LESSON MAKER PRO

# Base Rate Detectives

*Read exponential bases, rates, and change patterns.*

**HIGH SCHOOL · HSF-IF.C.8b**

**CCSS.Math.Content.HSF-IF.C.8b** "Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)12^t$, $y = (1.2)^t/10$..."

NAME _____ DATE _____

## PRACTICE: READ THE BASE

In y = a(b^x), the base b is the multiplier for each 1-unit increase in x. If b = 1 + r, the function has r percent growth. If b = 1 - r, the function has r percent decay. Use exponent properties to rewrite expressions so the exponent is just x.

## WORKED EXAMPLE

Interpret y = (1.04)^(3t). Rewrite it in the form y = b^t, then state the percent rate of change and whether it is growth or decay.

1. Use a^(kt) = (a^k)^t: y = ((1.04)^3)^t.
2. (1.04)^3 = 1.124864, so y = (1.124864)^t.
3. 124864 = 1 + 0.124864, so the rate is a 12.4864% increase.

**Answer: y = (1.124864)^t; 12.4864% growth.**

## PRACTICE 6 problems

**1** For y = (1.07)^x, state the percent rate of change and classify the function as growth or decay.

**ANSWER** _____

**2** For y = (0.96)^x, state the percent rate of change and classify the function as growth or decay.

**ANSWER** _____

**3** Rewrite y = (1.2)^(2x) in the form y = b^x. Then state the percent rate of change and classification.

**ANSWER** _____

**4** Rewrite y = (0.9)^(2x) in the form y = b^x. Then state the percent rate of change and classification.

**ANSWER** _____

**5** Rewrite y = (1.44)^(x/2) in the form y = b^x. Then state the percent rate of change and classification.

**ANSWER** _____

**6** For y = 5(0.75)^x, state the percent rate of change and classify the function as growth or decay.

**ANSWER** _____

## APPLY IT Show your work

**1** An esports club models its fundraiser balance with B = 200(1.1)^w, where w is the number of weeks. What is the starting balance? What is the weekly percent rate of change and classification? Find the balance after 2 weeks.

WORK SPACE

**ANSWER** _____

**2** The resale value of a used game console is modeled by V = 640(0.875)^m, where m is the number of months. What is the starting value? What is the monthly percent rate of change and classification? Find the value after 2 months.

WORK SPACE

**ANSWER** _____

## CHALLENGE One step up

**CHALLENGE**

A student says A = 300(1.21)^(x/2) and B = 300(1.1)^x have different growth rates because they look different. Are the models equivalent? Explain using exponent properties, then state the percent growth rate.

_____

_____

**ANSWER KEY**

# Base Rate Detectives

**HIGH SCHOOL · HSF-IF.C.8b**

## PART 1 · PRACTICE

| # | PROBLEM | ANSWER |
|---|---|---|
| 1 | For y = (1.07)^x, state the percent rate of change and classify the function as growth or decay. | **7% growth.** |
| 2 | For y = (0.96)^x, state the percent rate of change and classify the function as growth or decay. | **4% decay.** |
| 3 | Rewrite y = (1.2)^(2x) in the form y = b^x. Then state the percent rate of change and classification. | **y = (1.44)^x; 44% growth.** |
| 4 | Rewrite y = (0.9)^(2x) in the form y = b^x. Then state the percent rate of change and classification. | **y = (0.81)^x; 19% decay.** |
| 5 | Rewrite y = (1.44)^(x/2) in the form y = b^x. Then state the percent rate of change and classification. | **y = (1.2)^x; 20% growth.** |
| 6 | For y = 5(0.75)^x, state the percent rate of change and classify the function as growth or decay. | **25% decay.** |

## PART 2 · APPLY IT

1. **Starting balance: $200. Rate: 10% growth per week. After 2 weeks: $242.** The coefficient 200 is the starting balance. Since 1.1 = 1 + 0.1, multiply 200 by 1.1 twice: 200(1.1)^2 = 242.
2. **Starting value: $640. Rate: 12.5% decay per month. After 2 months: $490.** The coefficient 640 is the starting value. Since 0.875 = 1 - 0.125, the value decays 12.5% each month, and 640(0.875)^2 = 490.

## CHALLENGE

**Yes. Since 1.21 = (1.1)^2, A = 300(((1.1)^2)^(x/2)) = 300(1.1)^x, which is B. Both models show 10% growth per x-unit.**

Accept equivalent rewritten forms, such as 1.44^x for (1.2)^(2x), and equivalent percent statements, such as a decrease of 19%. For the challenge, students should show that the exponent operations produce a base of 1.1.