**Lesson 1.7 Notes**

Mr. and Mrs. Gloop want their son, Augustus to do his homework every day. Augustus loves to eat candy, so his parents have decided to motivate him to do his homework b giving him candies for each day that the homework is complete. Mr. Gloop says that on the first dat that Augustus turns in his homework, he will give him 10 candies. On the second day he promises to give 20 candies, on the third day he will give 30 candies, and so on.

| Describe the pattern of candies given. | Recursive rule: | Explicit rule: | How many candies will Augustus get on day 30? |
|---|---|---|---|
| Each day Augustus is adding 10 candies. | $f(0) = 0$<br>$f(x) = f(x-1) + 10$ | $f(x) = 10x$ | $f(30) = 10(30)$<br>$f(30) = 300$<br><br>On day 30 Augustus will receive 300 candies. |

Augustus looks in the mirror and decides that he is gaining weight. He is afraid that all that candy will just make it worse, so he tells his parents that it would be ok if they just gave him 1 candy on the first day, 2 on the second day, continuing to double the amount each day as he completes his homework. Mr. and Mrs. Gloop like Augustus' plan and agree to it.

| Describe the pattern of candies given. | Recursive rule: | Explicit rule: | How many candies will Augustus get on day 30? |
|---|---|---|---|
| Each day Augustus multiplies the number of candies given the previous day by two. | $f(0) = 0.5$<br>$f(x) = f(x-1) \cdot 2$ | $f(x) = 2^x \cdot 0.5$ | $f(30) = 2^{30} \cdot 0.5$<br>$f(30) = 1{,}073{,}741{,}824 \cdot 0.5$<br>$f(30) = 536{,}870{,}912$<br><br>On day 30 Augustus will receive 536,870,912 candies. |

Augustus is generally selfish and somewhat unpopular at school. He decides that he could improve his image by sharing his candy with everyone at school. When he has a pile of 100,000 candies, he generously plans to give away 60% of the candies that are in the pile each day. Although Augustus may be earning more candies for doing his homework, he is only giving away candies from the pile that started with 100,000. (He's not that generous.)

| Describe the pattern of candies kept. | How many pieces of candy will be left on day 4? | How many pieces of candy will be left on day 8? | Why is 0.4 important and how was it calculated? |
|---|---|---|---|
| If Augustus is giving away 60% of his candy, he is keeping 40%. | Day 0 = 100,000<br>Day 1 = 40% of 100,000 = 40,000<br>Day 2 = 40% of 40,000 = 16,000<br>Day 3 = 40% of 16,000 = 6,400<br>Day 4 = 40% of 6,400 = 2,560 | Day 5 = 40% of 2,560 = 1,024<br>Day 6 = 40% of 1,024 = 409.6 = 410<br>Day 7 = 40% of 410 = 164<br>Day 8 = 40% of 164 = 65.6 = 66 | We are modeling the amount kept, not the amount given away. The two things should add to 100%. So, $100\% - 60\% = 40\%$.<br>$40\% = 0.4$ |

| Recursive rule: | Explicit rule: | How many days will it take for the candy to be gone? | Important notes about percents: |
|---|---|---|---|
| $f(0) = 100{,}000$<br>$f(x) = f(x-1) \cdot 0.4$ | $f(x) = 0.4^x \cdot 100{,}000$ | Day 9 = 40% of 66 = 26.4 = 26<br>Day 10 = 40% of 26 = 10.4 = 10<br>Day 11 = 40% of 10 = 4<br>Day 12 = 40% of 4 = 1.6 = 2<br>Day 13 = 40% of 2 = 0.8 = 1<br>Day 14 = 40% of 1 = 0.4 = 0<br>The candy would be gone on day 14. | Remember to move the decimal two places to convert from percent to decimal form.<br><br>100% is the whole amount. Add or subtract from 100% to determine what percent you want. |

**Other important notes from today:**

Find the missing values for each arithmetic or geometric sequence. Then say if the sequence has a constant difference or ratio, and say what the constant difference/ratio is.

1) 7, 5, ___, 1, -1, … Arithmetic

   3 Constant Difference $= -2$

2) 4, ____, 1, $\frac{1}{2}$, $\frac{1}{4}$, … Geometric

   2 Constant Ratio $= \cdot \frac{1}{2}$

3) 18, 26, 34, ____, 50, … Arithmetic

   42 Constant Difference $= +8$

4) -3, 6, _____, 24, -48, … Geometric

   -12 Constant Ratio $= \cdot -2$

Determine whether each situation represents an arithmetic or geometric sequence and then find the recursive and explicit equation for each.

1) 27, 9, 3, 1, $\frac{1}{3}$, … Geometric

   Recursive: $f(0) = 81$ Explicit:

   $f(x) = f(x-1) \cdot \frac{1}{3}$ $f(x) = \left(\frac{1}{3}\right)^x \cdot 81$

2) 5, 13, 21, 29, 37, … Arithmetic

   Recursive: $f(0) = -3$ Explicit:

   $f(x) = f(x-1) + 8$ $f(x) = 8x - 3$

3) 5, 15, 45, 135, 405, … Geometric

   Recursive: $f(0) = 1\frac{2}{3}$ Explicit:

   $f(x) = f(x-1) \cdot 3$ $f(x) = 3^x \cdot 1\frac{2}{3}$

4) Steven invested $1,000 into an account that earns 8% interest each year.

   Geometric $100\% + 8\% = 108\% = 1.08$

   Recursive: $f(0) = 1{,}000$ Explicit:

   $f(x) = f(x-1) \cdot 1.08$ $f(x) = 1.08^x \cdot 1000$

5) John has $20 to spend on chocolate. Each candy costs $2.50.

   Arithmetic

   Recursive: $f(0) = 20$ Explicit:

   $f(x) = f(x-1) - 2.50$ $f(x) = -2.5x + 20$

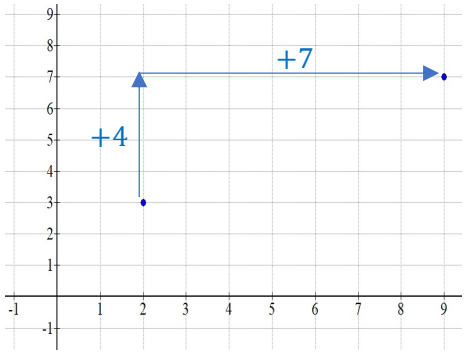
Find the slope of each set of points. Show the slope on a graph.

1) (2, 3), (9,7)

| $x$ | $y$ |
|---|---|
| 2 | 3 |
| 9 | 7 |

+7 and +4

$$\frac{\Delta y}{\Delta x} = \frac{4}{7}$$

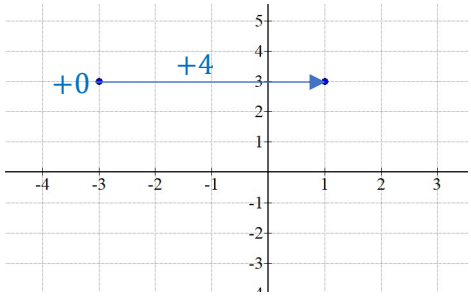



2) (−3, 3), (1, 3)

| $x$ | $y$ |
|---|---|
| -3 | 3 |
| 1 | 3 |

+4 and +0

$$\frac{\Delta y}{\Delta x} = \frac{0}{4} = 0$$

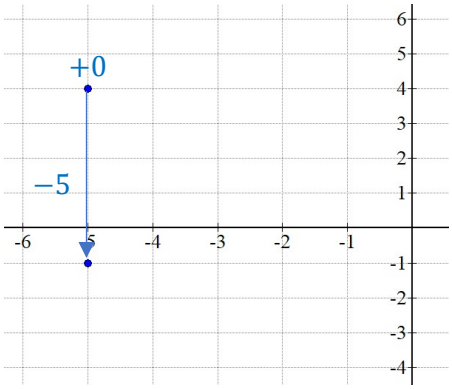



3) (−5, 4), (−5, − 1)

| $x$ | $y$ |
|---|---|
| -5 | 4 |
| -5 | -1 |

+0 and −5

$$\frac{\Delta y}{\Delta x} = \frac{-5}{0} = \text{undefined}$$

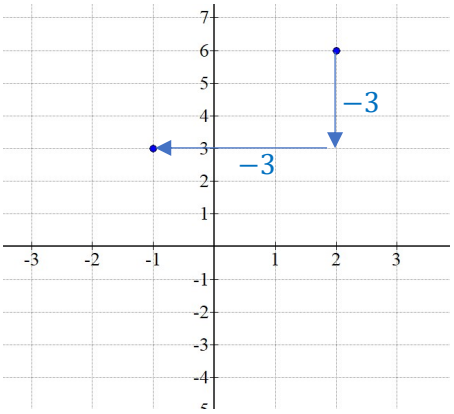



4) (2, 6), (−1, 3)

| $x$ | $y$ |
|---|---|
| 2 | 6 |
| -1 | 3 |

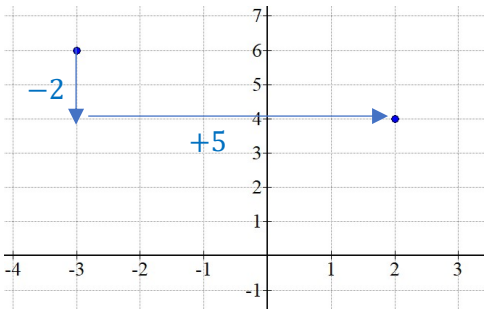
−3 and −3

$$\frac{\Delta y}{\Delta x} = \frac{-3}{-3} = 1$$




5) (−3, 6), (2, 4)

| $x$ | $y$ |
|---|---|
| -3 | 6 |
| 2 | 4 |

+5 and −2

$$\frac{\Delta y}{\Delta x} = \frac{-2}{5}$$