# Difference or Factor

Sort functions by how their outputs change.

**AI-F.LE.1.a** "Justify that a function is linear because it grows by equal differences over equal intervals, and that a function is exponential because it grows by equal factors over equal intervals."

NAME _____ DATE _____

### LINEAR, EQUAL DIFFERENCES

A linear function changes by the same amount over equal input intervals. The repeated difference can be positive or negative.

A garden border gains 4 stones per section.

### EXPONENTIAL, EQUAL FACTORS

An exponential function is multiplied by the same factor over equal input intervals. The repeated factor can be greater than 1 or between 0 and 1.

A mold patch triples each season.

## 1 SORT

8 items

Part 1: Circle LINEAR or FACTOR for each item, then Part 2: choose two items, name their categories, and explain the repeated difference or factor you used. For each finite sequence, assume the displayed difference or factor continues at equal input intervals; a finite list alone does not determine a unique function.

**1.** At equal intervals: 4, 12, 36, 108 — LINEAR / FACTOR

**2.** A tank loses 9 liters every minute. — LINEAR / FACTOR

**3.** $g(x) = 14 - 5x$ — LINEAR / FACTOR

**4.** A rumor reaches 1.5 times as many people each hour. — LINEAR / FACTOR

**5.** $h(x) = 6(4)^x$ — LINEAR / FACTOR

**6.** At equal intervals: 30, 24, 18, 12 — LINEAR / FACTOR

**7.** $M = 75 + 11d$ — LINEAR / FACTOR

**8.** $q = 3x + 20$ — LINEAR / FACTOR

## 2 PROVE IT

Explain your thinking

Pick two items from Part 1. For each one, tell how you knew where it belonged.

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

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

## 3 MAKE YOUR OWN

One of each

Part 3: Write one new LINEAR example and one new FACTOR example. Make the repeated difference or repeated factor clear.

**LINEAR** _____

**FACTOR** _____

**CHALLENGE**

Write a four-term sequence at equal intervals for LINEAR and a different four-term sequence at equal intervals for FACTOR. Underline the repeated difference or factor in each sequence.

**ANSWER KEY**

# Difference or Factor



## PART 1 · SORT

| # | ITEM | CATEGORY | WHY |
|---|---|---|---|
| 1 | At equal intervals: 4, 12, 36, 108 | **FACTOR** | Each term is multiplied by 3. |
| 2 | A tank loses 9 liters every minute. | **LINEAR** | The amount changes by -9 liters per minute. |
| 3 | $g(x) = 14 - 5x$ | **LINEAR** | For each increase of 1 in x, g(x) changes by -5. |
| 4 | A rumor reaches 1.5 times as many people each hour. | **FACTOR** | The number is multiplied by 1.5 each hour. |
| 5 | $h(x) = 6(4)^x$ | **FACTOR** | For each increase of 1 in x, the output is multiplied by 4. |
| 6 | At equal intervals: 30, 24, 18, 12 | **LINEAR** | Each term decreases by 6. |
| 7 | $M = 75 + 11d$ | **LINEAR** | For each increase of 1 in d, M increases by 11. |
| 8 | $q = 3x + 20$ | **LINEAR** | For each increase of 1 in x, q increases by 3. |

## PART 2 · PROVE IT

Accept any explanation that names the deciding feature from the rule box for the chosen item.

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

- **LINEAR**: A machine makes 8 additional parts each hour.
- **FACTOR**: A balance is multiplied by 0.9 each month.

**Challenge:** LINEAR: 10, 14, 18, 22, repeated difference $+4$. FACTOR: 10, 20, 40, 80, repeated factor $\times 2$.

For Part 2, students should identify equal input intervals and state the constant difference for a linear item or constant multiplier for a factor item. Accept equivalent wording, including a negative difference for linear decrease.