

**Unit Name:** Unit 2: Quadratic Functions and Modeling

**Lesson Plan Number & Title:** Lesson 3: Decision Making Factors

**Grade Level:** High School Math II

**Lesson Overview:**

Students will analyze functions using different representations. They will use the process of factoring and completing the square as an aide in making connections and interpretations of quadratics in terms of context. More specifically, students will investigate the graphs of quadratic functions by recognizing symmetry, extrema and zeros. They will extend their work begun in Math I on exponential functions with integer exponents. Using the properties of exponents whose domain is the set of real numbers, students will interpret expressions for exponential functions by identifying percent rate of change and classifying the functions as representing exponential grow or decay.

**Focus/Driving Question:**

How can different forms of quadratic and exponential functions be useful in modeling physical world applications?

**West Virginia College- and Career-Readiness Standards:**

M.2HS.11

Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

- a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values and symmetry of the graph and interpret these in terms of a context.
- b. Use the properties of exponents to interpret expressions for exponential functions. (e.g., Identify percent rate of change in functions such as  $y = (1.02)^t$ ,  $y = (0.97)^t$ ,  $y = (1.01)^{12t}$ ,  $y = (1.2)^{t/10}$ , and classify them as representing exponential growth or decay.) Instructional Note: This unit and, in particular, this standard extends the work begun in Mathematics I on exponential functions with integer exponents.

Instructional Note: Extend work with quadratics to include the relationship between coefficients and roots and that once roots are known, a quadratic equation can be factored.

**Manage the Lesson:**

Divide students into teams of 3 or 4 students.

Prepare a Resource/Learning Center for differentiating and tiering. Include the following possible tips or hints:

[Quadratics Help](#)

[Exponential Growth and Decay Help](#)

As a homework assignment at the end of each day, each student will use a word processor to keep a daily writing journal that includes accomplishments and a reflection of lessons learned. All entries will be in complete sentences.

Students will complete the activities in the Launch/Introduction, Investigate/Explore and Lesson Reflection sections in 90 minute periods as follows:

Step 1 -- Launch/Introduction activity; Factoring Activity

Step 2 -- Completing the Square Activity

Step 3 -- Quadratic Functions Key Features Activity

Step 4 -- Investigating Exponential Growth & Decay Activity

Step 5 -- Summarize/Debrief activity

After students have completed an activity, the teacher will lead a discussion either with individual groups or as whole class discourse.

Differentiation: Classroom format includes a mix of whole group, collaborative group, paired and individual activities. Functions are modeled in a wide variety of ways using physical and virtual manipulatives, graphing technology and Internet web sites. All explorations and discovery activities offer a variety of entry points. A Resource/Learning Center is provided that includes materials to meet the needs of all learners. Step-by-step instructions should be provided for the special needs student.

### **Academic Vocabulary Development:**

coefficient  
constant  
constant function  
exponential decay  
exponential growth  
factor  
parabola  
perfect square  
vertex

The vocabulary was developed and used extensively in the Math I course. The teacher will reinforce the vocabulary development from Math I by using the terms during the whole class discourse after each of the discovery and investigation activities. The students will demonstrate mastery of vocabulary by using each of the terms properly in their daily journal entries.

### **Launch/Introduction:**

At the beginning of the lesson, the teacher will present the class with the following problem.

Your parents offer you two allowance deals

- (1) \$30 plus \$2 increase each month, or
- (2) \$20 plus 11% increase each month.

Which deal would you choose and why?

Most students will attempt to solve the problem using tables of values. Other students may apply the concepts learned in Lesson 2 and say, "Option 2 is the best choice since it is increasing exponentially and Option 1 is linear." You may ask these students if Option 2 is the best choice for all situations. Do not respond to the correctness of their responses at this time, but allow students to think about their solution during the entire lesson. Currently, the intention of the problem is for discussion purposes only. The allowance problem with a guided solution is revisited at the end of the lesson. After discussing different solutions, the teacher will ask the class which solution, if any of the ones used, is the most efficient method to solve the problem.

### **Investigate/Explore:**

Factoring Activity

The teacher will introduce the lesson using Insights into Algebra 1 Workshop 5 -

<http://www.learner.org/workshops/algebra/workshop5/lessonplan1.html>. Students in pairs will use Algebra Tiles and/or Algebra Tiles - [http://nlvm.usu.edu/en/nav/frames\\_asid\\_189\\_g\\_1\\_t\\_2.html?open=activities](http://nlvm.usu.edu/en/nav/frames_asid_189_g_1_t_2.html?open=activities) to factor quadratics of the form  $x^2 + bx + c$ . They will also explore relationships between  $x^2 + bx + c$  and its factored form.

Completing the Square Activity

Students will use Algebra Tiles and/or Algebra Tiles -

[http://nlvm.usu.edu/en/nav/frames\\_asid\\_189\\_g\\_1\\_t\\_2.html?open=activities](http://nlvm.usu.edu/en/nav/frames_asid_189_g_1_t_2.html?open=activities) to discover the method of completing the square in a quadratic function. In the following activity, students will build perfect square quadratics, find the missing term in perfect square quadratics and write the perfect square in factored form.

In pairs, students will discuss and individually complete [Completing the Square Discovery](#) activity.

Suggested solutions can be found at [Completing the Square Discovery Key](#). (The color of the tiles in the key does not indicate positive or negative values.)

At the end of the activity, students will use inductive reasoning to discover the method of completing the square.

#### Quadratic Functions Key Features Activity

In this activity, students will examine the graphs and solutions of linear equations. This review prepares the students with basic knowledge that can be used later in finding the solution to quadratic equations. Students will use a graphing calculator and/or CAS (Computer Algebra System) as an aide in discovering the relationships among the key features of the graph and the factored and parabolic forms of quadratic functions.

In their groups, students will discuss and individually complete [Discovering Quadratic Functions Key Features](#) activity.

Suggested solutions can be found at [Discovering Quadratic Functions Key Features Key](#).

Ask the students, "What is the connection between factors, zeros, roots, solutions and x-intercepts?"

#### Investigating Exponential Growth & Decay Activity

Students will use a graphing calculator and/or CAS as an aide in investigating the relationships of the parameters of  $y = A(1+r)^t$  and the graph of exponential growth and decay.

In their groups, students will discuss and individually complete [Exponential Growth and Decay Investigation](#) activity.

Suggested solutions can be found at [Exponential Growth and Decay Investigation Key](#).

#### Summarize/Debrief:

Students will individually complete [Allowance Problem Revisited](#) activity. Suggested solutions can be found at [Allowance Problem Revisited Key](#). The teacher and students will use the student responses to determine the concepts that students have learned and the concepts that they don't understand.

After students have completed each activity, the teacher will lead a discussion either with individual groups or as whole class discourse. The teacher will use students' responses from activities and their responses during discussion to determine concepts that need to be retaught and revisited.

#### Materials:

Graph paper

Graphing calculator and/or CAS

Insights Into Algebra 1 Workshop 5 -

<http://www.learner.org/workshops/algebra/workshop5/lessonplan1.html>

Algebra Tiles and/or Algebra Tiles -

[http://nlvm.usu.edu/en/nav/frames\\_asid\\_189\\_g\\_1\\_t\\_2.html?open=activities](http://nlvm.usu.edu/en/nav/frames_asid_189_g_1_t_2.html?open=activities)

XP Math - Jobs That Use Quadratic Equations -

<http://www.xpmath.com/careers/topicsresult.php?subjectID=2&topicID=10>

We Use Math - <http://weusemath.org/>

[Quadratics Help](#)

[Exponential Growth and Decay Help](#)

[Completing the Square Discovery](#)

[Completing the Square Discovery Key](#)

[Discovering Quadratic Functions Key Features](#)

[Discovering Quadratic Functions Key Features Key](#)

[Exponential Growth and Decay Investigation](#)

[Exponential Growth and Decay Investigation Key](#)

[Allowance Problem Revisited](#)

[Allowance Problem Revisited Key](#)

**Career Connection:**

Careers in the Science, Technology, Engineering and Mathematics Cluster that use quadratics and exponential functions are actuaries, aerospace engineers, chemical engineers, civil engineers, computer software engineers, electrical engineers, environmental engineers, industrial engineers, mathematicians, nuclear engineers and statisticians. For more information, see XP Math - Jobs That Use Quadratic Equations - <http://www.xpmath.com/careers/topicsresult.php?subjectID=2&topicID=10> and We Use Math - <http://weusemath.org/>.

**Lesson Reflection:**

The teacher will reflect on how the lesson went and determine the parts from the entire lesson that need to be revised or revisited.

As a final entry in their daily journal, students will respond to the following:

As you reflect on this lesson, in what ways were you most successful? In what areas do you still need improvement? Justify your responses.

## Quadratics Help

Completing the Square using Algebra Tiles (Example) --

<http://courses.wccnet.edu/~rwhatche/VAT/CompletingTheSquare/CompletingTheSquare/Example.html>

Completing the Square --

<http://www.mathsisfun.com/algebra/completing-square.html>

Factoring Quadratics: The Simple Case --

<http://www.purplemath.com/modules/factquad.htm>

Solving Quadratic Equations in Factored Form --

<http://www.sophia.org/solving-quadratic-equations-in-factored-form/solving-quadratic-equations-in-factored-form--4-tutorial?pathway=quadratic-equations-and-functions--2>

Graphing Quadratic Equations --

[http://hotmath.com/hotmath\\_help/topics/quadratic-function.html](http://hotmath.com/hotmath_help/topics/quadratic-function.html)

## Exponential Growth & Decay Help

The effect of parameter change in  $y = Ab^t$  (Exponential Growth and Decay) --

[http://hotmath.com/help/gt/genericalg1/section\\_9\\_6.html](http://hotmath.com/help/gt/genericalg1/section_9_6.html)

Course 1, Unit 6 - Exponential Models --

<http://www.wmich.edu/cmp/parentresource/units/c1u6.html>

Graphs and example problems of exponential functions (cpm.org) --

[http://www.cpm.org/pdfs/state\\_supplements/Exponential\\_Growth\\_Decay.pdf](http://www.cpm.org/pdfs/state_supplements/Exponential_Growth_Decay.pdf)

## Completing the Square Discovery

Use algebra tiles to find the missing term to make the following perfect square quadratics. Fill in the missing term, use a straight edge to copy the algebra tiles solutions to your paper and write the quadratic as  $(x \pm a)^2$ .

1.  $x^2 + 2x + \underline{\hspace{2cm}}$

2.  $x^2 + \underline{\hspace{2cm}} + 4$

3.  $x^2 - 10x + \underline{\hspace{2cm}}$

4.  $x^2 - \underline{\hspace{1cm}} + 9$

5.  $x^2 + 8x + \underline{\hspace{1cm}}$

Answer each of the following questions about the process of completing the square.

6. What relationship exists between the length of the side of the square and the x-coefficient of the quadratic?

7. What relationship exists between the length of the side of the square and the constant term of the quadratic?

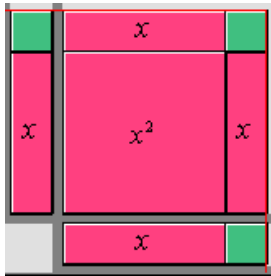
8. What relationship exists between the x-coefficient of the quadratic and the constant term of the quadratic?



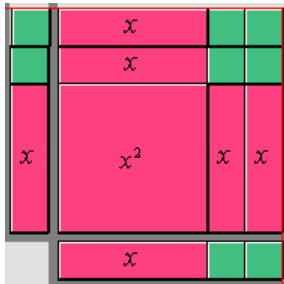
## Completing the Square Discovery Key

Use algebra tiles to find the missing term to make the following perfect square quadratics. Fill in the missing term, use a straight edge to copy the algebra tiles solutions to your paper and write the quadratic as  $(x \pm a)^2$ .

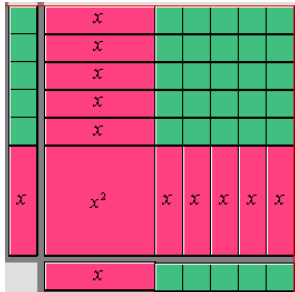
1.  $x^2 + 2x + \underline{1} = (x+1)^2$



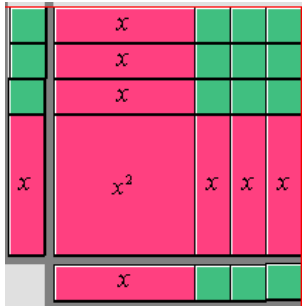
2.  $x^2 + 4x + \underline{4} = (x+2)^2$



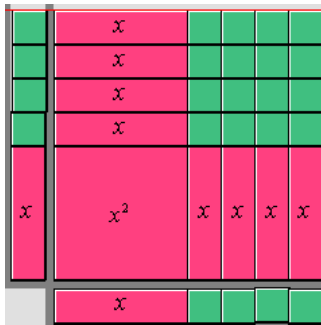
3.  $x^2 - 10x + \underline{25} = (x-5)^2$



4.  $x^2 - 6x + 9 = (x - 3)^2$



5.  $x^2 + 8x + 16 = (x + 4)^2$



Answer each of the following questions about the process of completing the square.

6. What relationship exists between the length of the side of the square and the x-coefficient of the quadratic?

The constant term of the side of the square is one-half the x-coefficient of the quadratic.

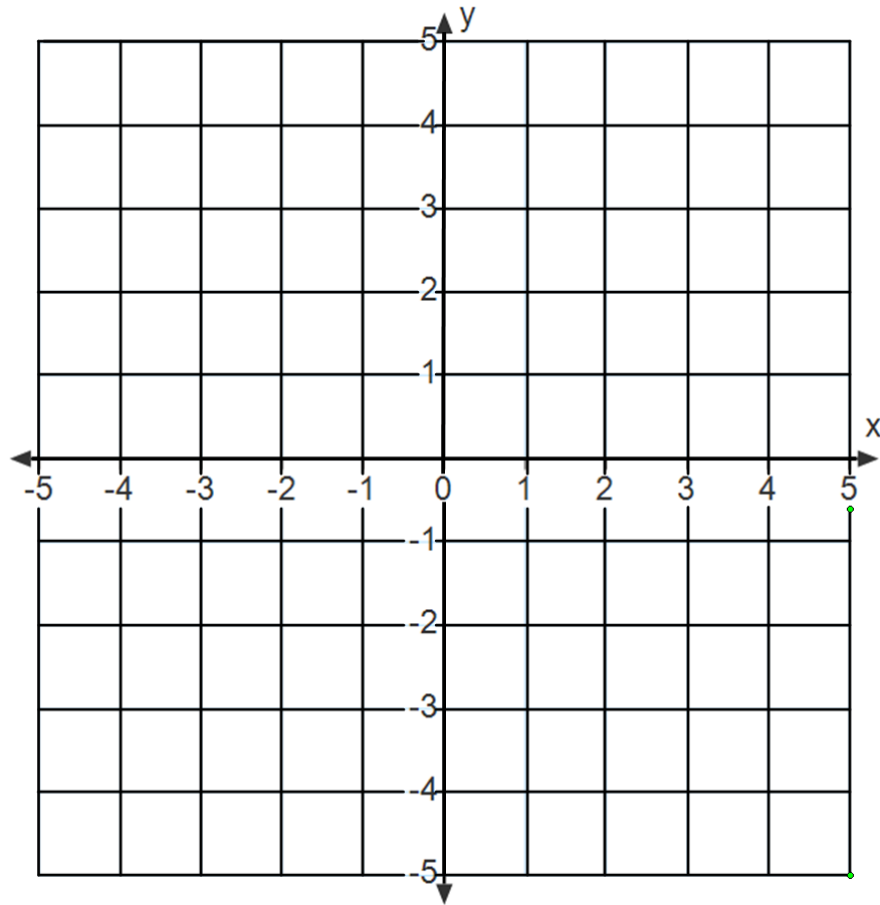
7. What relationship exists between the length of the side of the square and the constant term of the quadratic?

The absolute value of the constant term of the side of the square is the square root of the constant term of the quadratic.

8. What relationship exists between the x-coefficient of the quadratic and the constant term of the quadratic?

The absolute value of one-half of the x-coefficient is the square root of the constant term.

## Discovering Quadratic Functions Key Features



1. Use a graphing calculator or CAS (Computer Algebra System) to graph  $y = x^2 - 2x - 3$ . Sketch your graph on the above grid.
2. What is another name for the graph of a quadratic function?
3. Factor  $x^2 - 2x - 3$ .
4. Sketch the graphs of  $y =$  "first factor" of  $x^2 - 2x - 3$  and  $y =$  "second factor" of  $x^2 - 2x - 3$  on the above grid.
5. Write the ordered pairs for the  $x$ -intercepts of  $y = x^2 - 2x - 3$ .

6. Use information from the graph and other mathematical facts to explain why  $(a, 0)$  &  $(b, 0)$  are the  $x$  - intercepts of a quadratic function that is written in factored form  $y = (x - a)(x - b)$ .

7. Write the ordered pair for the  $y$  - intercept of  $y = x^2 - 2x - 3$ .

8. Use information from the graph and other mathematical facts to explain why  $(0, c)$  is the  $y$  - intercept of a quadratic function that is written in standard form  $y = ax^2 + bx + c$ .

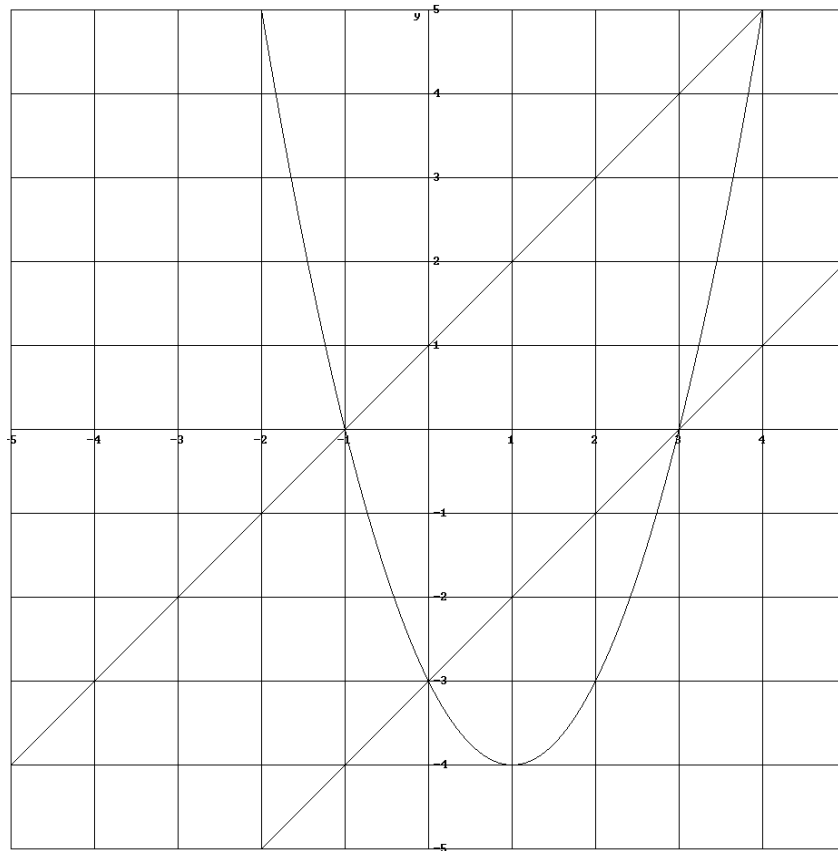
9. Write the quadratic function  $y = x^2 - 2x - 3$  in parabolic form  $y = a(x - h)^2 + k$ .

10. Use information from the graph to write the general equation for the line of symmetry of a quadratic function that is written in parabolic form  $y = a(x-h)^2 + k$ .

11. What is the vertex of  $y = x^2 - 2x - 3$ ?

12. Use information from the graph to write the ordered pair for the vertex of a quadratic function that is written in parabolic form  $y = a(x-h)^2 + k$ .

## Discovering Quadratic Functions Key Features Key



1. Use a graphing calculator or CAS (Computer Algebra System) to graph  $y = x^2 - 2x - 3$ . Sketch your graph on the above grid.

2. What is another name for the graph of a quadratic function?  
The graph of a quadratic function is a parabola.

3. Factor  $x^2 - 2x - 3$ .  
 $(x-3)(x+1)$

4. Sketch the graphs of  $y =$  "first factor" of  $x^2 - 2x - 3$  and  $y =$  "second factor" of  $x^2 - 2x - 3$  on the above grid.

5. Write the ordered pairs for the  $x$ -intercepts of  $y = x^2 - 2x - 3$ .  
 $(-1, 0)$  &  $(3, 0)$

6. Use information from the graph and other mathematical facts to explain why  $(a,0)$  &  $(b,0)$  are the  $x$  - intercepts of a quadratic function that is written in factored form  $y = (x-a)(x-b)$ .

The equation of the  $x$  - axis is  $y = 0$ . All points on the  $x$  - axis have an ordinate value of 0. Since the  $x$  - intercepts are the intersection of the  $x$  - axis and the quadratic function  $y = (x-a)(x-b)$ , the abscissa value of the  $x$  - intercepts are the solutions of the system  $y = 0$  &  $y = (x-a)(x-b)$ .

$$0 = (x-a)(x-b)$$

If the product of two real factors is 0, one of the factors is 0. In other words, the  $x$  - intercepts of  $y = (x-a)(x-b)$  are the same as the  $x$  - intercepts of  $y = x-a$  &  $y = x-b$ .

The abscissa value of the  $x$  - intercept of  $y = x-a$  is the solution of the system  $y = 0$  &  $y = x-a$ .

$$0 = x-a$$

$$x = a$$

Similarly, the abscissa value of the  $x$  - intercept of  $y = x-b$  is the solution of the system  $y = 0$  &

$$y = x-b.$$

$$0 = x-b$$

$$x = b$$

Hence,  $(a,0)$  &  $(b,0)$  are the  $x$  - intercepts of a quadratic function that is written in factored form

$$y = (x-a)(x-b).$$

7. Write the ordered pair for the  $y$  - intercept of  $y = x^2 - 2x - 3$ .

$$(0, -3)$$

8. Use information from the graph and other mathematical facts to explain why  $(0,c)$  is the  $y$  - intercept of a quadratic function that is written in standard form  $y = ax^2 + bx + c$ .

The equation of the  $y$  - axis is  $x = 0$ . All points on the  $y$  - axis have an abscissa value of 0. Since the  $y$  - intercept is the intersection of the  $y$  - axis and the quadratic function  $y = ax^2 + bx + c$ , the ordinate value of the  $y$  - intercept is the solution of the system  $x = 0$  &  $y = ax^2 + bx + c$ .

$$y = a \cdot 0^2 + b \cdot 0 + c$$

So,  $y = c$  when  $x = 0$ .

Hence,  $(0,c)$  is the  $y$  - intercept of a quadratic function that is written in standard form  $y = ax^2 + bx + c$ .

9. Write the quadratic function  $y = x^2 - 2x - 3$  in parabolic form  $y = a(x-h)^2 + k$ .

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

$$y = (x^2 - 2x + 1) - 1 - 3$$

$$y = (x^2 - 2x + 1) - 4$$

$$y = (x-1)^2 - 4$$

10. Use information from the graph to write the general equation for the line of symmetry of a quadratic function that is written in parabolic form  $y = a(x-h)^2 + k$ .

$$x = h$$

11. What is the vertex of  $y = x^2 - 2x - 3$ ?

$$(1, -4)$$

12. Use information from the graph to write the ordered pair for the vertex of a quadratic function that is written in parabolic form  $y = a(x-h)^2 + k$ .

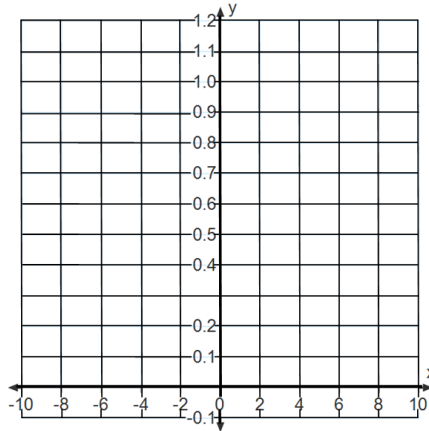
$$(h, k)$$



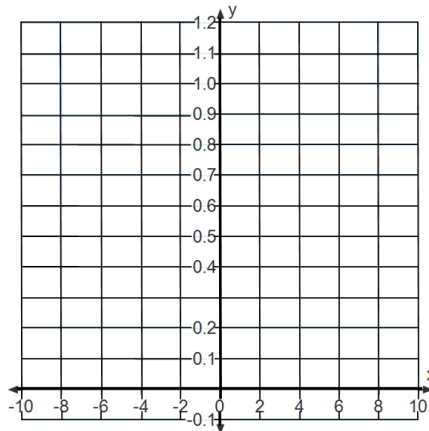
## Exponential Growth & Decay Investigation

Use a graphing calculator or CAS (Computer Algebra System) to graph each of the following exponential functions. Rewrite the function in the form  $y = A(1+r)^t$ , state the value of  $A$  and  $r$ , and sketch the graph on the adjacent grid. Use the graph to classify each function as constant, increasing or decreasing.

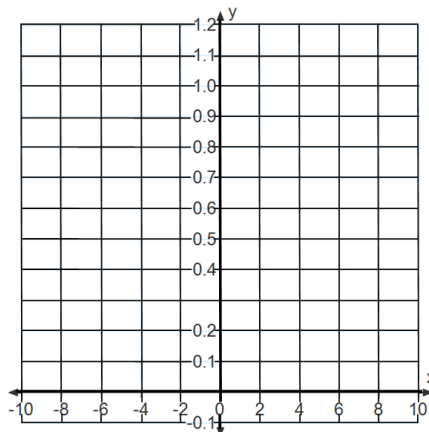
$$y = 0.1(0.8)^t$$



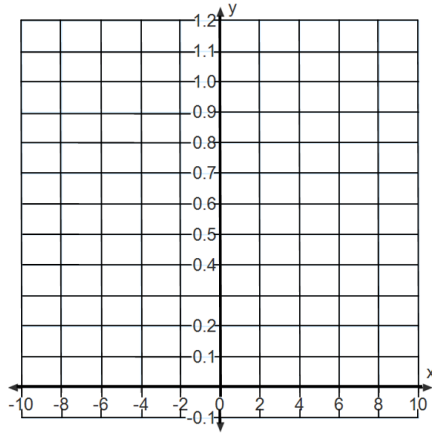
$$y = 0.1(1)^t$$



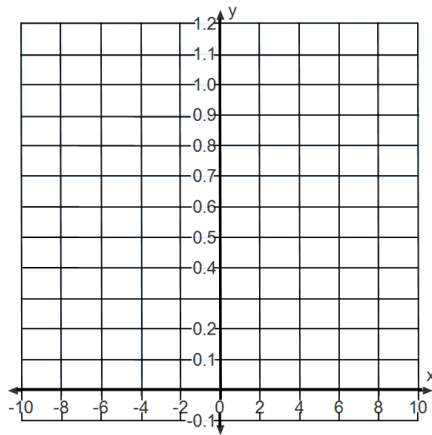
$$y = 0.1(1.2)^t$$



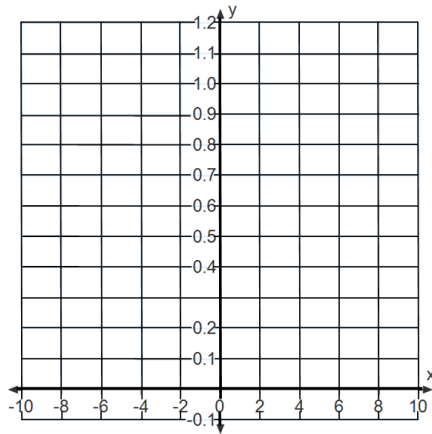
$$y = 0.8^t$$



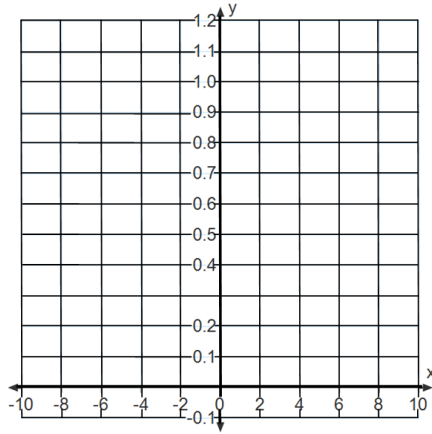
$$y = 1^t$$



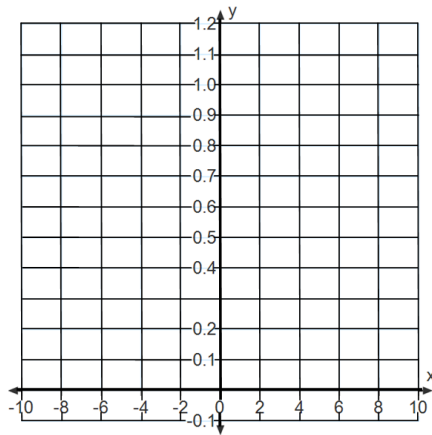
$$y = 1.2^t$$



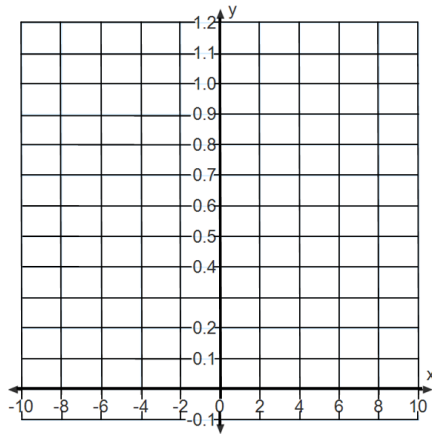
$$y = 1.1(0.8)^t$$



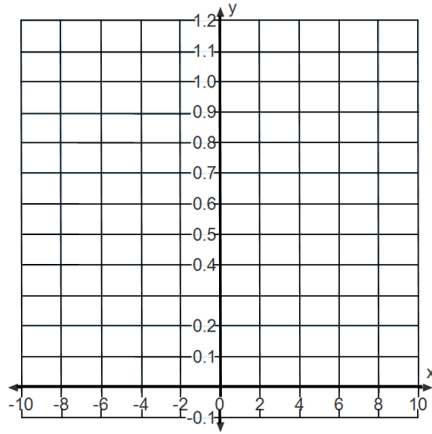
$$y = 1.1(1)^t$$



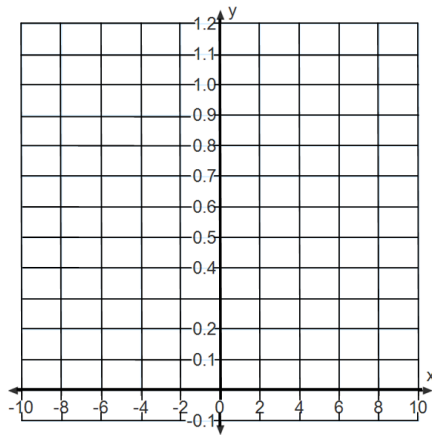
$$y = 1.1(1.2)^t$$



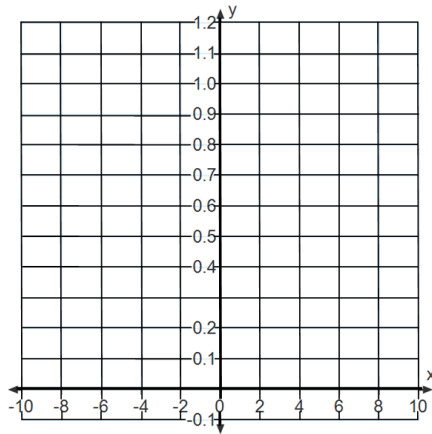
$$y = 0.1(2)^t$$



$$y = 10^t$$



$$y = 1.1(20)^t$$



Use information from the graphs and their corresponding functions in the form  $y = A(1+r)^t$ ,  $A > 0$  to complete the following table.

Value of $A$	Value of $r$	exponential growth, decay or neither?
$A > 1$	$r > 0$	
$A > 1$	$r = 0$	
$A > 1$	$r < 0$	
$A = 1$	$r > 0$	
$A = 1$	$r = 0$	
$A = 1$	$r < 0$	
$A < 1$	$r > 0$	
$A < 1$	$r = 0$	
$A < 1$	$r < 0$	

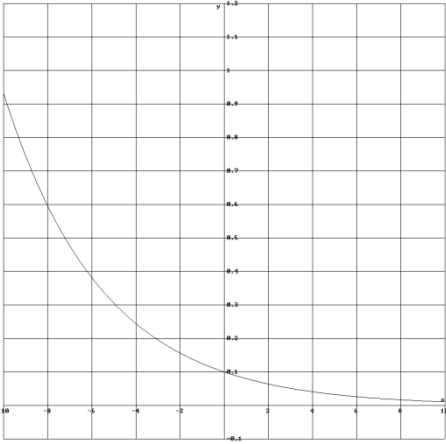
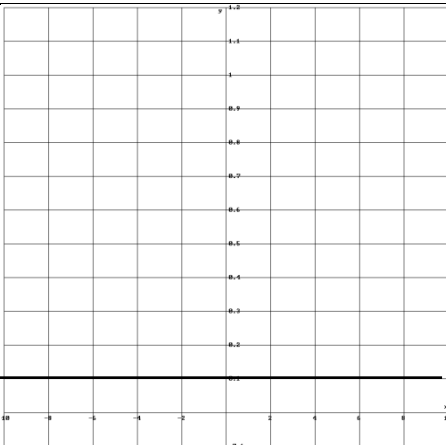
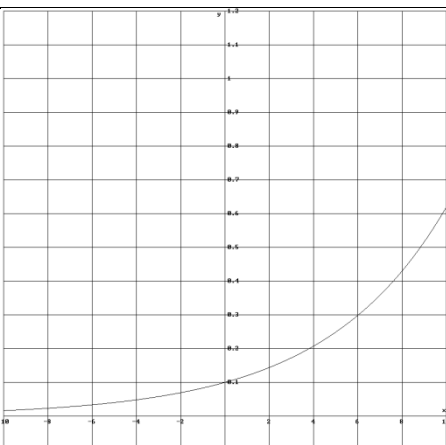
Use information from the graphs and the parameters of their corresponding functions,  $y = A(1+r)^t$ , to write the general form of the  $y$  - intercept of an exponential function.

Use the parameters of  $y = A(1+r)^t$ ,  $A > 0$  to write the percent rate of change of an exponential function.

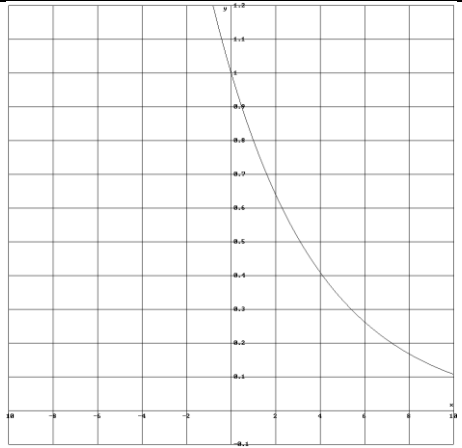
Using the above information, describe the graph of exponential function  $y = A(1+r)^t$ ,  $A > 0$  in general using the parameters of the function and classify the function as exponential growth, exponential decay or neither.

## Exponential Growth & Decay Investigation Key

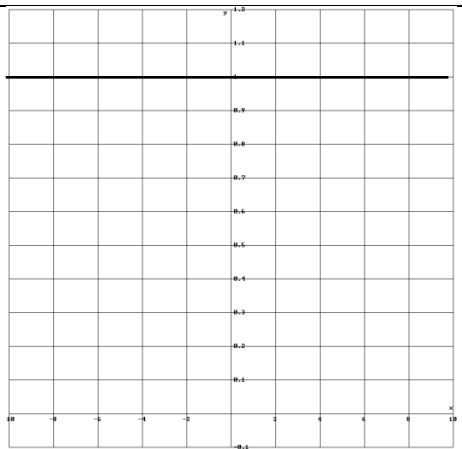
Use a graphing calculator or CAS (Computer Algebra System) to graph each of the following exponential functions. Rewrite the function in the form  $y = A(1+r)^t$ , state the value of  $A$  and  $r$ , and sketch the graph on the adjacent grid. Use the graph to classify each function as constant, increasing or decreasing.

$y = 0.1(0.8)^t$ $y = 0.1(1+(-0.2))^t$ $A = 0.1$ $r = -0.2$ decreasing	
$y = 0.1(1)^t$ $y = 0.1(1+0)^t$ $A = 0.1$ $r = 0$ constant	
$y = 0.1(1.2)^t$ $y = 0.1(1+0.2)^t$ $A = 0.1$ $r = 0.2$ increasing	

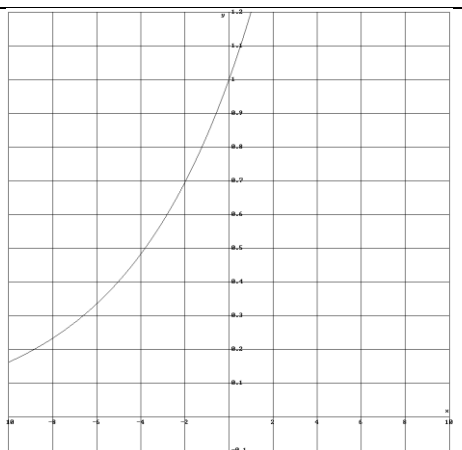
$y = 0.8^t$   
 $y = (1 + (-0.2))^t$   
 $A = 1$   
 $r = -0.2$   
decreasing



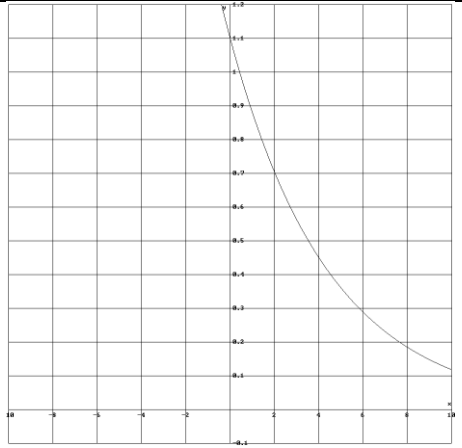
$y = 1^t$   
 $y = (1 + 0)^t$   
 $A = 1$   
 $r = 0$   
constant



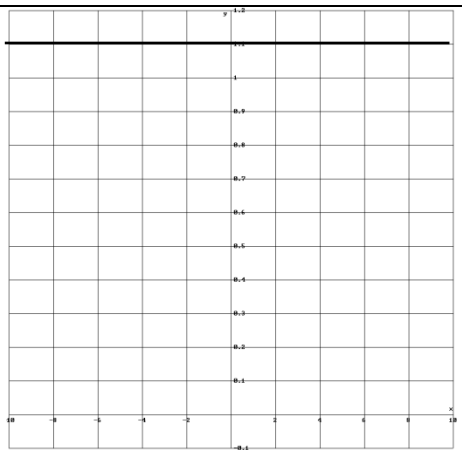
$y = 1.2^t$   
 $y = (1 + 0.2)^t$   
 $A = 1$   
 $r = 0.2$   
increasing



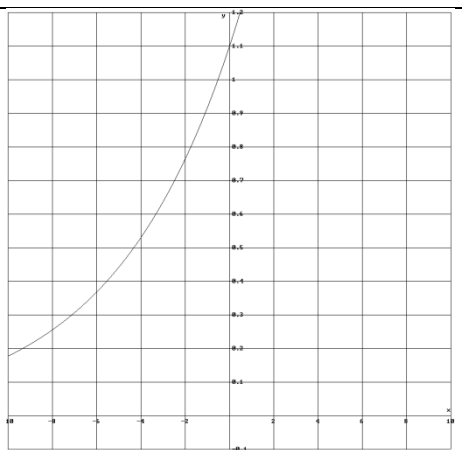
$y = 1.1(0.8)^t$   
 $y = 1.1(1+(-0.2))^t$   
 $A = 1.1$   
 $r = -0.2$   
decreasing



$y = 1.1(1)^t$   
 $y = 1.1(1+0)^t$   
 $A = 1.1$   
 $r = 0$   
constant

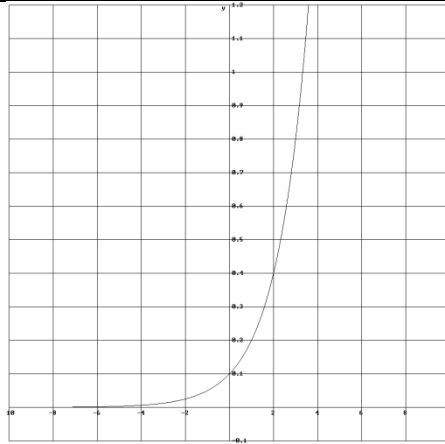


$y = 1.1(1.2)^t$   
 $y = 1.1(1+0.2)^t$   
 $A = 1.1$   
 $r = 0.2$   
increasing

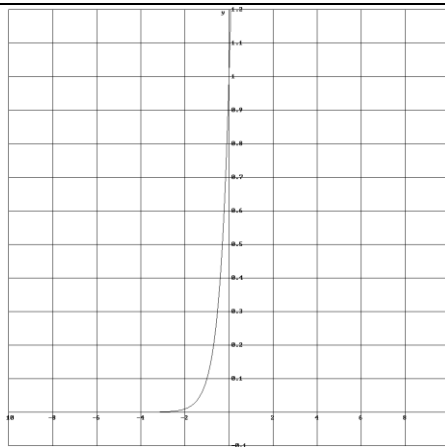




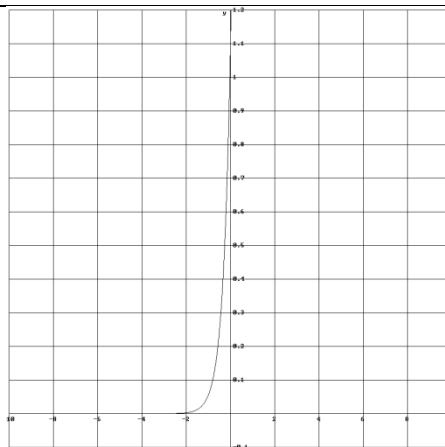
$y = 0.1(2)^t$   
 $y = 0.1(1+1)^t$   
 $A = 0.1$   
 $r = 1$   
increasing



$y = 10^t$   
 $y = (1+9)^t$   
 $A = 1$   
 $r = 9$   
increasing



$y = 1.1(20)^t$   
 $y = 1.1(1+19)^t$   
 $A = 1.1$   
 $r = 19$   
increasing



Use information from the graphs and their corresponding functions in the form  $y = A(1+r)^t$ ,  $A > 0$  to complete the following table.

Value of $A$	Value of $r$	exponential growth, decay or neither?
$A > 1$	$r > 0$	exponential growth
$A > 1$	$r = 0$	neither
$A > 1$	$r < 0$	exponential decay
$A = 1$	$r > 0$	exponential growth
$A = 1$	$r = 0$	neither
$A = 1$	$r < 0$	exponential decay
$A < 1$	$r > 0$	exponential growth
$A < 1$	$r = 0$	neither
$A < 1$	$r < 0$	exponential decay

Use information from the graphs and the parameters of their corresponding functions,  $y = A(1+r)^t$ , to write the general form of the  $y$  - intercept of an exponential function.

$(0, A)$

Use the parameters of  $y = A(1+r)^t$ ,  $A > 0$  to write the percent rate of change of an exponential function.

$100r$  percent

Using the above information, describe the graph of exponential function  $y = A(1+r)^t$ ,  $A > 0$  in general using the parameters of the function and classify the function as exponential growth, exponential decay or neither.

If  $r < 0$ , the graph of  $y = A(1+r)^t$ ,  $A > 0$  is a decreasing exponential function that represents exponential decay with a  $100r$  percent rate of change and a  $y$  - intercept of  $(0, A)$ . If  $r = 0$ , the graph of  $y = A(1+r)^t$  is a constant function  $y = A$  that is a horizontal line with  $y$  - intercept,  $(0, A)$ . If  $r = 0$ , the graph of  $y = A(1+r)^t$  is neither exponential growth nor decay. If  $r > 0$ , the graph of  $y = A(1+r)^t$ ,  $A > 0$  is an increasing exponential function that represents exponential growth with a  $100r$  percent rate of change and a  $y$  - intercept of  $(0, A)$ .

## Allowance Problem Revisited A Guided Reflection

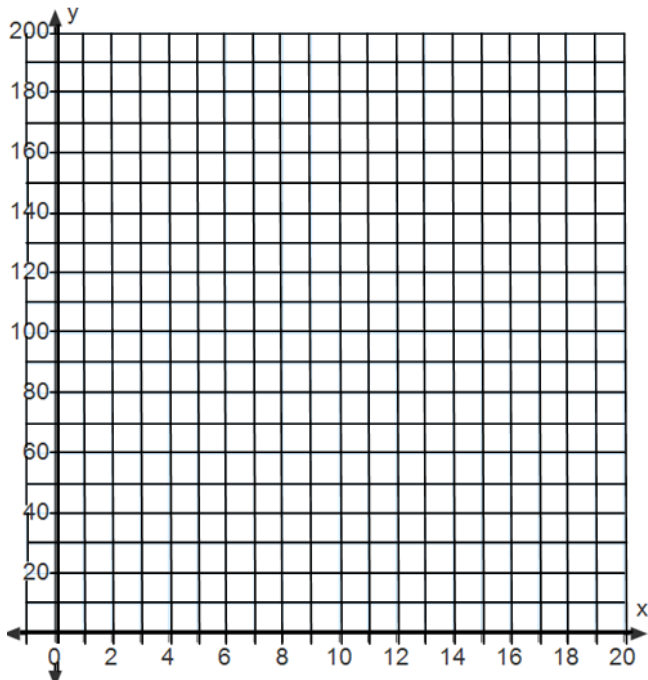
Your parents offer you two allowance deals

(3) \$30 plus \$2 increase each month, or

(4) \$20 plus 11% increase each month.

Use the mathematical concepts learned in this lesson to respond to the following:  
Write each allowance deal as a continuous function.

Sketch the graph of each deal as a continuous function.



Which months will the first deal's monthly allowance be more than the second?

Which month will the monthly allowance be approximately the same amount for both deals?

Which months will the second deal's monthly allowance be more than the first?

Complete the following table. Approximate each monthly allowance to the nearest cent.

<b>Month</b>	<b>Deal 1 Monthly Allowance</b>	<b>Deal 1 Total Allowance</b>	<b>Deal 2 Monthly Allowance</b>	<b>Deal 2 Total Allowance</b>
0				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

Which deal would you choose and why?

## Allowance Problem Revisited Key A Guided Reflection

Your parents offer you two allowance deals

(5) \$30 plus \$2 increase each month, or

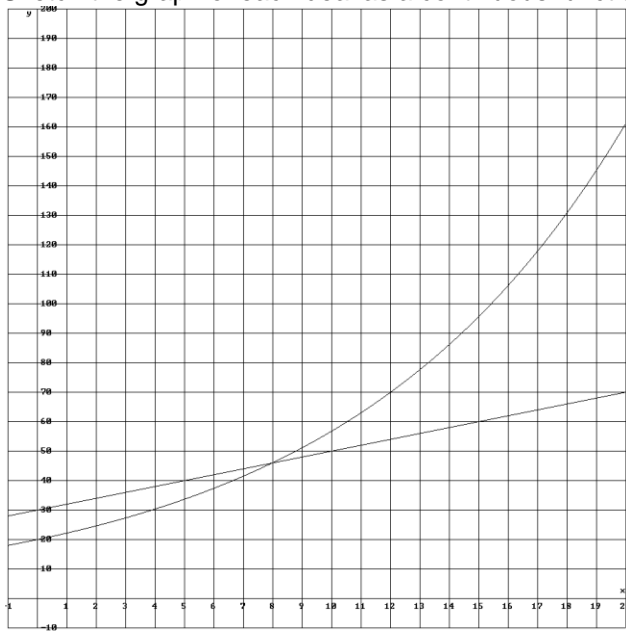
(6) \$20 plus 11% increase each month.

Use the mathematical concepts learned in this lesson to respond to the following:  
Write each allowance deal as a continuous function.

$$y = 2t + 30$$

$$y = 20(1.11)^t$$

Sketch the graph of each deal as a continuous function.



Which months will the first deal's monthly allowance be more than the second?

$$\{t : 0 \leq t < 8, t \in \mathbb{Z}\} \quad (\text{Note: } \mathbb{Z} \text{ is the set of integers})$$

Which month will the monthly allowance be approximately the same amount for both deals?

The eighth month's allowance is approximately \$46.00 for both  $y = 2t + 30$  &  $y = 20(1.11)^t$ .

Which months will the second deal's monthly allowance be more than the first?

$$\{t : t > 8, t \in \mathbb{Z}\}$$

Complete the following table. Approximate each monthly allowance to the nearest cent.

Month	Deal 1 Monthly Allowance	Deal 1 Total Allowance	Deal 2 Monthly Allowance	Deal 2 Total Allowance
0	\$30.00	\$30.00	\$20.00	\$20.00
1	\$32.00	\$62.00	\$22.20	\$42.20
2	\$34.00	\$96.00	\$24.64	\$66.84
3	\$36.00	\$132.00	\$27.35	\$94.19
4	\$38.00	\$170.00	\$30.36	\$124.55
5	\$40.00	\$210.00	\$33.70	\$158.25
6	\$42.00	\$252.00	\$37.41	\$195.66
7	\$44.00	\$296.00	\$41.52	\$237.18
8	\$46.00	\$342.00	\$46.09	\$283.27
9	\$48.00	\$390.00	\$51.16	\$334.43
10	\$50.00	\$440.00	\$56.79	\$391.22
11	\$52.00	\$492.00	\$63.04	\$454.26
12	\$54.00	\$546.00	\$69.97	\$524.23
13	\$56.00	\$602.00	\$77.67	\$601.90
14	\$58.00	\$660.00	\$86.21	\$688.11
15	\$60.00	\$720.00	\$95.70	\$783.81

Which deal would you choose and why?

Monthly allowances for Deal 1 are better than Deal 2 for the first seven months. Deal 2 is \$0.09 more for the eighth month and continues to be more monthly for the remaining months, but the total amount received for Deal 2 is not more than the total amount received for Deal 1 until month 14. So, Deal 1 is better if for some reason the monthly allowances are limited to less than 14 months, but if monthly allowances continue for more than 13 months, Deal 2 is better than Deal 1.