Name: Key

Date: ____________ Period: ____________

Exponential Growth & Decay Functions

Complete this if you lost any points on #1-5

#1-2: Rewrite the geometric rule as an exponential function, $f(x)$.

1.) $a_n = 3 \cdot (1.5)^{n-1}$

$f(x) = 3 \cdot 1.5^x \cdot 1.5^{-1}$

$f(x) = 3 \cdot \frac{1}{1.5} \cdot 1.5^x$

$f(x) = 2 \cdot 1.5^x$

2.) $a_n = 0.5 \cdot (4)^{n-1}$

$f(x) = 0.5 \cdot 4^x \cdot 4^{-1}$

$f(x) = 0.5 \cdot \frac{1}{4} \cdot 4^x$

$f(x) = \frac{1}{8} \cdot 4^x$

#3-7: Determine whether each function represents exponential growth or decay. Explain your reasoning.

3.) $f(x) = 7 \cdot \left(\frac{1}{4}\right)^{-x}$ Growth Reasoning: $b=4, \quad b>1$

4.) $f(x) = 0.7 \cdot (5)^x$ Growth Reasoning: $b=5, \quad b>1$

5.) $f(x) = \frac{1}{2} \cdot \left(\frac{4}{3}\right)^{-x}$ Decay Reasoning: $b=3/4 \quad 0<b<1$

6.) $f(x) = 3.9^x$ Growth Reasoning: $b=3.9 \quad b>1$

7.) $f(x) = 3 \cdot \left(\frac{1}{9}\right)^x$ Decay Reasoning: $b=\frac{1}{9} \quad 0<b<1$

Name: ____________

Date: ____________ Period: ____________

Exponential Growth & Decay Functions

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1.) $a_n = 3 \cdot (1.5)^{n-1}$

2.) $a_n = 0.5 \cdot (4)^{n-1}$

#3-7: Determine whether each function represents exponential growth or decay. Explain your reasoning.

3.) $f(x) = 7 \cdot \left(\frac{1}{4}\right)^{-x}$ ____________ Reasoning: ____________

4.) $f(x) = 0.7 \cdot (5)^x$ ____________ Reasoning: ____________

5.) $f(x) = \frac{1}{2} \cdot \left(\frac{4}{3}\right)^{-x}$ ____________ Reasoning: ____________

6.) $f(x) = 3.9^x$ ____________ Reasoning: ____________

7.) $f(x) = 3 \cdot \left(\frac{9}{7}\right)^x$ ____________ Reasoning: ____________

Name: Key

Half-Life Problems

Date: ___________________ Period: ___________

Complete this if you lost any points on #6

Write the formula used here: $A(t) = A_0\left(\frac{1}{2}\right)^{rt}$

Explain what each variable represents in the half-life formula.

A: Amount after t (time) A$_0$: Initial Amount t: time h: half life

1. Hg-197 is used in kidney scans. It has a half-life of 64.128 hours.

    a. Write the exponential function for a 12-mg sample.

    $A(t) = 12\left(\frac{1}{2}\right)^{t/64.128}$

    b. Find the amount remaining after 72 hours.

    $A(72) = 12\left(\frac{1}{2}\right)^{72/64.128} \approx 5.51$ mg

2. Barium-122 has a half-life of 3 minutes. A fresh sample weighing 90 g was obtained. If it takes 10 minutes to set up an experiment using barium-122, how much barium-122 will be left when the experiment begins?

$A(10) = 90\left(\frac{1}{2}\right)^{10/3} \approx 8.93$ mg

Name: ____________________________________

Half-Life Problems

Date: ___________________ Period: ___________

Complete this if you lost any points on #6

Write the formula used here: ______________________

Explain what each variable represents in the half-life formula.

A: A$_0$: t: h:

1. Hg-197 is used in kidney scans. It has a half-life of 64.128 hours.

    a. Write the exponential function for a 12-mg sample.

    b. Find the amount remaining after 72 hours.

2. Barium-122 has a half-life of 3 minutes. A fresh sample weighing 90 g was obtained. If it takes 10 minutes to set up an experiment using barium-122, how much barium-122 will be left when the experiment begins?

Name: ______________________________________

Compound Interest Problems

Date: ___________________ Period: ___________

Complete this if you lost any points on #7

Write the formula used here: $A = P\left(1+\frac{r}{n}\right)^{n\cdot t}$

Explain what each variable represents in the compound interest formula.

A: Amount P: Principal r: rate n: number of times compounded t: time

1. If you have a bank account whose principal = $500, and your bank compounds the interest monthly at an interest rate of 1.3%, how much money do you have in your account at the year's end?

$$A = 500\left(1+\frac{.013}{12}\right)^{12\cdot 1} \approx \$506.54$$

2. If you start a bank account with $5,500 and your bank compounds the interest quarterly at an interest rate of 6%, how much money do you have at the year's end?

$$A = 5500\left(1+\frac{.06}{4}\right)^{4\cdot 1} \approx \$5837.50$$

Name: ______________________________________

Compound Interest Problems

Date: ___________________ Period: ___________

Complete this if you lost any points on #7

Write the formula used here: _____________________

Explain what each variable represents in the compound interest formula.

A: P: r: n: t:

1. If you have a bank account whose principal = $500, and your bank compounds the interest monthly at an interest rate of 1.3%, how much money do you have in your account at the year's end?

2. If you start a bank account with $5,500 and your bank compounds the interest quarterly at an interest rate of 5%, how much money do you have at the year's end?

Name: Key

Population Growth Problems

Date: ____________________ Period: ____________

Complete this if you lost any points on #9

Write the formula used here: $A(t) = A_0 \cdot e^{rt}$

Explain what each variable represents in the population growth formula.

A(t): Amount after t time A_0: Initial Population r: rate of growth t: time

1. In 2016, the population in Lockport was 39,000. It is projected that the population will grow continuously at a rate of 2.3% each year. What is the anticipated population for Lockport in the year 2025?

$$A(9) = 39{,}000 \cdot e^{.023 \cdot 9} \approx \boxed{47{,}969}$$

2. Using your population model from the above example, what was the population of Lockport in 1980? (Assume the population grew at the same ~~1.9%~~ 2.3% rate from 1980 to 2016).

$$A(-36) = 39{,}000 \cdot e^{.023 \cdot -36} \approx \boxed{17{,}040}$$

Name: ______________________________________

Population Growth Problems

Date: ____________________ Period: ____________

Complete this if you lost any points on #9

Write the formula used here: ______________________

Explain what each variable represents in the population growth formula.

A(t): A_0: r: t:

1. In 2016, the population in Lockport was 39,000. It is projected that the population will grow continuously at a rate of 2.3% each year. What is the anticipated population for Lockport in the year 2025?

2. Using your population model from the above example, what was the population of Lockport in 1980? (Assume the population grew at the same 1.9% rate from 1980 to 2016).

Name: key

Graphing Exponential Functions

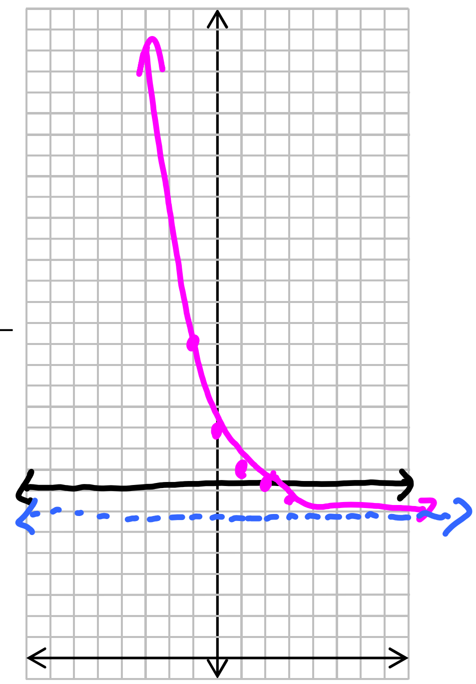
Date: ____________ Period: ____________

Complete this if you lost any points on #10 or 11

Graph each exponential function & its asymptote. Identify ALL characteristics using proper notation.

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

x	-1	0	1	2	3
f(x)	7	3	1	0	-.5



Describe ALL transformations on the parent function: translated right 2 and down 1

Domain: $(-\infty, \infty)$ Range: $(-1, \infty)$

Asymptote: $y = -1$ Intercept: $(0, 3)$

Interval of Increase or Decrease (Circle One): $(-\infty, \infty)$

End Behavior (using limits):

$\lim_{x \to \infty} f(x) = -1$ $\lim_{x \to -\infty} f(x) = \infty$

2.) $f(x) = -2\left(\frac{2}{3}\right)^{-x}$

x	-3	-2	-1	0	1
f(x)	-.6	-.8	-1.3	-2	-3

Describe ALL transformations on the parent function: reflect over x-axis Vertical Stretch by a factor of 2

Domain: $(-\infty, \infty)$ Range: $(-\infty, 0)$

Asymptote: $y = 0$ Intercept: $(0, -1)$

Interval of Increase or Decrease (Circle One): $(-\infty, \infty)$

End Behavior (using limits):

$\lim_{x \to \infty} f(x) = -\infty$ $\lim_{x \to -\infty} f(x) = 0$

Name: key

Date: ____________________ Period: ____________

Writing Equations of Exponential Functions

Complete this if you lost any points on #8

Write an equation for an exponential function having the given characteristics.

1.) decreasing over $(-\infty, \infty)$

reference point $(-2, 9)$

$9 = b^{-2}$

$\frac{1}{9} = b^{2}$

$b = \frac{1}{3}$

$f(x) = \left(\frac{1}{3}\right)^x$

2.) end behavior: as $x \to -\infty$, $f(x) \to \cancel{\infty}\ 0$
as $x \to \infty$, $f(x) \to \cancel{0}\ \infty$

reference point $(-3, \frac{8}{27})$

$\frac{8}{27} = b^{-3}$

$\frac{27}{8} = b^{3}$

$f(x) = \left(\frac{3}{2}\right)^x$

Name: ____

Date: ____________________ Period: ____________

Writing Equations of Exponential Functions

Complete this if you lost any points on #8

Write an equation for an exponential function having the given characteristics.

1.) decreasing over $(-\infty, \infty)$

reference point $(-2, 9)$

2.) end behavior: as $x \to -\infty$, $f(x) \to \infty$
as $x \to \infty$, $f(x) \to 0$

reference point $(-3, \frac{8}{27})$