# Difference or Factor?

Sort how outputs change when inputs increase equally.

**A1P.AF.H.24.a** "Show that linear functions grow by equal differences over equal intervals, while exponential functions grow by equal factors over equal intervals."

NAME _____ DATE _____

### EQUAL DIFFERENCES

When x increases by equal amounts, y changes by the same amount each time.

A vine is 13 cm tall and grows 9 cm each week.

### EQUAL FACTORS

When x increases by equal amounts, y is multiplied by the same factor each time.

A game awards 10 points in round 0. The points awarded in each new round are 5 times those in the previous round.

## 1 SORT

8 items

Circle LINEAR or EXPONENTIAL for each item, then choose one item from each category and explain how its outputs change over equal input intervals.

**1.** x = 0, 1, 2, 3; y = 8, 14, 20, 26 — LINEAR / EXPONENTIAL

**2.** y = 11 + 4x, for x = 0, 1, 2, … — LINEAR / EXPONENTIAL

**3.** x = 0, 1, 2, 3; y = 3, 12, 48, 192 — LINEAR / EXPONENTIAL

**4.** A taxi charges $5 plus $3 per mile. — LINEAR / EXPONENTIAL

**5.** $y = 6(3)^x$, for x = 0, 1, 2, … — LINEAR / EXPONENTIAL

**6.** x = 0, 1, 2, 3; y = 7, 14, 28, 56 — LINEAR / EXPONENTIAL

**7.** A savings jar starts with $18 and gains $5 each week. — LINEAR / EXPONENTIAL

**8.** A sticker collection starts with 4 stickers and doubles each month. — LINEAR / EXPONENTIAL

## 2 PROVE IT

Explain your thinking

Choose one item from each category and explain how its outputs change over equal input intervals.

**ITEM #** _____ **HOW I KNEW** _____

**ITEM #** _____ **HOW I KNEW** _____

## 3 MAKE YOUR OWN

One of each

Write one new LINEAR example and one new EXPONENTIAL example by listing their outputs for x = 0, 1, 2, 3.

**LINEAR**

**EXPONENTIAL**

**CHALLENGE**

Make two sets of outputs for x = 0, 1, 2, 3 that start at 1 and end at 64, one LINEAR and one EXPONENTIAL; state the equal difference and equal factor.

**ANSWER KEY**

# Difference or Factor?



## PART 1 · SORT

| # | ITEM | CATEGORY | WHY |
|---|---|---|---|
| 1 | x = 0, 1, 2, 3; y = 8, 14, 20, 26 | **LINEAR** | Each increase of 1 in x adds 6 to y. |
| 2 | y = 11 + 4x, for x = 0, 1, 2, ... | **LINEAR** | Each increase of 1 in x adds 4 to y. |
| 3 | x = 0, 1, 2, 3; y = 3, 12, 48, 192 | **EXPONENTIAL** | Each increase of 1 in x multiplies y by 4. |
| 4 | A taxi charges $5 plus $3 per mile. | **LINEAR** | Each additional mile adds $3 to the fare. |
| 5 | $y = 6(3)^x$, for x = 0, 1, 2, ... | **EXPONENTIAL** | Each increase of 1 in x multiplies y by 3. |
| 6 | x = 0, 1, 2, 3; y = 7, 14, 28, 56 | **EXPONENTIAL** | Each increase of 1 in x multiplies y by 2. |
| 7 | A savings jar starts with $18 and gains $5 each week. | **LINEAR** | Each week adds $5 to the total. |
| 8 | A sticker collection starts with 4 stickers and doubles each month. | **EXPONENTIAL** | Each month multiplies the number of stickers by 2. |

## PART 2 · PROVE IT

**Task:** Choose one item from each category and explain how its outputs change over equal input intervals. Accept any explanation that names the deciding feature from the rule box for the chosen item.

## PART 3 · MAKE YOUR OWN (SAMPLE ANSWERS)

- **LINEAR**: x = 0, 1, 2, 3; y = 12, 20, 28, 36.
- **EXPONENTIAL**: x = 0, 1, 2, 3; y = 5, 15, 45, 135.

**Challenge:** LINEAR: 1, 22, 43, 64, with an equal difference of 21. EXPONENTIAL: 1, 4, 16, 64, with an equal factor of 4.

For Part 2, explanations should compare changes across equal input intervals. Accept any valid Part 3 examples with a constant difference or a constant factor, as appropriate.