LESSON MAKER PRO

# Function Pattern Builder

*Build linear and exponential rules from patterns.*

**HIGH SCHOOL · HSF-LE.A.2**

**CCSS.Math.Content.HSF-LE.A.2** "Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table)."

NAME _____ DATE _____

## SPOT THE PATTERN

A linear function changes by the same amount for each increase of 1 in x. An exponential function is multiplied by the same factor for each increase of 1 in x. Use the change or factor to write a rule.

## WORKED EXAMPLE

Assume a linear function fits this input-output table. Find f(x).

| x | f(x) |
|---|---|
| 1 | 3 |
| 2 | 7 |
| 3 | 11 |

1. The outputs increase by 4 each time.
2. Use slope 4 in f(x)=4x+b.
3. Since f(1)=3, 4(1)+b=3, so b=-1.

**Answer: f(x)=4x-1**

## PRACTICE 4 problems

**1** A linear function has f(1)=8 and f(5)=16. Write f(x).

**ANSWER** _____

**2** A linear function has f(1)=12 and f(4)=0. Write f(x).

**ANSWER** _____

**3** An exponential function has f(1)=10 and f(4)=80. Write f(x).

**ANSWER** _____

**4** An exponential function has f(1)=5 and f(4)=40. Its growth factor is positive. Write f(x).

**ANSWER** _____

## APPLY IT Show your work

**1** The table shows views on a concert clip. Let x be hours after posting. Write an exponential function f(x) for the views.

**CONCERT CLIP VIEWS**

| Hours posted, x | Views |
|---|---|
| 0 | 40 |
| 1 | 80 |
| 2 | 160 |
| 3 | 320 |

**2** Your savings balance starts at $18 and rises by $5 each week. Let x be weeks. Write f(x), then find f(6).

## CHALLENGE One step up

Assume the relationship belongs to either the linear or exponential family. Use the table to identify the family and write f(x). Explain your choice.

| x | f(x) |
|---|---|
| 1 | 2 |
| 2 | 10 |
| 3 | 50 |

**ANSWER KEY**

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## PART 1 · PRACTICE

| # | PROBLEM | ANSWER |
|---|---|---|
| 1 | A linear function has f(1)=8 and f(5)=16. Write f(x). | **f(x)=2x+6** |
| 2 | A linear function has f(1)=12 and f(4)=0. Write f(x). | **f(x)=16-4x** |
| 3 | An exponential function has f(1)=10 and f(4)=80. Write f(x). | **$f(x)=5*2^x$** |
| 4 | An exponential function has f(1)=5 and f(4)=40. Its growth factor is positive. Write f(x). | **$f(x)=5*2^{x-1}$** |

## PART 2 · APPLY IT

1. **$f(x)=40*2^x$** At x=0, the clip has 40 views. The views are multiplied by 2 each hour.
2. **f(x)=5x+18; f(6)=48** The starting balance is 18 and the constant weekly increase is 5. Substitute x=6 to get 5(6)+18=48.

## CHALLENGE

**$f(x)=2*5^{x-1}$. Each output is multiplied by 5, while the differences are not constant.**

Accept equivalent linear forms and equivalent exponential forms, such as $5*2^{x-1}$ for $f(x)=(5/2)*2^x$. For the challenge, accept any correct explanation that identifies a constant factor of 5 and nonconstant differences. Finite pairs do not uniquely determine an unrestricted function; the family assumption is necessary. For practice 3 use a positive real exponential base.