

Factor to Percent

Reveal the rate hidden in an exponential factor.

HIGH SCHOOL • MA.912.AR.5.5

MA.912.AR.5.5 "Given an expression or equation representing an exponential function, reveal the constant percent rate of change per unit interval using the properties of exponents..."

NAME _____

DATE _____

FIND THE HIDDEN RATE

In an exponential function $y = a(b)^x$, the factor b tells what happens when the input increases by 1. Rewrite b as $1 + r$ for growth or $1 - r$ for decay, then change r to a percent.

WORKED EXAMPLE

For $y = 81(7/6)^x$, reveal the constant percent rate of change per 1-unit increase in x .

1. Rewrite the factor: $7/6 = 1 + 1/6$.
2. Convert $1/6$ to a percent: $1/6 = 16 \frac{2}{3}\%$.
3. The factor has the form $1 + r$, so the function grows.

Answer: The function increases $16 \frac{2}{3}\%$ for each 1-unit increase in x .

PRACTICE 6 problems

- 1** For $f(x) = 30(9/8)^x$, rewrite the factor as $1 + r$ or $1 - r$. State the constant percent rate per 1-unit increase in x .

ANSWER _____

- 2** For $N(t) = 200(3/5)^t$, rewrite the factor as $1 + r$ or $1 - r$. State the constant percent rate per 1-unit increase in t .

ANSWER _____

- 3** For $y = 12(11/10)^x$, rewrite the factor as $1 + r$ or $1 - r$. State the constant percent rate per 1-unit increase in x .

ANSWER _____

- 4** For $C(m) = 40(2/3)^m$, rewrite the factor as $1 + r$ or $1 - r$. State the constant percent rate per 1-unit increase in m .

ANSWER _____

- 5** For $h(x) = 100(27/25)^x$, rewrite the factor as $1 + r$ or $1 - r$. State the constant percent rate per 1-unit increase in x .

ANSWER _____

- 6** For $q(n) = 18(2^n/4^n)$, use exponent properties to reveal the constant percent rate per 1-unit increase in n .

ANSWER _____

APPLY IT Show your work

- 1** A student posts a short video, and its total views are modeled by $V(d) = 240(5/4)^d$, where d is the number of days after posting. What is the constant percent rate of change? Interpret the rate in this context.

WORK SPACE

ANSWER _____

- 2** The number of active players in an online game is modeled by $A(w) = 120(5/8)^w$, where w is the number of weeks after a new game update. What is the constant percent rate of change? Interpret the rate in this context.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A streaming app models the number of users still using a free trial by $U(w) = 150(2/3)^{(2w)}$, where w is weeks after the trial begins. Use exponent properties to rewrite the model with an exponent of w . Then reveal and explain the constant percent rate of change per week.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	For $f(x) = 30(9/8)^x$, rewrite the factor as $1 + r$ or $1 - r$. State the constant percent rate per 1-unit increase in x .	$9/8 = 1 + 1/8$. The function increases 12.5% per unit of x .
2	For $N(t) = 200(3/5)^t$, rewrite the factor as $1 + r$ or $1 - r$. State the constant percent rate per 1-unit increase in t .	$3/5 = 1 - 2/5$. The function decreases 40% per unit of t .
3	For $y = 12(11/10)^x$, rewrite the factor as $1 + r$ or $1 - r$. State the constant percent rate per 1-unit increase in x .	$11/10 = 1 + 1/10$. The function increases 10% per unit of x .
4	For $C(m) = 40(2/3)^m$, rewrite the factor as $1 + r$ or $1 - r$. State the constant percent rate per 1-unit increase in m .	$2/3 = 1 - 1/3$. The function decreases 33 $1/3$ % per unit of m .
5	For $h(x) = 100(27/25)^x$, rewrite the factor as $1 + r$ or $1 - r$. State the constant percent rate per 1-unit increase in x .	$27/25 = 1 + 2/25$. The function increases 8% per unit of x .
6	For $q(n) = 18(2^{n/4}/4^n)$, use exponent properties to reveal the constant percent rate per 1-unit increase in n .	$2^{n/4}/4^n = (1/2)^n$, and $1/2 = 1 - 1/2$. The function decreases 50% per unit of n .

PART 2 • APPLY IT

1. **The total number of views increases 25% each day.** Rewrite $5/4$ as $1 + 1/4$. Since $1/4 = 25\%$, the model predicts a 25% daily increase in total views.
2. **The number of active players decreases 37.5% each week.** Rewrite $5/8$ as $1 - 3/8$. Since $3/8 = 37.5\%$, the model predicts a 37.5% weekly decrease in active players.

CHALLENGE

$U(w) = 150(4/9)^w$. Since $4/9 = 1 - 5/9$, the number of users decreases 55 $5/9$ % each week.

Accept equivalent rate forms, such as $1/8$ and 12.5%, or $3/8$ and 37.5%. Students may state decrease, decay, or loss when the factor is less than 1.