

Notes: Day 3 Linear vs. Exponential

Linear vs. Exponential

$y = mx + b$
 $f(x) = mx + b$
 $\frac{\Delta y}{\Delta x}$ slope (rate of change)
 y-intercept (starting point)
 $f(x) = b + m + m + m + m + m + \dots$

$f(x) = a \cdot b^x$
 y-intercept (starting point)
 factor of change Multiplier
 $f(x) = b \cdot a \cdot a \cdot a \cdot a \cdot a \dots$

Linear <u>Increasing</u> vs. Linear <u>Decreasing</u>		Exponential <u>Growth</u> vs. Exponential <u>Decay</u>																																									
$f(x) = \frac{1}{2}x + 4$ m : positive	$f(x) = -3x + 6$ m : neg	$f(x) = 2 \cdot 3^x$ Start. Factor $b > 1$	$f(x) = 16 \left(\frac{1}{4}\right)^x$ Start. Factor $b < 1$																																								
<table border="1"> <tr><th>x</th><th>f(x)</th></tr> <tr><td>-2</td><td>3</td></tr> <tr><td>0</td><td>4</td></tr> <tr><td>2</td><td>5</td></tr> <tr><td>4</td><td>6</td></tr> </table>	x	f(x)	-2	3	0	4	2	5	4	6	<table border="1"> <tr><th>x</th><th>f(x)</th></tr> <tr><td>-1</td><td>9</td></tr> <tr><td>0</td><td>6</td></tr> <tr><td>1</td><td>3</td></tr> <tr><td>2</td><td>0</td></tr> </table>	x	f(x)	-1	9	0	6	1	3	2	0	<table border="1"> <tr><th>x</th><th>f(x)</th></tr> <tr><td>-1</td><td>$\frac{2}{3}$</td></tr> <tr><td>0</td><td>2</td></tr> <tr><td>1</td><td>6</td></tr> <tr><td>2</td><td>18</td></tr> </table>	x	f(x)	-1	$\frac{2}{3}$	0	2	1	6	2	18	<table border="1"> <tr><th>x</th><th>f(x)</th></tr> <tr><td>-1</td><td>64</td></tr> <tr><td>0</td><td>16</td></tr> <tr><td>1</td><td>4</td></tr> <tr><td>2</td><td>1</td></tr> </table>	x	f(x)	-1	64	0	16	1	4	2	1
x	f(x)																																										
-2	3																																										
0	4																																										
2	5																																										
4	6																																										
x	f(x)																																										
-1	9																																										
0	6																																										
1	3																																										
2	0																																										
x	f(x)																																										
-1	$\frac{2}{3}$																																										
0	2																																										
1	6																																										
2	18																																										
x	f(x)																																										
-1	64																																										
0	16																																										
1	4																																										
2	1																																										

$\frac{16}{64} = .25 = \frac{1}{4}$
 $\frac{4}{16} = \frac{1}{4}$
 $\frac{1}{4} = \frac{1}{4}$

Fill in the correct rows for each function.

$f(x) = -x - 8$ $f(x) = mx + b$	Linear	Increasing Decreasing	$m = -1$ $b = -8$
	Exponential	Growth Decay	a = b =
$f(x) = 5 \cdot 3^x$ $f(x) = a \cdot b^x$	Linear	Increasing Decreasing	m = b =
	Exponential	Growth Decay	$a = 5$ $b = 3$

Decide if the situation represents a linear increasing function, a linear decreasing function, an exponential growth function, or an exponential decay function. Then write the equation that represents the situation.

- a) Cookie monster starts with 60 cookies and each minute he eats a third of what is left.

Exponential: $f(x) = a \cdot b^x$
 $M(x) = 60 \left(\frac{1}{3}\right)^x$

- b) You have \$75 in the bank and you spend \$15 per week.

Linear: $f(x) = mx + b$
 $f(x) = -15x + 75$

- c) There are 5 water lilies on a pond and each day the lilies quadruple in number.

Exp: $f(x) = 5(4)^x$ • 4

- d) There are 64 basketball teams invited to the NCAA tournament. After each round there are half as many teams as the previous round.

Exp: $f(x) = 64 \cdot \left(\frac{1}{2}\right)^x$
 $= a \cdot (b)^x$

Fill in the table

Context	Table																
<p>With the outbreak of the flu, the health department tracks the number of people who have the flu. They notice that it started with 3 people being sick and doubled per day.</p> <p><u>• 2</u></p>	<table border="1"> <thead> <tr> <th>x</th> <th>y</th> </tr> <tr> <th>days</th> <th># sick</th> </tr> </thead> <tbody> <tr><td>0</td><td>3</td></tr> <tr><td>1</td><td>6</td></tr> <tr><td>2</td><td>12</td></tr> <tr><td>3</td><td>24</td></tr> <tr><td>4</td><td>48</td></tr> <tr><td>5</td><td>96</td></tr> </tbody> </table>	x	y	days	# sick	0	3	1	6	2	12	3	24	4	48	5	96
x	y																
days	# sick																
0	3																
1	6																
2	12																
3	24																
4	48																
5	96																
<p><u>Graph</u></p>	<p><u>Growth Factor (b):</u> 2</p> <p><u>Start Point (a):</u> 3</p> <p><u>Equation:</u></p> $f(x) = 3(2)^x$																

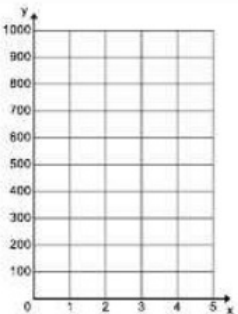
Decide if the situation represents a linear increasing function, a linear decreasing function, an exponential growth function, or an exponential decay function. Then write the equation that represents the situation.

1. A geologist discovers a radioactive material that starts with 1,200 particles and has a half-life of one day.
2. A marathon runner starts by running 3 miles and then adds an additional 4 miles per week to his workout schedule.
3. The value of a car starts at \$15,000 and drops \$1000 per year it is owned.
4. Madden started a rumor and the number of students who heard the rumor doubled every hour.
5. An investor gains \$500 per year on his \$10,000 investment.
6. A clearance item was \$200, but is marked down 50% per day for an entire week.

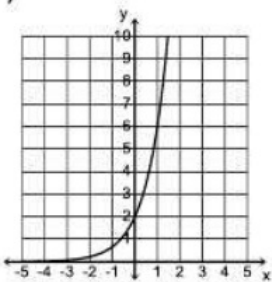
Fill in the correct rows for each function.

7. $f(x) = 7 \cdot 1.5^x$	Linear	Increasing	$m =$ $b =$
		Decreasing	
	Exponential	Growth	$a =$ $b =$
		Decay	
8. $f(x) = \frac{3}{2}x + 1$	Linear	Increasing	$m =$ $b =$
		Decreasing	
	Exponential	Growth	$a =$ $b =$
		Decay	
9. $f(x) = \left(\frac{2}{3}\right)^x$	Linear	Increasing	$m =$ $b =$
		Decreasing	
	Exponential	Growth	$a =$ $b =$
		Decay	

10.

<p>Context</p> <p>There are 800 downloads of a new song the day it is released. Each day after the release date, there are half as many downloads of the song.</p>	<p>Table</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="padding: 5px;">Day</th> <th style="padding: 5px;">Downloads</th> </tr> </thead> <tbody> <tr><td style="padding: 5px;">0</td><td style="padding: 5px;"></td></tr> <tr><td style="padding: 5px;">1</td><td style="padding: 5px;"></td></tr> <tr><td style="padding: 5px;">2</td><td style="padding: 5px;"></td></tr> <tr><td style="padding: 5px;">3</td><td style="padding: 5px;"></td></tr> <tr><td style="padding: 5px;">4</td><td style="padding: 5px;"></td></tr> <tr><td style="padding: 5px;">5</td><td style="padding: 5px;"></td></tr> </tbody> </table>	Day	Downloads	0		1		2		3		4		5	
Day	Downloads														
0															
1															
2															
3															
4															
5															
<p>Graph</p> 	<p>Decay Factor (b):</p> <p>Start Point (a):</p> <p>Equation:</p>														

11. For each box below, decide if each equation, context, table, or graph is linear or exponential. ***Explain your answer and identify the y-intercept and the rate of change or factor of change.*** If it is linear, state if it is increasing or decreasing. If it is exponential, state if it is growth or decay.

<p>a)</p> $f(x) = 3x$	<p>b)</p> 												
<p>c)</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="padding: 5px;">x</th> <th style="padding: 5px;">$f(x)$</th> </tr> </thead> <tbody> <tr><td style="padding: 5px;">-1</td><td style="padding: 5px;">100</td></tr> <tr><td style="padding: 5px;">0</td><td style="padding: 5px;">50</td></tr> <tr><td style="padding: 5px;">1</td><td style="padding: 5px;">25</td></tr> <tr><td style="padding: 5px;">2</td><td style="padding: 5px;">12.5</td></tr> <tr><td style="padding: 5px;">3</td><td style="padding: 5px;">6.25</td></tr> </tbody> </table>	x	$f(x)$	-1	100	0	50	1	25	2	12.5	3	6.25	<p>d)</p> <p>Rachel writes 2 notes per class period to give to her friends.</p>
x	$f(x)$												
-1	100												
0	50												
1	25												
2	12.5												
3	6.25												