

## L1 - Exponential Growth

MCR3U

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### DO IT NOW!

A type of bacteria grows so that it triples in number every day. On the day we begin observations, the bacteria has a population of 100.

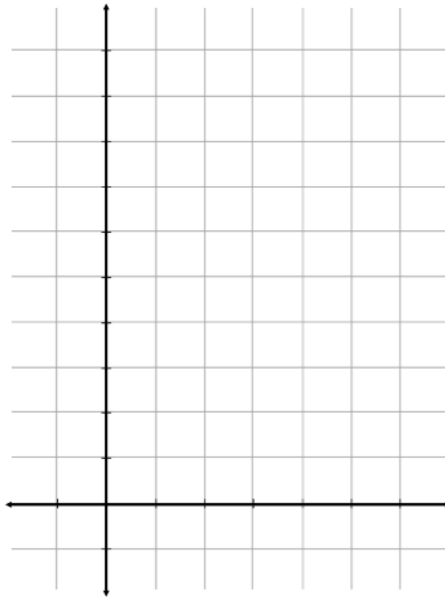
a) Make a table to show the population over 5 days.

Day	Population
0	
1	

b) Calculate finite differences and indicate any patterns you see

Day	Population	1 <sup>st</sup> Differences	2 <sup>nd</sup> Differences
0			
1			

c) Graph the relation



d) Write an equation to model this growth

Day	Population
0	$100 \times 3^0 = 100$
1	$100 \times 3^1 = 300$
2	$100 \times 3^2 = 900$
3	
4	
5	

*The relationship between days and population is easier to see when we look at the number of times the population has been tripled.*

### General Properties of Exponential Growth

**Equation:**

$a =$

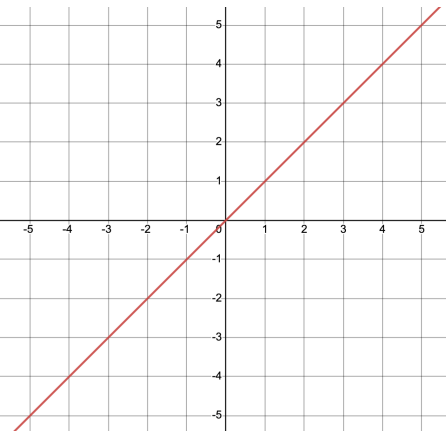
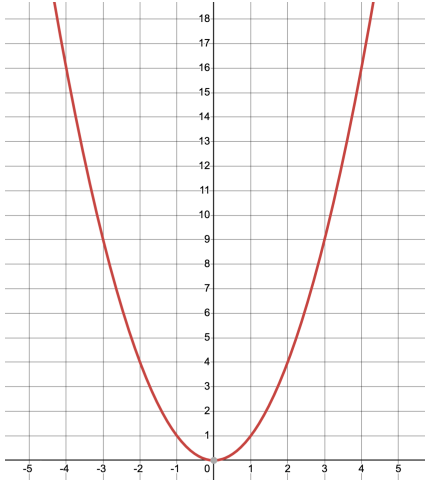
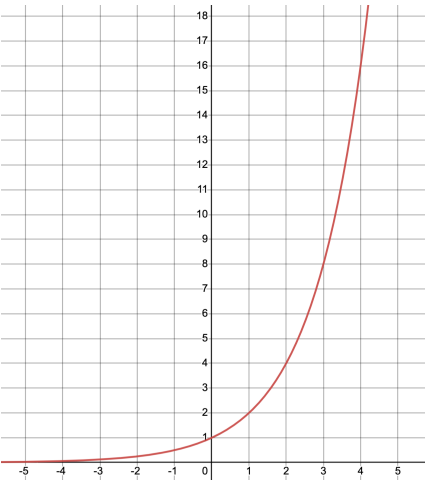
$b =$

$y =$

$x =$

To calculate  $x$ , use the equation:

## Summary of Patterns in First Differences for Various Functions

Linear ( $y = x$ )	Quadratic ( $y = x^2$ )	Exponential ( $y = 2^x$ )
		

**Example 1:** Your brother tells you a secret. You see no harm in telling two friends. After this second "passing" of the secret, 4 people now know the secret (your brother, you and two friends). If each of these friends now tells two new people, after the third "passing" of the secret, eight people will know. If this pattern of spreading the secret continues, how many people will know the secret after 10 such "passings"?

**Example 2:**

**a)** An insect colony has a current population of 50 insects. Its population doubles every 3 days. What is the population after 12 days?

**b)** The insect colony is actually full of giant, intelligent, mutant insects. They plot that they can overtake the Earth when their population has reached 1 billion. When will we meet our doom? (When does the population reach 1 billion?)

**Note:** a logarithm is a function that solves for an unknown exponent.

**Ex:**

$$\log_3 9 = 2$$

because 2 is the exponent that goes on 3 to get 9.

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If exponential growth is given as a percent you can use the equation:

$a =$

$r =$

$x =$

**Example 3:** In 2005, there were only 285 Pittsburgh Penguins fans in Oakville. The number of Penguins fans increased by 5% per year after 2005 (this is when Crosby was drafted). How many Penguins fans are now in Oakville this year?