Exponential Growth and Decay

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HW 9-6

1. {-1}
2. { }
3. {101/4}
4. {11}
5. {-3}
6. {10}
7. {-15}

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Name_____ Alg 2 HW 9-6

Solve and check.

1. $\sqrt{x+10} = 2-x$

$(\sqrt{x+10})^2 = (2-x)^2$

$x+10 = (2-x)(2-x)$

$x+10 = 4-4x+x^2$

$-x \quad -10 \quad -10 \quad -x$

$x^2-5x-6=0$

$(x-6)(x+1)=0$ {6}

$x-6=0$ | $x+1=0$

$x=6$ | $x=-1$

Check

$\sqrt{6+10} = 2-6$

$\sqrt{16} = -4$

$4 \neq -4$

Check

$\sqrt{-1+10} = 2--1$

$\sqrt{9} = 3$

$3 = 3$ ✓

2. $5-\sqrt{6x} = 16$

$-5 \quad -5$

$(-\sqrt{6x})^2 = (11)^2$

$\frac{6x}{6} = \frac{121}{6}$

$x = \frac{121}{6}$

{ }

Check

$5-\sqrt{6(\frac{121}{6})} = 16$

$5-\sqrt{121} = 16$

$5-11 = 16$

$-6 \neq 16$

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3. $12 = 52-4\sqrt{4x-1}$

$-52 \quad -52$

$\frac{-40}{-4} = \frac{-4\sqrt{4x-1}}{-4}$

$(10)^2 = (\sqrt{4x-1})^2$

$4x-1 = 100$

$4x = 101$

$x = \frac{101}{4}$ $\{\frac{101}{4}\}$

Check

$12 = 52-4\sqrt{4(\frac{101}{4})-1}$

$12 = 52-4\sqrt{101-1}$

$= 52-4\sqrt{100}$

$= 52-40$

$12 = 12$ ✓

4. $\sqrt{2x-5}-\sqrt{x+6}=0$

$+\sqrt{x+6} \quad +\sqrt{x+6}$

$(\sqrt{2x-5})^2 = (\sqrt{x+6})^2$

$2x-5 = x+6$

$-x+5 \quad -x+5$

$x = 11$ {11}

Check

$\sqrt{2(11)-5}-\sqrt{11+6}=0$

$\sqrt{17}-\sqrt{17}=0$

$0=0$

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5. $\sqrt{2x+15} = x+6$

$(\sqrt{2x+15})^2 = (x+6)^2$

$2x+15 = (x+6)(x+6)$

$2x+15 = x^2+12x+36$

$-2x-15 \quad -2x-15$

$0 = x^2+10x+21$

$\{-3\}$

$(x+7)(x+3) = 0$

$x+7=0 \quad | \quad x+3=0$

$x=-7 \quad | \quad x=-3$

Check | Check

$\sqrt{2(-7)+15} = -7+6 \quad | \quad \sqrt{2(-3)+15} = -3+6$

$\sqrt{1} = -1 \quad | \quad \sqrt{9} = 3$

$1 \neq -1 \quad | \quad 3 \checkmark 3$

6. $\sqrt{x-1}+4 = x-3$

$-4 \quad -4$

$(\sqrt{x-1})^2 = (x-7)^2$

$x-1 = x^2-14x+49$

$-x+1 \quad -x \quad +1$

$\{10\}$

$x^2-15x+50 = 0$

$(x-10)(x-5) = 0$

$x-10=0 \quad | \quad x-5=0$

$x=10 \quad | \quad x=5$

Check | Check

$\sqrt{10-1}+4 = 10-3 \quad | \quad \sqrt{5-1}+4 = 5-3$

$\sqrt{9}+4 = 7 \quad | \quad \sqrt{4}+4 = 2$

$3+4 = 7 \quad | \quad 2+4 = 2$

$7 \checkmark 7 \quad | \quad 6 \neq 2$

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7. Solve algebraically for all values of x:

$\sqrt{6-2x} + x = 2(x+15) - 9$

$\sqrt{6-2x} + x = 2x+30-9$

$-x \quad -x$

$(\sqrt{6-2x})^2 = (x+21)^2$

$6-2x = (x+21)(x+21)$

$6-2x = x^2+42x+441$

$-6+2x \quad +2x \quad -6$

$\{-15\}$

$y = 435/x$

$x^2+44x+435 = 0$

$(x+15)(x+29) = 0$

$x+15=0 \quad x+29=0$

$x=-15 \quad x=-29$

Check:

$x=-15$

$\sqrt{6+30} - 15 = 2(0) - 9$

$6-15 = -9$

$-9 = -9$

$x=-29$

$\sqrt{6+58} - 29 = 2(-29+15) - 9$

$\sqrt{64} - 29 = 2(-14) - 9$

$8-29 = -37$

$-21 \neq -37$

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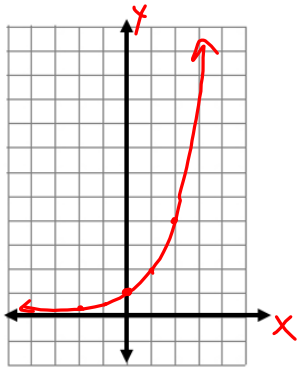
Exponential Growth & Decay Unit 9 Day 7

Exponential Function: $f(x) = b^x$

Graph $f(x) = 2^x$

x	y
-2	$2^{-2} = 1/4$
-1	$2^{-1} = 1/2$
0	$2^0 = 1$
1	$2^1 = 2$
2	$2^2 = 4$



Exponential growth or decay?
(Circle One)
End Behavior:
$x \to -\infty$ $f(x) \to 0$
$x \to \infty$ $f(x) \to \infty$

Graph $f(x) = 2^{-x}$ $= (2^{-1})^x = \left(\frac{1}{2}\right)^x$

x	y
-2	$2^{-(-2)} = 4$
-1	$2^{-(-1)} = 2$
0	$2^0 = 1$
1	$2^{-1} = \frac{1}{2}$
2	$2^{-2} = \frac{1}{4}$

Exponential growth or decay?
(Circle One)
End Behavior:
$x \to -\infty$ $f(x) \to \infty$
$x \to \infty$ $f(x) \to 0$

How can you tell from a given exponential function whether or not it will grow or decay?

base > 1 grow

0 < base < 1 decay

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Summary:

Point on every exponential graph: $(0,1)$

Domain: $(-\infty, \infty)$

Range: $(0, \infty)$

Quadrants: I, II

Asymptote(s)? $y = 0$

Are exponential functions 1-1? How can you tell? What does this tell you about their inverses?

Yes they are. They pass the vertical and horizontal line tests. Inverse is also a function.

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1. Now let's look at the function $f(x) = 7(3)^x$

Determine the y-intercept of this function algebraically.

$x = 0$ $f(0) = 7(3)^0 = 7 \cdot 1 = 7$

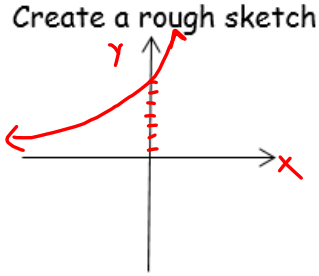
$(0, 7)$

Does the exponential function increase or decrease? Why?

Increase

base > 1

Create a rough sketch of this function, labeling its y-intercept.



How does this function's graph compare to that of $f(x) = 3^x$?

The graph will have a y-int (0,7)

The graph will be steeper.

7 is a vertical stretch

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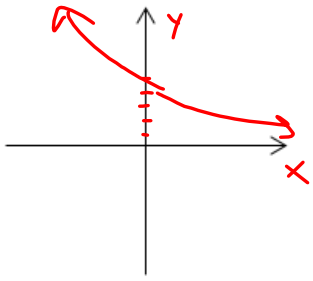
2. Now you look at the function $f(x) = (\frac{1}{3})^x + 4$.

Does the exponential function increase or decrease? Why?

$0 <$ base < 1

Create a rough sketch of this function, labeling its y-intercept.



Determine the graph's y-intercept algebraically.

$f(0) = (\frac{1}{3})^0 + 4 = 5$ $(0, 5)$

How does this function's graph compare to that $f(x) = (\frac{1}{3})^x$?

Vertical Shift up 4

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Can you recall the rules for transformations that we discussed earlier in the course? Let's look at two more exponential functions and see what transformations occurred.

1. $g(x) = 2^{x-2} - 1$ $g(x) = 2^x$

① down 1
② right 2

2. $h(x) = \frac{1}{3}(4)^{x+3}$ $h(x) = 4^x$

① left 3
② Vertical Compression of 1/3

One of the skills you acquired in Algebra 1 CC was the ability to write equations of exponential functions if you had information about the starting value and the base(growth constant). Determine the function of the form $f(x) = a \bullet b^x$ with the information in the table below. Before we start, what do a and b represent in this function.

_____

_____

You can use your calculator to generate the equation for the data. You will need to enter your data into a list by using *STAT → EDIT* and then use the *STAT → CALC → ExpReg* to generate the actual equation.

a=_____

b=_____

f(x)=_____

x	0	1	2	3
f(x)	5	15	45	135

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A runner is using a nine-week training program app to prepare for a "fun run." The table below represents the amount of the program completed, A, and the distance covered in a session, D, in miles.

A	4/9	5/9	6/9	8/9	1
D	2	2	2.25	3	3.25

Based on the data, write an exponential regression equation, rounded to the *nearest thousandth*, to model the distance the runner is able to complete in a session as she continues through the nine-week program.

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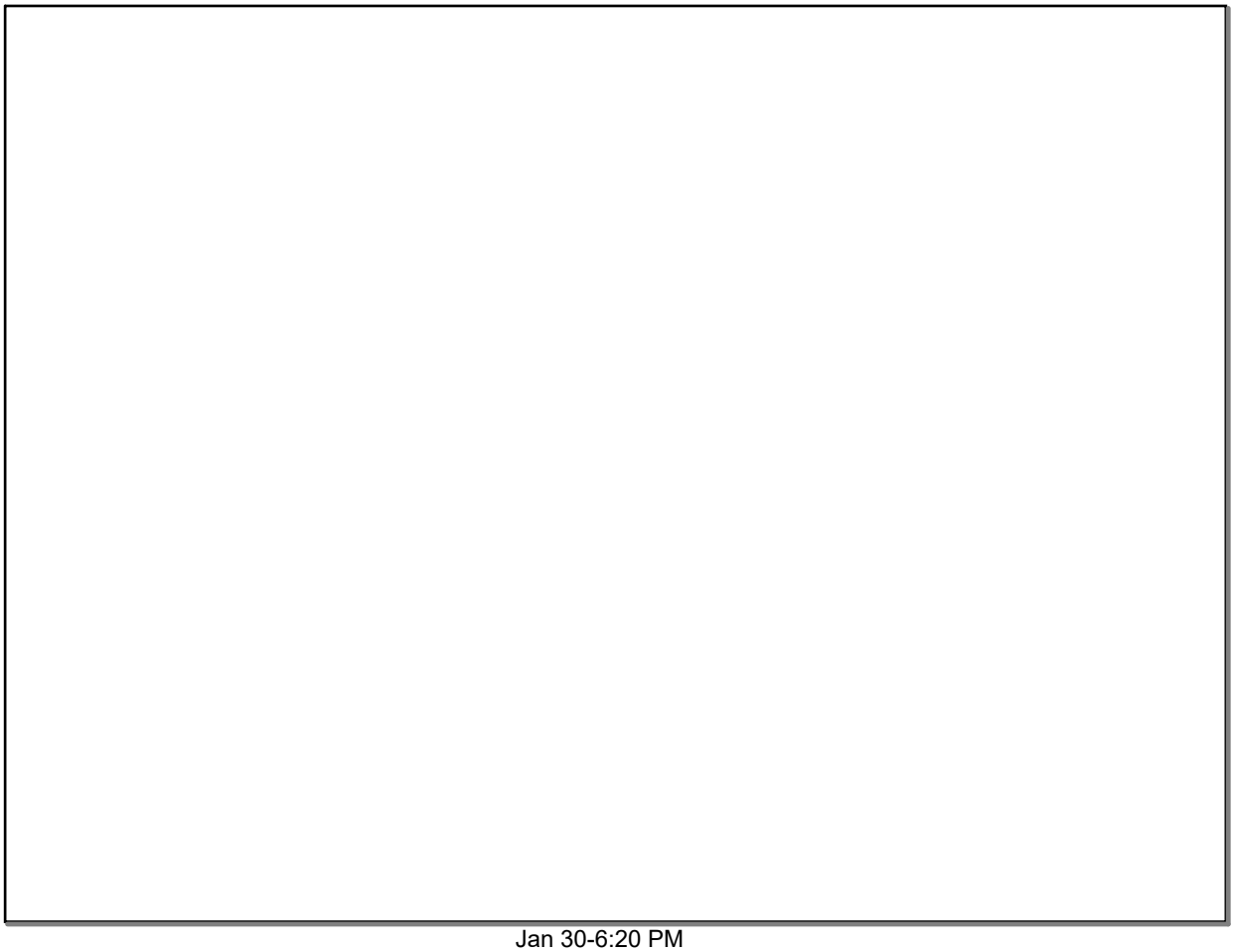

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