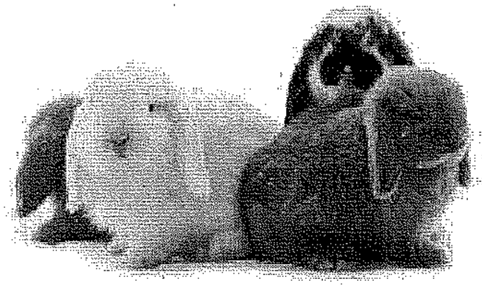
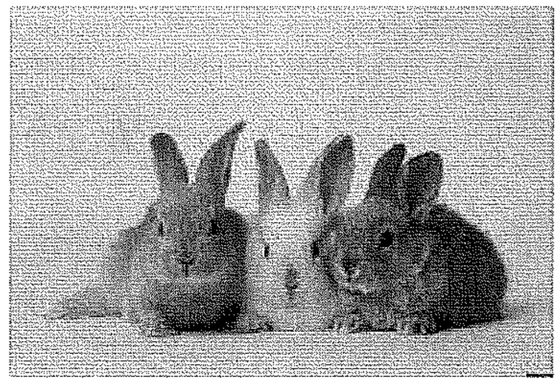
Advanced Algebra ¾ Name:____________

Bunnies!

Bunnies are pretty cute. Here's a few pictures before we do any math. Enjoy!





Bunnies are famous for reproducing really fast. The number of bunnies can be modeled as a function of time. In fact, although bunnies are really cute, their high growth rate poses an ecological challenge for habitats that lack natural bunny predators.

Here's an article with more information on bunny ecology:
http://www.abc.net.au/science/articles/2009/04/08/2538860.htm

For each of the following situations, find the number of bunnies after 1, 2, 3, 4, 5, and 10 generations.

1. Start with 1 pair of bunnies (2 total bunnies). Each generation, every pair of bunnies gives birth to another pair.

X	0	1	2	3	4	5	...	10
y	2	4	8	16	32	64	...	$2(2)^{10}$

2. Start with 10 pairs of bunnies. Each generation, every pair of bunnies gives birth to another pair.

X	0	1	2	3	4	5	...	10
y	20	40	80	160	320	640	...	$20(2)^{10}$

3. Start with 1 pair of bunnies. Each generation, every pair of bunnies gives birth to 2 more pairs (4 baby bunnies).

X	0	1	2	3	4	5	...	10
y	2	6	18	54	162	486	...	$2(3)^{10}$

4. Start with 1 pair of bunnies. Each generation, every pair of bunnies gives birth to 3 more pairs (6 baby bunnies).

X	0	1	2	3	4	5	...	10
y	2	8	32	128	512	2048	...	$2(4)^{10}$

5. Choose at least one situation from problems 1-4 and write an exponential model to fit the data.

Problem 1: $y = 2(2)^x$ x = # of generations, y = total # of bunnies

6. In the article, it states there were 24 bunnies were released into the wild 150 years ago. Use your exponential model to predict how many bunnies would be alive today. Is your answer reasonable? Explain why or why not.

$y = 24(2)^{150} = 3.43 \times 10^{46}$ This means move the decimal 46 times to the right.

Way too many bunnies.

AB Level

7. Let P = the inital number of bunnies, n = the number of baby bunnies from each pair. Write a function for the number of bunnies in any generation. Verify that your function works on one of the situations from problems 1-4.

$y = P\left(1+\frac{n}{2}\right)^x$ x = # of generations, y = total # of bunnies.

Problem 2: $y(1) = 40$ $n=2$

$y = 20\left(1+\frac{2}{2}\right)^1 = 20(1+1)^1 = 20(2) = 40$ ✓

8. Mr. Maurer was doing some bunny research, but he spilled coffee on his data table (oops!). He only has the following data left over:

x	0	2	4	6
y	5	15	45	135

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$\frac{135}{15} = 9$

$\sqrt{9} = 3$

Fill in the rest of Mr. Maurer's data table, and tell him what the initial number of bunnies, the number of baby bunnies from each pair, and the growth rate are.

Initial bunnies = 5

Every 2 generations, 4 bunnies, growth rate = ·3 every 2 generations

9. How can you find the exponential model for a table that has gaps in it? Describe your process in detail.

Use a root to "split the difference."

If they are 2 steps, use a square root. 3 steps = $\sqrt[3]{\ }$

150 years ago = 1878

1920s = 42 years later.

10. Recall that 24 bunnies were released into the wild 150 years ago. By the 1920s, the bunny population had swelled to 10 billion. What is the annual growth rate?

$y = 24(1+r)^x$

$\frac{10{,}000{,}000{,}000}{24} = \frac{24(1+r)^{42}}{24}$

$416{,}666{,}666.66 = (1+r)^{42}$

$\sqrt[42]{416666666.66} = 1.604 = 1+r$

$r = .604$

60%.

11. If the growth rate from problem 10 remained constant, how many bunnies would there be today? Is this kind of exponential growth reasonable? Explain why or why not.

$y = 24(1.60)^{150} = 9.96 \times 10^{31}$. Too many bunnies.