LESSON MAKER PRO

Growth in Motion

Model exponential change and find when a value is reached.

HIGH SCHOOL · A2.A.1.2

A2.A.1.2 "Use mathematical models to represent exponential relationships, such as compound interest, depreciation, and population growth. Solve these equations algebraically or graphically (including graphing calculator or other appropriate…"

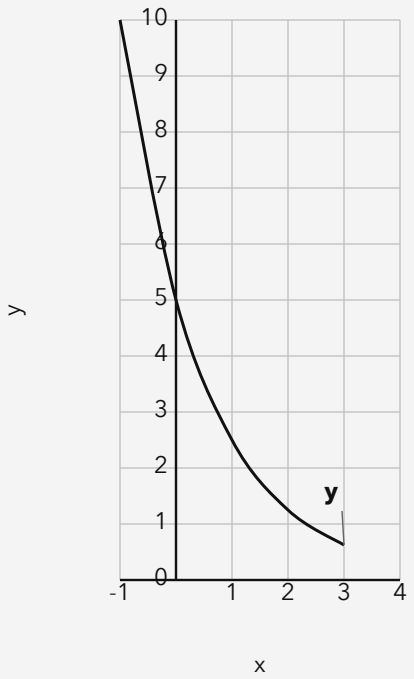
NAME _____ DATE _____

THE BIG IDEA

In an exponential model, $y = a \cdot b^x$, a is the value at x = 0 and b is the factor multiplied each time x increases by 1. On a graph, compare values one step apart to find b. To solve for x, look for a power of b that gives the target value.

WORKED EXAMPLE

Use the curve to write a model for y. Then find x when y = 1.25.

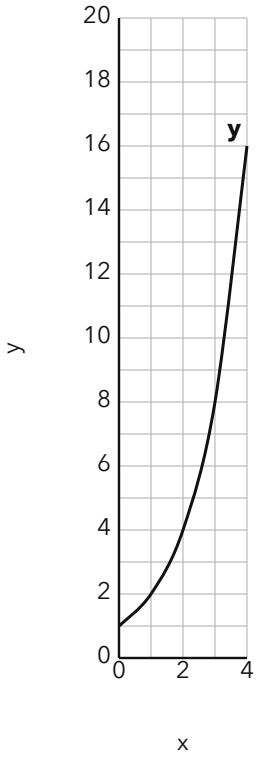


1. At x = 0, y = 5, so a = 5.
2. From x = 0 to x = 1, y changes from 5 to 2.5. The factor is 2.5/5 = 1/2.
3. Write the model: $y = 5 \cdot (1/2)^x$.
4. Set $1.25 = 5 \cdot (1/2)^x$. Then $(1/2)^x = 1/4$, so x = 2.

Answer: $y = 5 \cdot (1/2)^x$; x = 2

PRACTICE 6 problems

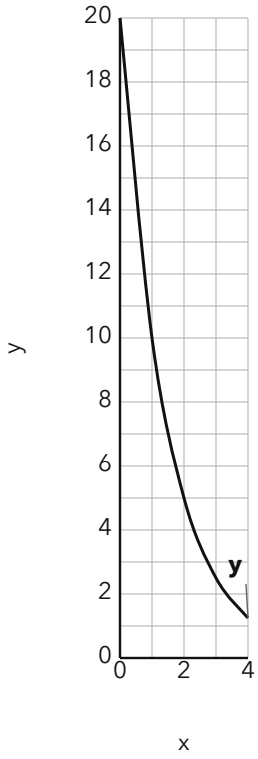
1 Use the curve to write a model for y. Then find x when y = 8.



ANSWER _____

_____

2 Use the curve to write a model for y. Then find x when y = 5.



ANSWER _____

_____

3 An account starts with $200 and earns 10% interest each year. Write a model for its balance B after x years. Find B after 2 years.

ANSWER _____

_____

4 A game item worth $81 loses 2/3 of its value each month. Write a model for its value V after x months. Find x when V = $3.

ANSWER _____

_____

5 A group starts with 7 members and doubles each week. Write a model for its size P after x weeks. Find x when P = 56.

ANSWER _____

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6 Solve $4 \cdot 3^x = 108$ for x.

ANSWER _____

APPLY IT Show your work

1 A singer has 40 followers on a new music page. The follower count grows by 50% each week. Write a model for the count F after x weeks. How many weeks will it take to reach 135 followers?

WORK SPACE

ANSWER _____

2 A used gaming console is worth $320. Its value drops by 25% each year. Write a model for its value V after x years. What will it be worth after 2 years?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Two online games track popularity scores. Game A starts at 12 points and doubles each week. Game B starts at 48 points and grows by 50% each week. Write both models. Find the first whole week when A's score is greater than B's, and explain why it is the first.

WORK SPACE AND ANSWER

Growth in Motion

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Use the curve to write a model for y. Then find x when y = 8.	**$y = 2^x$; x = 3**
2	Use the curve to write a model for y. Then find x when y = 5.	**$y = 20 \cdot (1/2)^x$; x = 2**
3	An account starts with $200 and earns 10% interest each year. Write a model for its balance B after x years. Find B after 2 years.	**$B = 200 \cdot (1.1)^x$; B = $242**
4	A game item worth $81 loses 2/3 of its value each month. Write a model for its value V after x months. Find x when V = $3.	**$V = 81 \cdot (1/3)^x$; x = 3 months**
5	A group starts with 7 members and doubles each week. Write a model for its size P after x weeks. Find x when P = 56.	**$P = 7 \cdot 2^x$; x = 3 weeks**
6	Solve $4 \cdot 3^x = 108$ for x.	**x = 3**

PART 2 · APPLY IT

1. **$F = 40 \cdot (1.5)^x$; 3 weeks** The weekly factor is 1.5. Since $40 \cdot (1.5)^3 = 135$, x = 3.
2. **$V = 320 \cdot (3/4)^x$; $180** A 25% drop leaves 3/4 of the value each year. At x = 2, $V = 320 \cdot (3/4)^2 = 180$.

CHALLENGE

$A = 12 \cdot 2^x$ and $B = 48 \cdot (1.5)^x$. At week 4, A = 192 and B = 243. At week 5, A = 384 and B = 364.5. A/B grows by a factor of 4/3 each week, so A could not have been ahead earlier. The first whole week is week 5.

Accept equivalent exponential models, such as using 0.75 instead of 3/4. For the challenge, a comparison of weeks 4 and 5 must also justify why A was not ahead before week 4.