$\boxed{\text{Key}}$

Math 1

4-3 Practice

Name ______________________

Date________

- *I can define an exponential function.*
- *I can determine if a function is linear or exponential given the sequence, graph or table of values.*
- *I can identify the quantity being compared and write explicit/recursive equations to describe a real-world problem.*
- *I can use technology to find the point where two functions intersect.*
- *I can determine the practical domain and range in the context of a problem. And explain how they are related to the graph.*

When people cough or sneeze, they spread germ. Suppose one of your group members sneeze on you by accident. The germs they just sprayed all over you are continually reproducing and creating more germs at a very fast rate. Let's say that 5 germs land on you from your partner's sneeze. Every hour the number of germs triple...

1. What is the starting amount of germs in this situation?

   5 germs

2. What is the growth factor in which these germs reproduce per hour?

   3 (triples)

3. Write a recursive rule to represent this situation.

   $$\begin{cases} a_0 = 5 \\ a_n = a_{n-1} \cdot 3 \end{cases}$$

4. Write a "explicit" rule, using ***g*** for # of germs and ***h*** for hours.

   $$g(h) = 5 \cdot 3^h$$

5. How many germs will be on you in just 3 hours?

   $$g(3) = 5 \cdot 3^3 = 5 \cdot 27 = \boxed{135 \text{ germs}}$$

6. How long until there are 885,735 germs on you?

   $$885735 = 5 \cdot 3^h$$

   $\cancel{177147 = 3^h}$

   graph in calc + find intersection!

   $h = 11$ hours

7. How many germs will be on you in 1 day, assuming you haven't showered yet?

   24 hrs

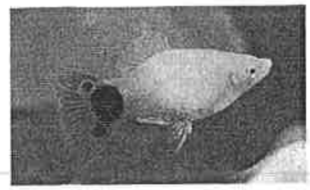
   $$g(24) = 5 \cdot 3^{24} = \boxed{1{,}412{,}147{,}682{,}405 \text{ germs}}$$

8. What is the domain and range for this situation?

   Domain: Any number ≥ 0

   Range: Whole numbers ≥ 5 or $\{5, 6, 7, \ldots\}$

9. A local fish supply company started off with 6 Mickey Mouse fish in their aquarium and noticed that they were having babies twice a year. After each set of babies were born, the population of fish in the aquarium increased by an average of 30% every 6 months.



a. Write a recursive formula that models the number of fish in the aquarium.

$$\begin{cases} a_1 = 6 \\ a_n = a_{n-1} \cdot 1.3 \end{cases}$$

b. Write an explicit formula that models the number of fish f[redacted] in the aquarium for any number of months *m*. $f(m) = 6(1.3)^m$

c. How many fish will be in the aquarium after 2 years? $\rightarrow$ 4 six-month periods

$f(4) = 6(1.3)^4 \approx \boxed{17 \text{ fish}}$

d. How many fish will be in the aquarium after 3.5 years?

$f(7) = 6(1.3)^7 \approx \boxed{38 \text{ fish}}$

e. When will the number of fish in the aquarium be at least 22,000 fish? (Assume a very large aquarium)

$6(1.3)^M \geq 22{,}000 \rightarrow$ graph & find intersection

$\boxed{M \approx 31.28 \text{ six-month periods or } 31.28 \cdot 6 = 187.68 \text{ Months or } 15.64 \text{ years}}$

10. Write each of the following calculations in more compact form by using exponents.

a. $5 \times 5 \times 5 \times 5$

$= \boxed{5^4}$

b. $3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$

$= \boxed{3^8}$

c. $1.5 \times 1.5 \times 1.5 \times 1.5 \times 1.5 \times 1.5$

$= \boxed{1.5^6 = \left(\frac{3}{2}\right)^6}$

d. $(-10) \times (-10) \times (-10) \times (-10) \times (-10) \times (-10) \times (-10) \times (-10)$

$= \boxed{(-10)^8}$

e. $\underbrace{6 \times 6 \times \cdots \times 6}_{n \text{ factors}} = \boxed{6^n}$

f. $\underbrace{a \times a \times \cdots \times a}_{n \text{ factors}} = \boxed{a^n}$

11. Evaluate the following:

a. $5^4 = \boxed{625}$

$= 5 \cdot 5 \cdot 5 \cdot 5$

$= 25 \cdot 25$

b. $(-7)^2 = \boxed{49}$

$= (-7)(-7)$

c. $-7^2 = \boxed{-49}$

$= -7 \cdot 7$

d. $(-8)^3 = \boxed{-512}$

$(-8)(-8)(-8)$

e. $2^8 = \boxed{256}$

$= 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$

f. $2^0 = 1$

$(\text{Anything})^0 = 1$

12. Find the missing terms in the following geometric sequence.

22, <u>33</u>, <u>49.5</u>, <u>74.25</u>, 111.375

$22 \cdot r^4 = 111.375$

$r^4 = 5.0625$

$r = \sqrt[4]{5.0625} = 1.5$

$22 \cdot 1.5 = 33$

$33 \cdot 1.5 =$

13. Write an explicit formula for number 12 then find the 7^{th} term. *Round your answer to the nearest thousandth.*

$a_n = 22(1.5)^{n-1}$

$a_7 = 22(1.5)^{7-1}$

$a_7 = 22(1.5)^6$

$\boxed{a_7 \approx \cancel{375.871}}$

$\approx \boxed{250.594}$