LESSON MAKER PRO

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 2/3%.
3. The factor has the form 1 + r, so the function grows.

Answer: The function increases 16 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

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.

WORK SPACE AND ANSWER

ANSWER KEY

Factor to Percent

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