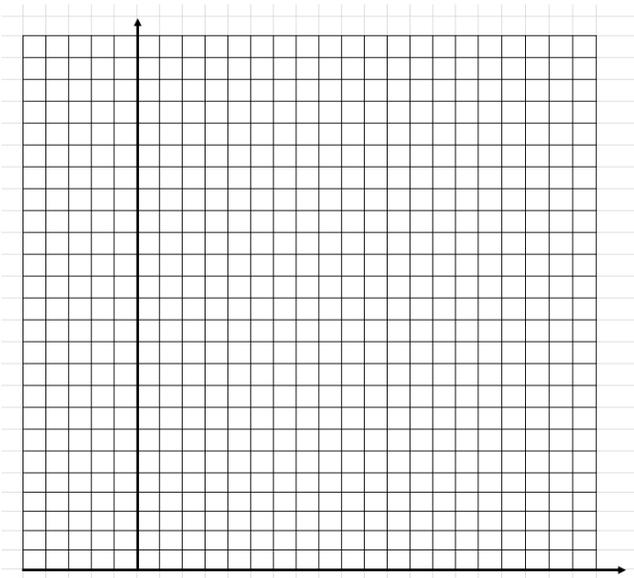
1.P INTRODUCTION

Some problems can be represented by linear equations which can then be used to find solutions or make predictions. In this activity you will use slopes and ordered pairs to write expressions that model these problems.

1. You need to find a formula for the number of cars produced by a new plant that was opened 25 days ago. You are told that three days ago the plant had 450 cars on hand, and that yesterday it had 480 cars on hand. You are also told that some of these cars came from previous inventory. Assume that the plant produces cars at this same rate and has produced them at this same rate since it opened.

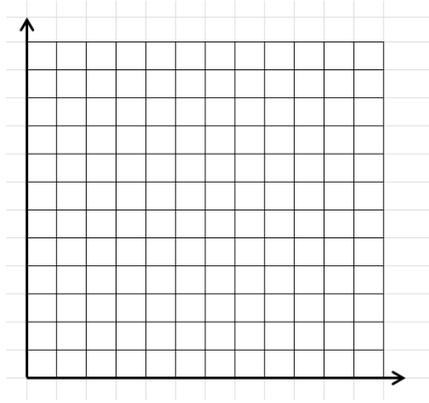
Define “ x ” to be the time from today and “ y ” to be the number of cars on hand. Therefore, an ordered pair (x, y) will represent (time from today, number of cars on hand).

- a) Write an ordered pair using the information about the cars on hand three days ago.
- b) Write a second ordered pair using the information about the cars on hand yesterday.
- c) You need to know the rate at which the plant is producing cars. Another name for this rate of change is “slope.” Use the two ordered pairs to find the rate of change.
- d) Use the slope and one of the ordered pairs (doesn’t matter which one!) to write a linear equation describing this problem. Use point-slope form: $y - y_1 = m(x - x_1)$.
- e) Write the equation in slope-intercept form: $y = mx + b$.
- f) Now write the equation in standard form: $ax + by = c$
- g) Use the equation to find the number of cars the plant had on hand when it opened.
- h) Use the equation to find the number of cars the plant will have on hand in five days.
- i) Use the equation to find when the plant will have 750 cars on hand.
- j) Graph the equation.



2. Ally Bank is offering its customers a 2-year Certificate of Deposit (CD) paying 1.29% (APR) with no minimum deposit. Define x to be the amount deposited and y to be the APR.
- Write ordered pairs that would represent depositing \$100, \$1000, and \$5000 in the CD.
 - What is the rate of change of the APR?
 - Find the linear equation that represents this problem.

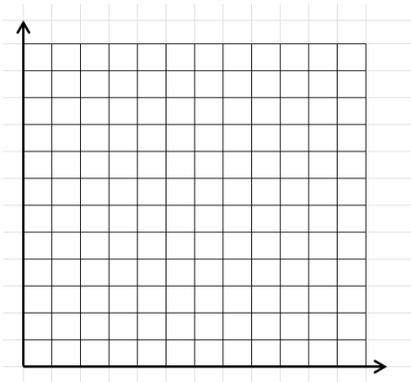
Graph the equation.



3. When Apple stock was first listed on the Nasdaq Stock Exchange on December 2, 1980, the price for one share of stock was \$28.75. On June 12, 1995, the day Sam was born, his aunt gave him one share of Apple stock. On that day it was worth \$44. On January 14, 2015, one share of Apple stock was selling for \$109.01.

Define x to be the number of shares of Apple stock and y to be the value of the stock.

- Write three ordered pairs to represent the value of the stock on these 3 days.
- Graph these three points.
- Write the equation of the line graphed.
- What is the slope of this line?
- Is this a function? Explain.



Algebra I: Factoring 1
Cut the squares apart.
Match equivalent expressions.
You should get a new 4 X 4 square.

	$(x-2)(x+2)$		$(4x-1)^2$		$(6x+1)(x-2)$		$(x+1)(x-1)$	
$x^2-14x+24$		$x^2-4x-12$	$(9-x)(2+x)$	x^2-16	$(4-x)(4+x)$	$6x^2+13x+6$	$(3+x^2)(2+x^2)$	
x^2+6x+9			$x^2-10x+24$		$25x^2-16$		$6x^2+41x+30$	
	$(x+3)^2$		$(x-4)(x-6)$		$(5x-4)(5x+4)$		$(x+6)(6x+5)$	
$x^2+7x-18$	$(6-x)(2-x)$	$x^2+3x-18$	$(9+x)(3-x)$	$x^2+6x-16$	$(8+x)(2-x)$	$9x^2+12x+4$	$x^2(2+x^2)$	
$x^2-7x+12$	$4x^2-25$		x^2-9		$16x^2-1$			
	$(2x+5)(2x-5)$		$(x+3)(x-3)$		$(4x-1)(4x+1)$		$(x-4)(x-3)$	
$6x^2-x-2$	$(5+x)(2+x)$	$(x^2-6x-16)$	$(8-x)(2+x)$	$x^2-2x-15$	$(5-x)(3+x)$	$4x^2+x-5$	$(4x+5)(x-1)$	
$x^2-8x+16$	x^2+4x+3		$7x^2-19x+10$		$9x^2-4$			
	$(x+3)(x+1)$		$(7x-5)(x-2)$		$(3x-2)(3x+2)$		$(x-4)^2$	
x^2+16	$(1+x^2)(5-x^2)$	$4x^2+20x+25$	$x^2(5+x^2)$	$3x^2+2x-1$	$(1+x)(1-x^2)$	x^2-x-12	$(4-x)(3+x)$	
x^2-15	$25x^2+20x+4$		x^2+9		$x^2+3x-10$			

Algebra I: Factoring 2
Cut the squares apart.
Match equivalent expressions.
You should get a new 4 X 4 square.

	x^2+3x+2			$(x-3)(x-4)$			$2x^2+8x-10$			x^2-y^2	
y^2+y+12		$(x+y)(x+y)$	$9+5y+y^2$		$-2x^2+4x+6$	$5+x^2+x^2$		$(y-5)(y-2)$	y^2-y-12		$(x+1)(x+1)$
	$(x-3)(x+4)$			$(2x-1)(x-3)$			$(2x+1)(x-1)$			$(x-5)(x+1)$	
	$(1-y)(2-y)$			x^2+5x+6			$6x^2+5x-4$			$(x+7)(x-1)$	
$4-x-4$ $6x^2-5x-4$		$2x^2+5x-3$	y^2+xy+y^2 $2x^2+x^2$		$(y+3)(y+2)$	$21+13y+3y^2$		$-2x^2-4x+6$	$4+x^2-6x$		$(2+x)(1-x)$
	$y^2-7y+10$			$(2x-1)(x-1)$			$(3x-4)(2x-1)$			$2(x+1)(x-5)$	
	$2x^2-x-1$			$2x^2-4x+6$			$-x^2-2x-3$			$(x-3)(x-3)$	
$2xy+xy^2$ x^2-2x^2-x		$(x-7)(2x-3)$	$4+x^2-2x^2$ x^2-9		$(5x-2)(x+3)$	$2+x^2-x^2$		$(4+3y)(3+y)$	$9-x^2+5x^2$		$(x+4)(x-4)$
	$(x+2)(x+3)$			$2(3+x)(1-x)$			$2(x+5)(x-1)$			y^2-3y+2	
	$2x^2+4x-6$			$(x-y)(x-y)$			$(3-x)(1+x)$			$(2x-1)(x+3)$	
$5-4x-x^2$		$(x-5)(x-1)$	$6-x^2$		$(x+1)(x+2)$	$10-x^2-8x$		$(x-3)(x+3)$	$12+x^2+17x$		$(y-4)(y+3)$
	$2(1+x)(3-x)$			x^2+9			x^2+y^2			$x^2-7x+12$	

<p>You're having a rough month financially and you need to borrow \$400 to cover this month's rent. Your friend agrees to loan you the money as long as you pay it back in 6 months with 5% simple interest. How much will you have to pay your friend in interest for the 6-month loan?</p>	<p>10</p>
$I = P \cdot APR \cdot Y$	$a^2 + b^2 = c^2$
$A = PMT \times \frac{\left[\left(1 + \frac{APR}{n} \right)^{nY} - 1 \right]}{\left(\frac{APR}{n} \right)}$	$PMT = \frac{P \times \left(\frac{APR}{n} \right)}{\left[1 - \left(1 + \frac{APR}{n} \right)^{-nY} \right]}$
$PMT = \frac{P \times \left(\frac{APR}{n} \right)}{\left[1 - \left(1 + \frac{APR}{n} \right)^{-nY} \right]}$	$A = P \left(1 + \frac{APR}{n} \right)^{nY}$
$PMT = \frac{P \times \left(\frac{APR}{n} \right)}{\left[1 - \left(1 + \frac{APR}{n} \right)^{-nY} \right]}$	$\frac{\%}{100} = \frac{rise}{run}$
<p>Your great aunt left you an inheritance that you didn't know about. When you were born she invested \$500 in a mutual fund account that averages 6.5% interest compounded quarterly. If you leave the money in the mutual fund account until you are 50 years old, how much money will have in the account?</p>	<p>12,562.66</p>
<p>You graduate from college owing \$20,000 in student loans. The interest rate on your loan is 4.66% and the loan term is ten years. Calculate your monthly payments on the student loan.</p>	<p>208.82</p>
<p>How much should you deposit at the end of each month in an IRA that pays 7% compounded monthly to have \$500,000 when you retire in 30 years?</p>	<p>409.85</p>
<p>You are buying a cute little starter home right outside of Knoxville. Your loan amount is \$85000, and you have a 30-year fixed-rate mortgage at 3.25%. If you live in this home for 30 years and pay off the loan as scheduled, how much money will you end up paying total for the house?</p>	<p>133,173.13</p>
<p>You just bought a 2016 Honda Civic for \$18640. You got a 4-year loan at 3.7% APR. What are your monthly payments?</p>	<p>418.38</p>

A rectangular garden bed measures 40 feet by 60 feet. A water faucet is located at one corner of the garden bed. A hose will be connected to the water faucet. The hose must be long enough to reach the opposite corner of the garden bed when stretched straight. Find the required length of the hose.	72.11
You are walking on a trail in the Smoky Mountains that has a grade of 15%. How much does the trail rise for each 1500 horizontal feet?	225
How much oil will a drum hold if it has a radius of 2 feet and a height of 3 feet?	37.7
A company is making a box to use for their merchandise that measures 8 inches by 6.25 inches by 10.5 inches. How much cardboard would be needed to make this box?	399.25
Samantha is a first grade teacher who is putting up a bulletin board. If the bulletin board is a square that measures 5 feet on each side, how much paper will she need to cover it?	25
Samantha is a first grade teacher who is putting up a bulletin board. If the bulletin board is a square that measures 5 feet on each side, how much border will she need for it?	20
A baseball pitcher won 80% of the games he pitched. If he pitched 35 ballgames, how many games did he win?	28
Last year gasoline was \$3.20/gallon. This week it is \$1.87/gallon. What is the percent decrease?	41.5%
$P = \text{Sum of all sides}$	$A = lw$
$V = \pi r^2 h$	$SA = 2lw + 2lh + 2wh$
$\text{Part} = \%(\text{Whole})$	$\% = \frac{\text{new\#} - \text{old\#}}{\text{old\#}}$