

Exponential Functions: math practice, Grade 11 – download the PDF

22 problems graded by difficulty (★ easy, ★★ medium, ★★★ hard). Try first, without looking at the solutions!

1 Evaluating an exponential function

★ ★ ★

Let $f(x) = 4 \cdot 3^x$. Compute $f(0)$, $f(1)$, $f(2)$ and $f(-1)$.

2 Growth or decay?

★ ★ ★

For each function, say whether it models growth or decay, give the base b , and state the percent rate of change per step.

a. $y = 7(1.08)^x$

b. $y = 0.5(0.9)^x$

c. $y = 120\left(\frac{3}{2}\right)^x$

d. $y = 2\left(\frac{1}{4}\right)^x$

3 True or false?



Decide whether each statement is true or false, and justify your answer in one sentence.

- a. $y = 5^x$ is an exponential function.
- b. $y = x^5$ is an exponential function.
- c. $y = 1^x$ is an exponential function with base 1.
- d. The graph of $y = 2 \cdot 3^x$ crosses the y-axis at $(0, 2)$.
- e. The function $y = 0.5^x$ is decreasing.

4 Completing a table



The table shows an exponential function f . Find $f(3)$, then write a formula for f and compute $f(5)$.

x	0	1	2	3
$f(x)$	5	10	20	?

5 A growing town



A town of 12,000 people grows 3% each year. (a) Write a formula for the population $P(t)$ after t years. (b) Find the population after 2 years, rounded to the nearest person.

6 Percent to factor

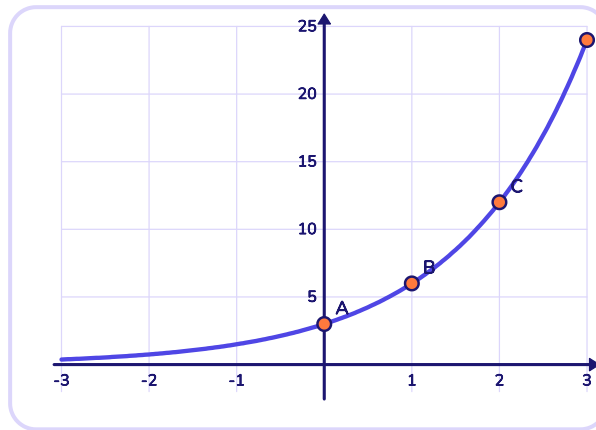


Write the factor b for each situation: (a) a price rises 6% per year; (b) a signal loses 12% of its strength per mile; (c) a balance grows 2.5% per month; (d) a sample shrinks 40% per day.

7 Reading a graph



The graph of an exponential function h is shown. (a) What is its y-intercept? (b) Find $h(2)$. (c) What is the horizontal asymptote? (d) For which x is $h(x) = 24$? (e) Is h a growth or a decay function?



8 A phone that loses value



A phone costs 900 dollars new and loses 20% of its value each year. (a) Write $V(t)$. (b) Find its value after 3 years. (c) After how many whole years is it worth less than 400 dollars?

9 Equation from two points



An exponential function $f(x) = a \cdot b^x$ passes through $(0, 3)$ and $(2, 48)$. Find a and b , write the formula, and compute $f(3)$.

10 Monthly or yearly?



You deposit 1,500 dollars at 5% for 3 years. Compare the balance when interest is compounded (a) monthly and (b) annually. How much more does monthly compounding earn?

11 Shifting left and down



Let $g(x) = 3^{x+2} - 4$. (a) Describe how its graph is obtained from $y = 3^x$. (b) Give the horizontal asymptote and the range. (c) Find $g(0)$ and $g(-2)$.

12 A reflected exponential



Let $h(x) = -2^x + 5$. (a) Describe the transformations of $y = 2^x$. (b) Find the asymptote and the range. (c) Compute $h(0)$ and $h(3)$.

13 Doubling every three hours



A yeast colony starts with 400 cells and doubles every 3 hours, so $N(t) = 400 \cdot 2^{t/3}$. Find the number of cells after (a) 9 hours, (b) 12 hours, (c) 1 hour (round to the nearest cell).

14 Find the mistakes



Two students made errors. Explain each one and give the correct answer. (a) Maya says $2 \cdot 3^2 = 6^2 = 36$. (b) Leo says $f(x) = 0.4 \cdot 2^x$ is a decay function because 0.4 is less than 1.

15 Which grows faster?



Two accounts: $A(x) = 200(1.5)^x$ and $B(x) = 500(1.2)^x$, with x in years. Make a table for $x = 0, 1, \dots, 6$ and find the first whole year when A exceeds B . Explain why A eventually wins even though B starts higher.

16 Half-life

★★★

A sample of 80 grams of a radioactive material has a half-life of 6 days, so

$A(t) = 80\left(\frac{1}{2}\right)^{t/6}$. (a) How much is left after 18 days? (b) After 9 days (nearest tenth of a gram)? (c) After how many days are 2.5 grams left?

17 Three ways to compound

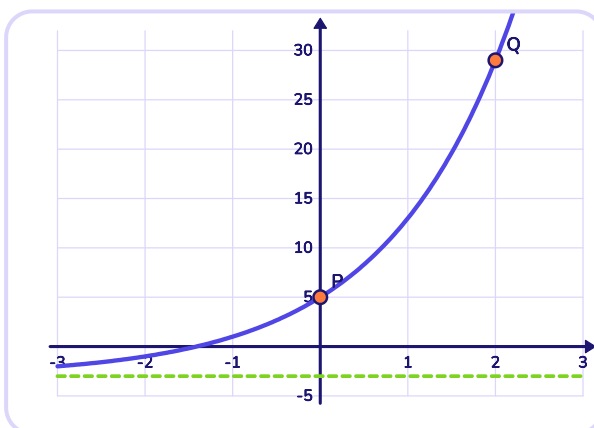
★★★

Deposit 8,000 dollars at 3.5% for 10 years. Compute the balance when compounded (a) annually, (b) quarterly, (c) continuously. By how much does continuous compounding beat annual compounding?

18 Finding a transformed function

★★★

The graph of $g(x) = a \cdot 2^x + k$ has the horizontal asymptote $y = -3$ and passes through $P(0, 5)$. Find a and k , then compute $g(2)$ and $g(-1)$.



19 Approaching e

★★★

Compute $\left(1 + \frac{1}{n}\right)^n$ for $n = 12$ and $n = 365$ (4 decimal places). Compare each with $e \approx 2.7183$. What happens to the gap as n increases, and what does this mean for a 1 dollar deposit at 100% interest?

20 Doubling an investment



You invest 5,000 dollars at 6% compounded annually. By trying whole numbers of years, find the first year in which the balance exceeds 10,000 dollars. Then use logarithms to find the exact doubling time to the nearest tenth of a year.

21 Continuous doubling time



An account holds 1,500 dollars and earns 4% compounded continuously. (a) Write the balance formula. (b) Solve $1500 e^{0.04t} = 3000$ for t . (c) Check your answer.

22 Modeling app users



The number of users of a study app (in thousands) was 50, 60, 72 and 86.4 in years 0, 1, 2 and 3. (a) Show the data are exponential and write a model $N(t)$. (b) Predict the users in year 6. (c) In which year do users first pass 100 thousand?



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