

Common Ratio: What you
are constantly
• by.

• change

3, 6, 12, 24, ...

$$\frac{6}{3} \frac{2nd}{1st} = \text{Common ratio}$$

Explicit Equation:

$$f(x) = a(b)^{x-x_1}$$

$$f(x) = y_1(b)^{x-x_1}$$

$$f(x) = \underline{\quad} \left(\frac{\text{Common ratio}}{\quad} \right)^{x - \underline{\quad}}$$

Recursive: $f(1) = 3^1$
 $f(x) = f(x-1) \cdot 2$

Explicit: $f(x) = 3(2)^{x-1}$

Notes 3-3

Sec 1 H Recursive & Explicit Equations for Geometric Sequences Unit 3

Example 1: Augustus Gloop is STILL struggling to get his homework done. His dad decides to offer him a different deal and Augustus needs to choose between mom or dad's deal. Dad offers one candy on the day he explains the plan (day 0), then he will give him 2 on the first day, 4 on the second day, and 8 on the third day. He'll continue the pattern as long as Augustus gets his homework done.

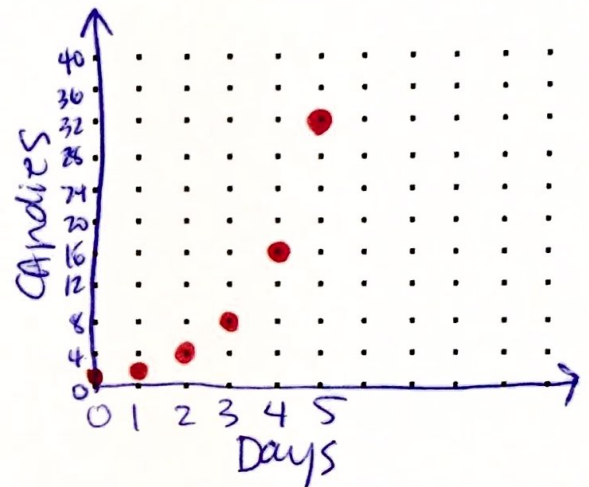
1. Write a recursive equation for dad's deal.

$$f(0) = 1 \quad f(x) = f(x-1) \cdot 2$$

2. Make a table (rule chart)

| Day x | y | Candies |
|---------|-----|-----------|
| 0 | 1 | $2^0 = 1$ |
| 1 | 2 | $2^1 = 2$ |
| 2 | 4 | $2^2 = 4$ |
| 3 | 8 | $2^3 = 8$ |

3. Make a graph



4. Write an EXPLICIT EQUATION to describe how many candies Augustus will receive on the "nth" day of completing his homework.

$$f(x) = 1 \cdot (2)^{x-0}$$

$$f(x) = 2^x$$

5. USE the explicit equation to find out how many pieces of candy Augustus will receive on the 15th day.

$$f(x) = 2^x$$

$$f(15) = 2^{15}$$

Notes 3-3

Sec 1 H Recursive & Explicit Equations for Geometric Sequences Unit 3

Example 2: Maybe you've received an email like this before:

Hi! My name is Bill Weights, founder of Super Scooper Ice Cream. I am offering you a gift certificate for our signature "Super Bowl" (a \$4.95 value) if you forward this letter to 10 people.

When you have finished sending this letter to 10 people, a screen will come up. It will be your Super Bowl gift certificate. Print that screen out and bring it to your local Super Scooper Ice Cream store. The server will bring you the most wonderful ice cream creation in the world - a Super Bowl with three yummy ice cream flavors and three toppings!

This is a sales promotion to get our name out to young people around the country. We believe this project can be a success, but only with your help. Thank you for your support.

Sincerely,

Bill Weights
Founder of Super Scooper Ice Cream

These chain emails rely on each person that receives the email to forward it on. Have you ever wondered how many people might receive this email if the chain remains unbroken? To figure this out, assume that it takes a day for the email to be opened, forwarded, and then received by the next person. On day 1, Bill Weights starts by sending the email out to his 8 closest friends. They each forward it on to 10 people so that on day 2, it is received by 80 people. Let's assume the chain remains unbroken.

1. Make a table:

| x | y | Rule |
|---|-------|---|
| ① | 8 | $8 = 8 \cdot 10^0$ |
| ② | 80 | $8 \cdot 10 = 8 \cdot 10^1$ |
| ③ | 800 | $8 \cdot 10 \cdot 10 = 8 \cdot 10^2$ |
| ④ | 8,000 | $8 \cdot 10 \cdot 10 \cdot 10 = 8 \cdot 10^3$ |
| n | | |

2. Recursive Equation:

$$f(1) = 8$$

$$f(x) = f(x-1) \cdot 10$$

3. Explicit Equation:

$$f(x) = 8(10)^{x-1}$$

$$f(x) = 8(10)^{x-1}$$

Notes 3-3

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Let's practice a few. As we do these, NOTICE how the RECURSIVE EQUATION helps us make the EXPLICIT EQUATION.

1.

| | | | | | | | | |
|--------|----|-----|-----|------|-------|-------|---------|----------|
| x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| $f(x)$ | -2 | -10 | -50 | -250 | -1250 | -6250 | -31,250 | -156,200 |

Recursive: $f(0) = -2$
 $f(x) = f(x-1) \cdot 5$

Explicit: $f(x) = -2(5)^{x+10}$

2.

| | | | | | | | | |
|--------|-----|-----|----|----|----|---------------|----------------|----------------|
| x | -11 | -10 | -9 | -8 | -7 | -6 | -5 | -4 |
| $f(x)$ | 768 | 192 | 48 | 12 | 3 | $\frac{3}{4}$ | $\frac{3}{16}$ | $\frac{3}{64}$ |

~~Explicit:~~

$\frac{12 \div 12}{48 \div 12} = \frac{1}{4}$

Recursive: $f(-11) = 768$
 $f(x) = f(x-1) \cdot \frac{1}{4}$

Explicit: $f(x) = \frac{3}{64} \left(\frac{1}{4}\right)^{x-4}$

3. $\frac{5}{2}, \frac{5}{4}, \frac{5}{8}, \frac{5}{16}, \dots$ $\cdot \frac{1}{2}$

$\frac{3}{4} \cdot \frac{1}{4} = \frac{3}{16}$

Recursive:

Explicit: $f(x) = \frac{5}{2} \left(\frac{1}{2}\right)^{x-1}$

$\frac{5}{2}, 5, 10, 20$