LESSON MAKER PRO

# When Growth Wins

*Compare growth in tables and graphs*

**GRADE 8 · 8A.AF.I.28**

**8A.AF.I.28** "Use graphs and tables to show that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically."

NAME _____ DATE _____

## THE BIG IDEA

Use the same whole-number inputs to compare two rules. A linear rule adds a fixed amount, while an exponential rule multiplies by a fixed factor. Check the values in order to find when the exponential rule first becomes larger.

## WORKED EXAMPLE

Use the table. When does $2 \times 3^n$ first exceed $5n + 4$?

**TWO GROWTH RULES**

| n | $2 \times 3^n$ | $5n + 4$ |
|---|---|---|
| 0 | 2 | 4 |
| 1 | 6 | 9 |
| 2 | 18 | 14 |

1. At n = 0, 2 < 4.
2. At n = 1, 6 < 9.
3. At n = 2, 18 > 14.

**Answer: n = 2**

## PRACTICE 4 problems

**1** Compare $2^n$ and $3n + 1$ for n = 0 to 4. At what n does $2^n$ first become larger?

**ANSWER** _____

**2** Compare $3^n$ and $n^2 + 3$ for n = 0 to 3. At what n does $3^n$ first become larger?

**ANSWER** _____

**3** Compare $4 \times 2^n$ and $7n + 5$ for n = 0 to 3. At what n does $4 \times 2^n$ first become larger?

**ANSWER** _____

**4** A student says $n^2 + 6$ always stays ahead of $2 \times 2^n$. Check n = 0 to 3. Give an n that disproves the claim and both values.

**ANSWER** _____

## APPLY IT Show your work

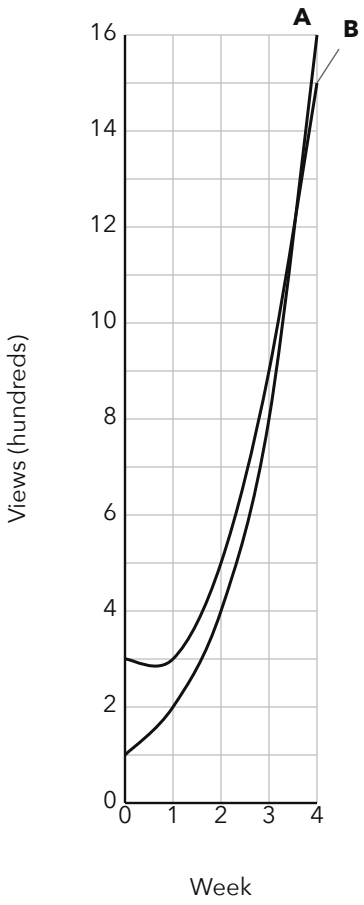
**1** Two gaming posts gain shares each day. Use the table. On what day does post A first gain more shares than post B, and how many more?

**SHARES GAINED EACH DAY**

| Day | Post A | Post B |
|---|---|---|
| 0 | 2 | 3 |
| 1 | 4 | 7 |
| 2 | 8 | 11 |
| 3 | 16 | 15 |

**ANSWER** _____

**2** The graph shows views for two gaming clips. At which whole-number week does clip A first have more views than clip B? How many hundreds more views does it have?




**ANSWER** _____

## CHALLENGE One step up

The rules $3^n$ and $2n^2 + 1$ tie at n = 0, 1, and 2. Compare them at n = 3 and 4. Do the early ties mean the rules always tie? Explain.

WORK SPACE AND ANSWER

# When Growth Wins



## PART 1 · PRACTICE

| # | PROBLEM | ANSWER |
|---|---|---|
| 1 | Compare $2^n$ and $3n + 1$ for n = 0 to 4. At what n does $2^n$ first become larger? | **n = 4** |
| 2 | Compare $3^n$ and $n^2 + 3$ for n = 0 to 3. At what n does $3^n$ first become larger? | **n = 2** |
| 3 | Compare $4 \times 2^n$ and $7n + 5$ for n = 0 to 3. At what n does $4 \times 2^n$ first become larger? | **n = 3** |
| 4 | A student says $n^2 + 6$ always stays ahead of $2 \times 2^n$. Check n = 0 to 3. Give an n that disproves the claim and both values. | **At n = 3, $n^2 + 6 = 15$ and $2 \times 2^n = 16$.** |

## PART 2 · APPLY IT

1. **Day 3, by 1 share.** Post A doubles, while post B gains 4 more shares each day. Day 3 is the first row where A exceeds B, and 16 - 15 = 1.
2. **Week 4, by 1 hundred views.** At weeks 0 through 3, A does not exceed B. At week 4, A has 16 hundred views and B has 15 hundred, a difference of 1 hundred.

## CHALLENGE

**At n = 3, 27 > 19. At n = 4, 81 > 33. No, the rules do not always tie.**

Accept a table of values or correct comparisons as supporting work. In the graph problem, 1 hundred views is 100 views.