

Investigation 2 - Examining Growth Patterns

Problem 2.1 Killer Plant Strikes Lake Victoria

Name: _____ Date: _____ Block: _____

Essential Question: How do the starting value and growth factor show up in the table, graph, and equation that represent an exponential function?

For example, students at Saco Middle School wrote two equations to represent the reward in Plan 1 of Problem 1.2. Some students wrote $r = 2^{n-1}$ and others wrote $r = \frac{1}{2}(2^n)$. In both equations, r represents the number of rubas on square n .

y intercept

n	$r = \frac{1}{2}(2^n)$	$r = 2^{n-1}$
1	$\frac{1}{2}(2^1) = 1$	$2^{1-1} = 2^0 = 1$
2	$\frac{1}{2}(2^2) = 2$	$2^{2-1} = 2^1 = 2$
3	$\frac{1}{2}(2^3) = 4$	$2^{3-1} = 2^2 = 4$

• Are both equations correct? Explain.
yes, data using each equation matched

• What is the value of r in both equations if $n = 1$? Does this make sense?

When $n = 1$

• What is the y-intercept for the graph of these equations?

$\frac{1}{2}$; following the pattern $r = \frac{1}{2}$ when $n = 0$

• Do you think there is any value for n that will result in more than one value for r ?

NO; There is only 1 value of rubas for each square

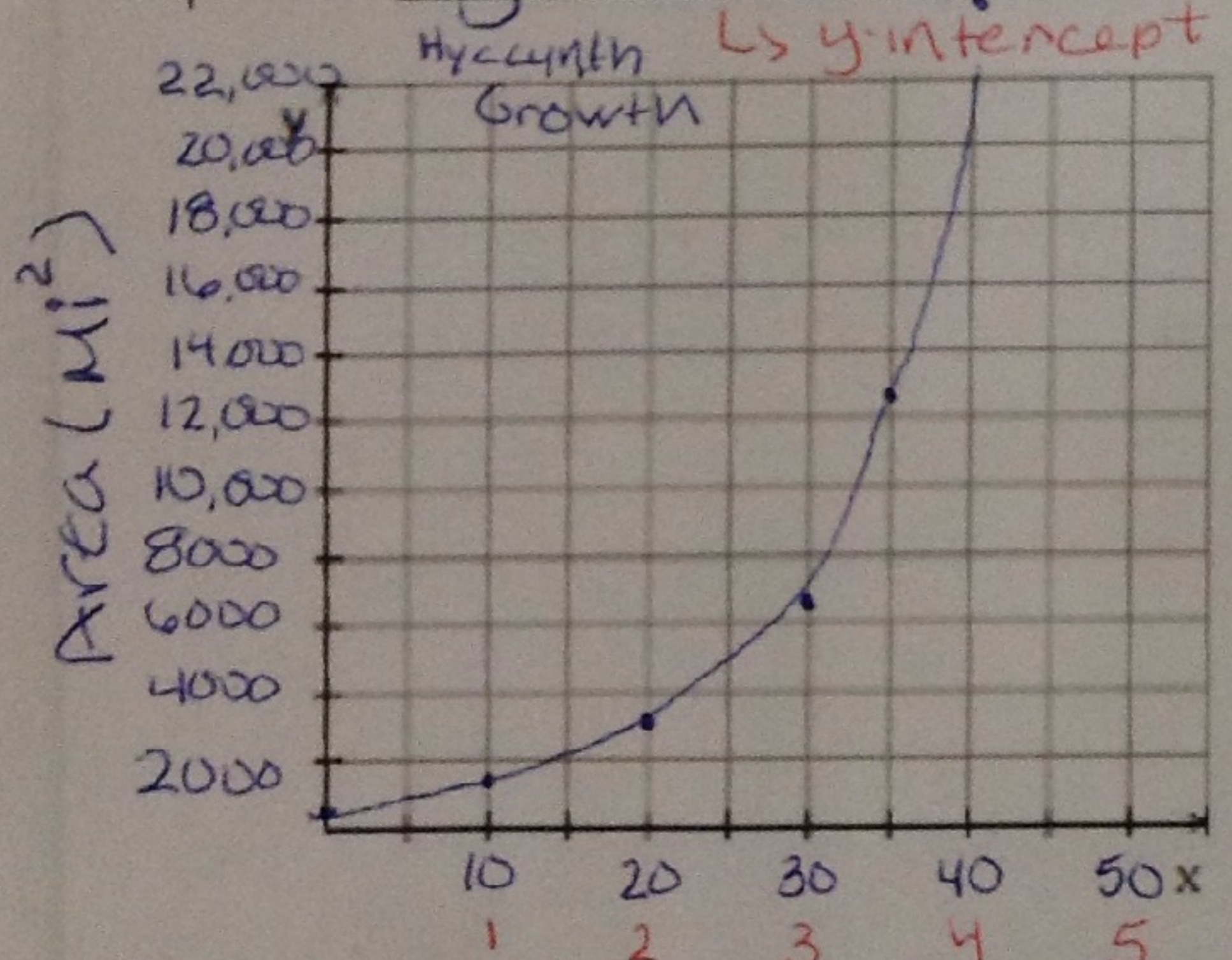
Killer Plant Strikes Lake Victoria

Use 10 → average of time

Water hyacinths, which experts say double in area every 5 to 15 days, are expanding across Africa's giant Lake Victoria. The foreign plant has taken over more than 769 square miles of the lake and is growing exponentially.

→ growth factor

Equation: $y = 769(2^n)$



Water Hyacinth Growth	
Days	Area Covered (sq. mi)
0	769
1 10	1538
2 20	3076
3 30	6152
4 40	12,304
5 50	24,608

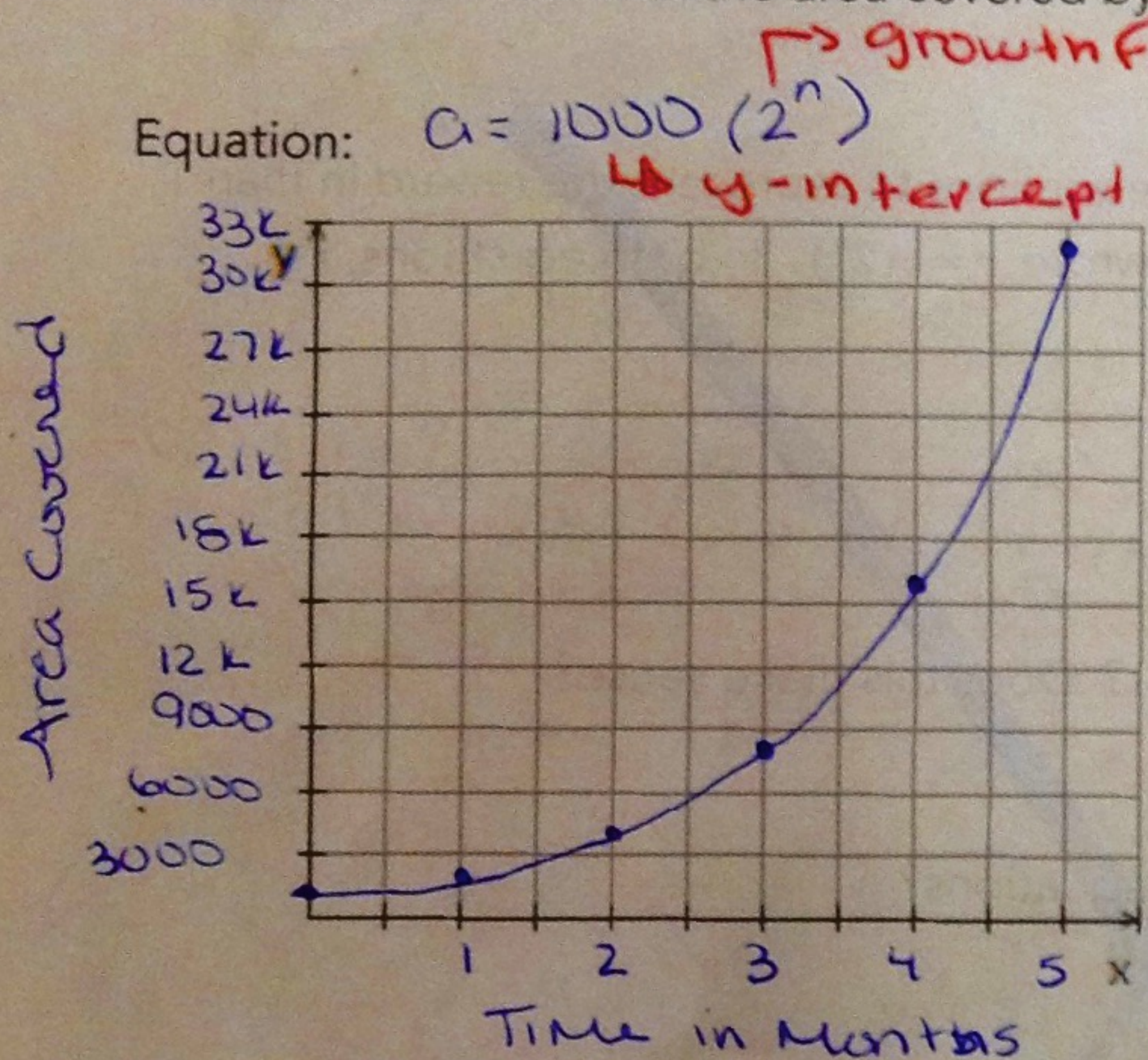
Don't use length in days, instead 10 days = 1 unit of time to double

Doubling time (10 day units)

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Ghost Lake is a popular site for fishermen, campers, and boaters. In recent years, a certain water plant has been growing on the lake at an alarming rate. The surface area of Ghost Lake is 25,000,000 square feet. At present, the plant covers 1,000 square feet of the lake. The Department of Natural Resources estimates that the area covered by the water plant is doubling every month.



Ghost Lake	
Months	Area Covered (sq. mi)
0	1000
1	2000
2	4000
3	8000
4	16,000
5	32,000

A1/B1. Create a table, equation, and graph for the scenario above.

A2. Explain what information the variables and numbers in your equation represent. **y-intercept!**

$a =$ area covered by plants 1000 - the amount covered at the start.

$n =$ time in months

2 - growth factor

A3. Compare this equation to the equations in Investigation 1.

Now it is multiplied by 1000 instead of $\frac{1}{2}$

because we start with 1000 sq mi at **(y-intercept)**

B2. How does this graph compare to the graphs of the exponential functions in Investigation 1?

This graph does not start at $(0, 1)$ or $(1, 1)$

The graph starts with a much higher number (1000) at the start.

C1. How much of the lake's surface will be covered at the end of a year by the plant? _____

$$a = 1000(2^{12}) = 4,096,000$$

C2. How many months will it take for the plant to completely cover the surface of the lake? ^{between} 14 & 15

$$a = \frac{1000}{1000}(2^n) = \frac{25,000,000}{1000}$$

$$2^n = 25,000$$

$$2^{15} = 32,000 (32,768)$$

$$2^{14} = 16,384$$