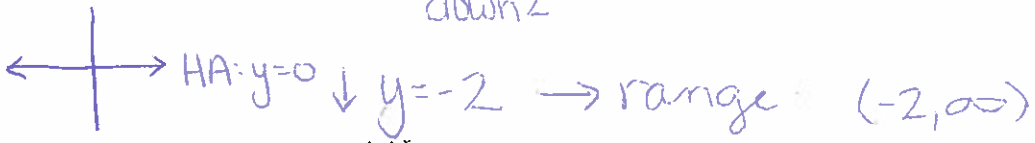
Name Key

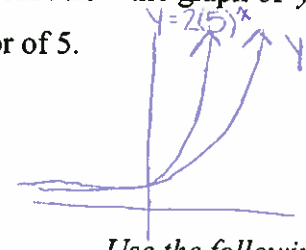
Math 30-1: 2.1-2.3 Exponents Practice

1. Suppose the graph of $f(x)=b^x$, where b > 1, is translated such that the equation of the image graph is expressed as $y=f(x-1)-2$. Write the range of the transformed function in interval notation.

down 2



2. **Describe** how the graph of $y=2(3)^x$ will change if the rate of growth were changed to a factor of 5.



As shown in the graph, changing the rate of growth from 3 to 5 will result in the graph increasing at a faster rate.

Use the following information to answer the next two questions.

The numbered characteristics below refer to graphs of an exponential functions in the form: $y=b^x$.

1. domain	2. range
3. *y*-intercept	4. *x*-intercept
5. horizontal asymptote	6. vertical asymptote
7. increasing	8. decreasing

3. When **comparing** the graphs of $y=b^x, b>1$ and $y=b^x, 0<b<1$ the characteristic(s) that would be the same for both graphs are number(s) 1, 2, 3, 5. *Record your answers in ascending order in the numerical response boxes.*

1	2	3	5

4. When **contrasting** the graphs of $y=b^x, b>1$ and $y=b^x, 0<b<1$ the characteristic(s) that would be different for the graphs are number(s) 7, 8. *Record your answers in ascending order in the numerical response boxes.*

7	8		

5. Given the function defined by $f(x)=3^{x-1}-5$, identify the following characteristics of the graph.

range $y>-5$ *x*-intercept (2.46, 0) *y*-intercept (4477 (0, -4.7)

equation of the horizontal asymptote $y=-5$

HT 1 right
VT 5 down

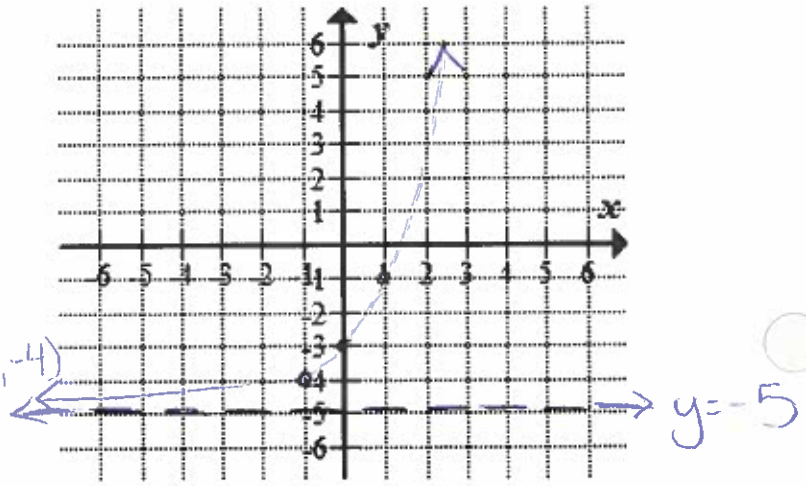
$0=3^{x-1}-5$
$5=3^{x-1}$
$x=2.46\ldots$

6. **Describe** the series of the transformations involved to transform the graph $y = 3^x$ to the graph of $y = -2(3)^{x-4} + 5$.

- Vertical reflection over x-axis
- Vertical stretch of a factor of 2 about $y=0$
- horizontal translation 4 right
- Vertical translation 5 up

7. **Sketch** the graph of the function defined by $y = 2^{x+1} - 5$ and identify the characteristics of the graph.

domain	$x \in \mathbb{R}$
range	$y > -5$
horizontal asymptote	$y = -5$
y-intercept	$(0, -3)$
$(0, 1) \rightarrow$	$(-1, -4)$
x intercept (Round to 0.1)	$(1.3, 0)$

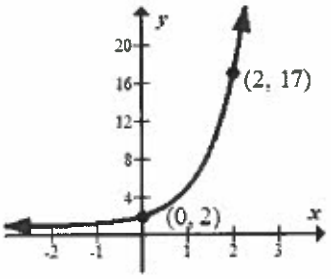


$0 = 2^{x+1} - 5$

$5 = 2^{x+1}$

Use the following information to answer the next question

The partial graph of an exponential function is shown below.



8. Write the function equation that represents the graph in the form $y = b^x + d$

$2 = b^0 + d$

$2 = 1 + d$

$1 = d$

$17 = b^2 + 1$

$16 = b^2$

$b = 4$

$y = 4^x + 1$

9. Use a graphing method to **determine** the roots of each equation, rounded to the nearest tenth if necessary.

a) $4^{-x+2} = 3^{2x}$

y_1 y_2

Intersection: (0.8, 5.5)

$x = 0.8$

b) $4^{3x+1} = \left(\frac{1}{2}\right)^{2x-3}$

y_1 y_2

Intersection: (0.1, 6.7)

$x = 0.1$

Use the following information to answer the next two questions.

Annabelle deposits $400 into an investment that earns 5% annual interest, compounded semi-annually. 0.05

10. Write an exponential function that could be used to determine the amount accumulated in the investment.

$y = 400\left(1 + \frac{0.05}{2}\right)^{2x}$ $y = 400(1.025)^{2x}$

11. What it the total amount in the investment after 4 years if Annabelle does not withdraw any money?

$y = 400(1.025)^8 = \$487.36$

12. **Algebraically** solve each of the following.

a) $5^{3-2x} = 5^{-x}$

$3 - 2x = -x$

$+2x \quad +2x$

$x = 3$

b) $6^{2b-12} = 1$

$6^{2b-12} = 6^0$

$2b - 12 = 0$

$2b = 12$

$b = 6$

c) $9^{4x-3} = 27^{2x+8}$

$3^{2(4x-3)} = 3^{3(2x+8)}$

$8x - 6 = 6x + 24$

$2x = 30$

$x = 15$

d) $3^{x^2-42} = 3^{-x}$

$x^2 - 42 = -x$

$x^2 + x - 42 = 0$

$(x+7)(x-6) = 0$

$x = -7 \quad x = 6$

-42

$7 \quad -6$

1

e) $5^x = 125(\sqrt{5})$

$5^x = 5^3 \cdot 5^{1/2}$

$5^x = 5^{7/2}$

$x = 7/2$

f) $64^{x-2} = (\sqrt[4]{4})^{3x+3}$

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

$3x - 6 = \frac{3x}{4} + \frac{3}{4}$

$4 \cdot \frac{9}{4}x = \frac{27}{4} \cdot 4$

$9x = 27$

$x = 3$

13. The amount of Phosphorous-32 can be found using the formula $A(t) = A_o\left(\frac{1}{2}\right)^{\frac{t}{h}}$, where $A(t)$ is the present mass, A_o is the initial mass, t is the time elapsed, and h is the half-life. Given that the half-life of this substance is 14.3 days, the length of time that it takes 96.2 kg to decay to 12.5 kg to the nearest day is _____.

$12.5 = 96.2(1/2)^{t/14.3}$

y_1 y_2

Intersection: (42.1, 12.5)

$t = 42$ days

14. The number of bacteria in a culture triples every 9 hours. There are initially 1500 bacteria present.

a) Write an equation that could be used to **model** the growth of the bacteria.

b, p, a

$y = 1500(3)^{x/9}$

b) Use your model equation to **algebraically** and graphically **determine** how many hours it would take for 13 500 bacteria to be present?

Algebraically

$13\,500 = 1500(3)^{x/9}$

$1500 \quad 1500$

$9 = 3^{x/9}$

$3^2 = 3^{x/9}$

$9 \cdot 2 = \frac{x}{9} \cdot 9$

$18 = x$

Graphically

$y_1 = 9$

$y_2 = 3^{x/9}$

Intersection: (18, 9)

$x = 18$