

Exponential Growth and Decay Models

Grade 9 – Algebra 1 math · Worksheet · Standards: F-LE.A.1a, F-LE.A.1c, F-LE.A.2, F-LE.A.3, F-IF.C.8b, F-LE.B.5

Name: _____ Date: _____ Class: _____

These 20 problems train the ideas of standards F-LE.A.1, F-LE.A.2 and F-LE.A.3. Early problems ask for the factor in a table or an equation. Middle problems build models for interest and depreciation. The last six are word problems that compare curves with lines.

Each problem is harder than the one before it, so work in order.

Standards: F-LE.A.1a, F-LE.A.1c, F-LE.A.2, F-LE.A.3, F-IF.C.8b, F-LE.B.5 · **Level:** Grade 9 Algebra 1

Problem 1 Spot the Pattern, Table One (easy)

Decide whether the table is linear or exponential. Give the constant difference or the constant factor.

x	0	1	2	3
y	5	10	20	40

Problem 2 Spot the Pattern, Table Two (easy)

Decide whether the table is linear or exponential. Give the constant difference or the constant factor.

x	0	1	2	3
y	7	12	17	22

Problem 3 Name the Parts of a Growth Model (easy)

For $y = 6(1.4)^x$, state the initial value and the factor. Then state whether the function shows growth or decay and the percent rate.

Problem 4 Name the Parts of a Decay Model (easy)

For $y = 250(0.8)^x$, state the initial value and the factor. Then state whether the function shows growth or decay and the percent rate.

Problem 5 Evaluate an Exponential Function (easy)

Let $f(x) = 5(4)^x$. Evaluate $f(0)$, $f(1)$, $f(2)$ and $f(3)$.

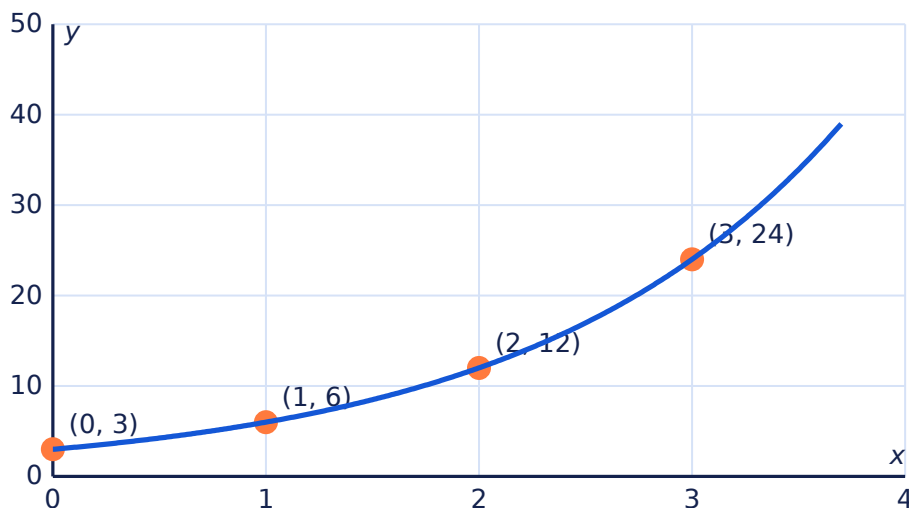
Problem 6 Write the Rule from a Table (easy)

Write an exponential function for the table.

x	0	1	2	3
y	8	12	18	27

Problem 7 Read an Exponential Graph (medium)

The graph shows points of an exponential function. Find the initial value and the factor, then write the equation and find y when $x = 4$.



Points of an exponential function.

Problem 8 Table Without the Starting Value (medium)

Write an exponential function for the table, starting from $x = 0$.

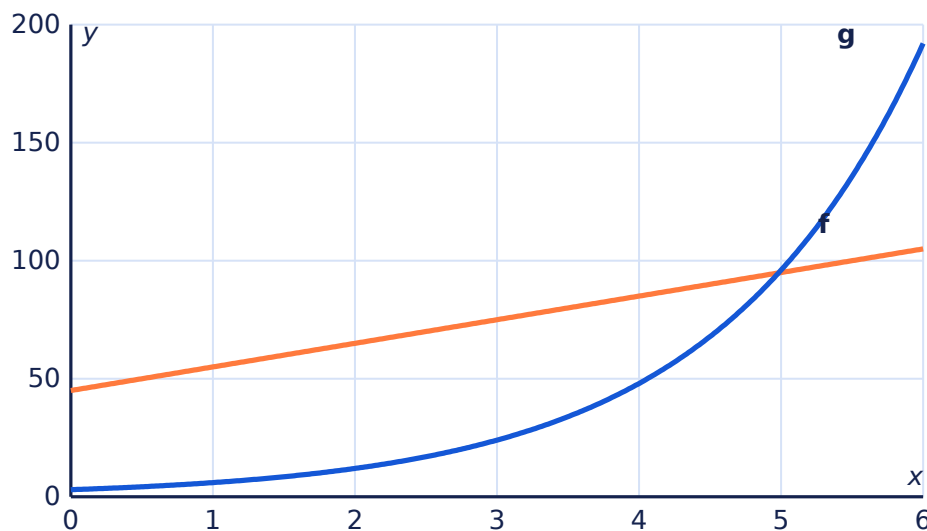
x	1	2	3	4
y	80	40	20	10

Problem 9 A Bank Rate Model (medium)

An account is modeled by $y = 1200(1.035)^x$, where x is the number of years. Give the yearly percent growth and find the balance after 2 years.

Problem 10 Line Versus Curve (medium)

Let $f(x) = 45 + 10x$ and $g(x) = 3(2)^x$. Use the graph or a table to find the first whole number x for which $g(x) > f(x)$.



Line f and curve g for x from 0 to 6.

Problem 11 Annual Compound Interest (medium)

A college fund of \$2,400 earns 3% interest, added once a year. Find the balance after 6 years.

Problem 12 Depreciating Truck (medium)

A used delivery truck is worth \$18,500 and loses 12% of its value each year. Write a function for its value after t years and find the value after 3 years.

Problem 13 Bacteria in a Lab Dish (medium)

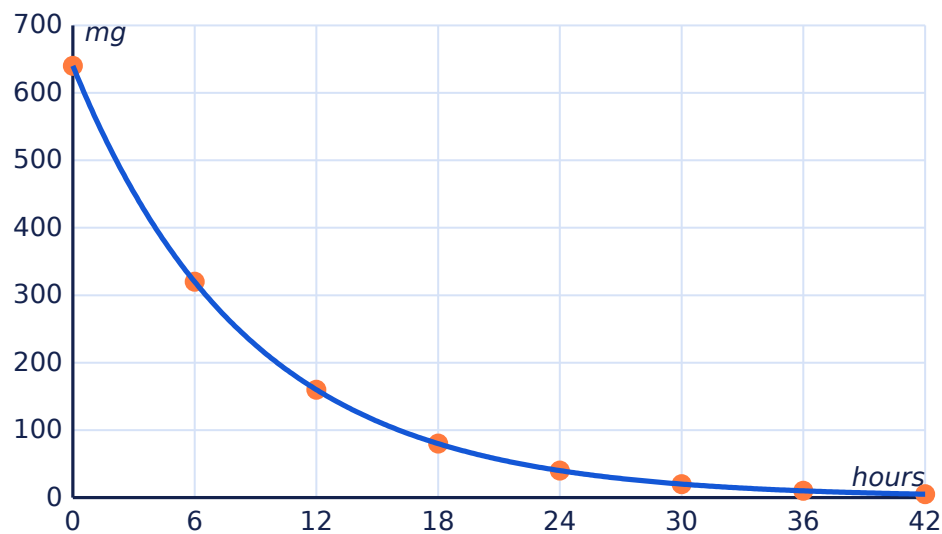
A dish holds 300 bacteria. The count doubles every hour. Write a function for the count after h hours. In which hour does the count first exceed 10,000?

Problem 14 Interpret a Follower Model (medium)

A club's followers are modeled by $F(t) = 1,800(1.06)^t$, where t is the number of weeks. Explain what 1,800 and 1.06 mean, then predict the followers after 10 weeks, rounded to the nearest whole number.

Problem 15 Half-Life of a Medicine (hard)

A patient takes 640 mg of a medicine. Half of the amount in the body leaves every 6 hours. Find the amount after 18 hours, and find the first multiple of 6 hours at which less than 10 mg remains.



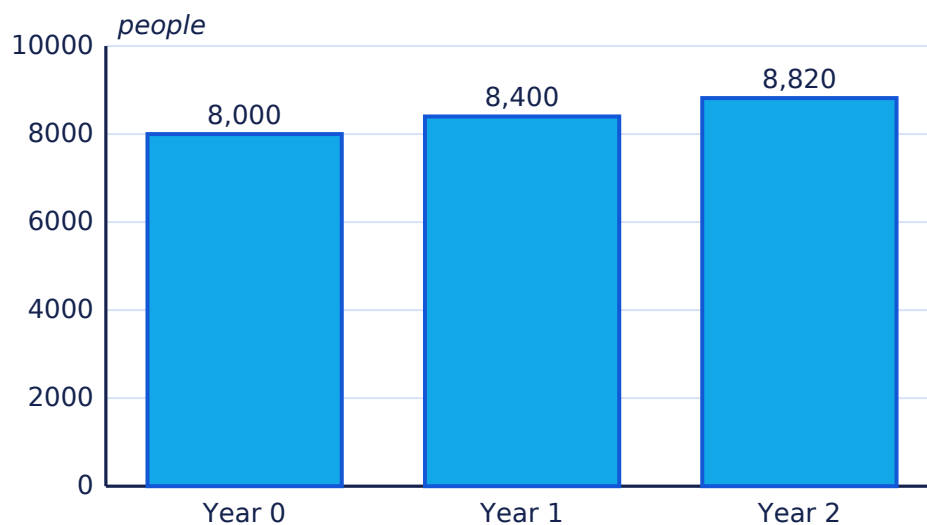
The amount halves every 6 hours.

Problem 16 Compounding Four Times a Year (hard)

Calculate the balance when \$5,000 earns 6% per year compounded quarterly for 2 years.

Problem 17 Find the Growth Rate from Data (hard)

A town had 8,000 residents. After 1 year it had 8,400 and after 2 years 8,820. Find the yearly rate, write the function and predict the population after 4 years (nearest whole number).



Population of a town for the first three years.

Problem 18 Two Savings Plans (hard)

Plan A starts at \$100 and adds \$25 each month. Plan B starts at \$100 and grows 20% each month. Write both functions and find the first month when Plan B has more than Plan A.

Problem 19 Which Amount Is Larger? (hard)

For a school raffle, Option A pays $\$25 + \$15$ per day on day n , and Option B pays \$2 on day 1 and doubles every day after that, so day n pays 2^n dollars. Find the first day on which Option B pays more than Option A.

Problem 20 Phone Value Over Time (hard)

A phone that cost \$900 loses 15% of its value each year. Write the value function. After how many whole years is the phone first worth less than half of its price?