

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.

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.

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.