

# Comparing Linear, Quadratic, and Exponential Models

Algebra 1 • Section 11.3

Name: \_\_\_\_\_

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## Quick Review and Helpful Hints

Exponential models multiply by a constant factor over equal input intervals. Compare the initial value, multiplier, and long-term behavior before deciding what the model means.

▷ **Example:** Evaluate  $100(1.05)^2$ .

**Work:** Square the growth factor:  $1.05^2 = 1.1025$ . Then multiply:  $100(1.1025) = 110.25$ .

★ **Answer:** 110.25

## ◆ Practice Problems

Solve each problem. Show enough work that another student could follow your thinking.

- |  |  |
|--|--|
| 1. Which grows faster eventually: $5x + 20$ or $2^x$ ? _____ | 6. Which has a constant ratio in outputs? _____              |
| 2. Classify $y = 3x + 7$ . _____                             | 7. Which model has constant first differences? _____         |
| 3. Classify $y = x^2 - 4$ . _____                            | 8. Compare at $x = 3$ : $f = x^2$ and $g = 2^x$ . _____      |
| 4. Classify $y = 6(1.4)^x$ . _____                           | 9. Compare at $x = 5$ : $f = 3x + 1$ and $g = x^2$ . _____   |
| 5. Which has constant second differences? _____              | 10. Which model can represent repeated percent growth? _____ |

## ◆ Word Problems

11. A savings account adds \$50 monthly. Linear or exponential? \_\_\_\_\_
12. A bacteria culture doubles hourly. Linear, quadratic, or exponential? \_\_\_\_\_



## Answer Keys

- |                |                          |
|----------------|--------------------------|
| 1. $2^x$       | 7. Linear                |
| 2. Linear      | 8. $f(3) = 9$ is greater |
| 3. Quadratic   | 9. $g$ is greater        |
| 4. Exponential | 10. Exponential          |
| 5. Quadratic   | 11. Linear               |
| 6. Exponential | 12. Exponential          |

### Step-by-Step Explanations

- Linear growth adds the same chunk each step, but exponential keeps multiplying — given time, it always wins.
- The  $x$  sits at power 1 and the rate never changes, which is the signature of a linear function.
- That  $x^2$  as the biggest power is the telltale sign — this one's quadratic.
- The variable is up in the exponent, which means the function grows by multiplying — that's exponential.
- In a quadratic table the first differences keep changing, but the differences of THOSE settle to a constant.
- Step the input evenly and an exponential multiplies the output by the same factor each time — a steady ratio.
- Even input steps produce even output steps in a linear function — the differences stay the same.
- At  $x = 3$ ,  $2^3 = 8$  but  $3^2 = 9$  — so this early, the quadratic is still ahead.
- Plug in 5: the line gives 16 while the parabola gives 25, so  $g$  pulls ahead here.
- Percent growth multiplies by the same factor over and over, and that repeated multiplying is exactly exponential.
- The same \$50 goes in every month — a fixed amount added repeatedly makes it linear.
- Doubling each hour means multiplying by 2 again and again, and repeated multiplying is the heart of exponential.



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