

Name: Lee

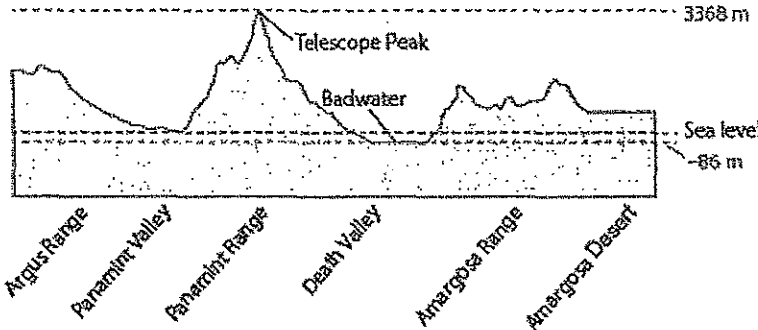
Block: 2

Date: March 19

Representing Patterns (Day 2)

Example 2: Describe a Written Pattern Using an Equation

Death Valley, located in eastern California, is the lowest point of elevation in North America, at -86 m. A tourism company wants to make a promotional video of the region. They release a drone from the lowest point to film the landscape as the drone rises at a constant rate of 2 m/s. The drone continues up until it reaches a campsite located 194 m above sea level on the side of Telescope Peak (elevation 3368 m).



Death Valley = -86 m

$$h = 2t - 86$$

- a) Create a table of values showing the height of the drone from the time it is released ($t = 0$) or when it reaches a height of 194 m. Use a time interval of 20 s for your table.

height increases by 40 m for each 20 seconds

| time, t , (s) | height, h , (m) |
|-----------------|-------------------|
| 0 | -86 |
| 20 | -46 |
| 40 | -6 |
| 60 | 34 |
| 80 | 74 |
| 100 | 114 |
| 120 | 154 |
| 140 | 194 |

$\times 2 = 56$
how do we know?

$\frac{40}{20}$

- b) Use your table to estimate how long it takes the drone to reach sea level, an elevation of 0 m. How accurate is your estimate? Explain your answer.

somewhere around 42 seconds

- c) What equation describes the relation between time and the height of the drone?

$$h = 2t - 86$$

- d) What is the drone's height 95 s after it has been released?

$$h = 2(95) - 86$$

$$h = 190 - 86$$

$$h = 104 \text{ m}$$

- e) Use your equation to confirm your answer to part b).

$$h = 2t - 86$$

$$0 = 2t - 86$$

$$86 = 2t$$

$$t = 43 \text{ s}$$

8. Write an equation that models the relationship between the two columns of numbers in each table.

a)

| x | y |
|---|----|
| 0 | 13 |
| 1 | 16 |
| 2 | 19 |
| 3 | 22 |

$$y = 3x + 13$$

c)

| k | t |
|---|----|
| 0 | -2 |
| 1 | 1 |
| 2 | 4 |
| 3 | 7 |

$$t = 3k - 5$$

b)

| r | p |
|---|----|
| 0 | 17 |
| 1 | 24 |
| 2 | 31 |
| 3 | 38 |

$$p = 7r + 17$$

d)

| f | w |
|---|----|
| 1 | -1 |
| 2 | -3 |
| 3 | -5 |
| 4 | -5 |

not linear

Apply

9. Competency Check

a) Explain how to develop an equation to represent the perimeter in this pattern.



Figure 1



Figure 2



Figure 3

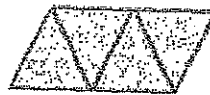


Figure 4

b) What is the equation? Explain what each term represents.

c) Compare your equation with a classmate's.

$$y = x + 2$$

of sides Figure

| x | y |
|---|---|
| 0 | 2 |
| 1 | 3 |
| 2 | 4 |
| 3 | 5 |
| 4 | 6 |

10. Christina and Liam work in a shoe store and earn a flat rate of \$35/day plus \$6 for every pair of shoes they sell. Each got a different value for how much they would earn after selling 8 pairs of shoes.



Christina

I substituted $p = 8$ into the expression $6p + 35$. When I calculated the result, I got \$83.



Liam

I substituted $p = 8$ into the equation $w = 6p$. When I calculated the result, I got \$48.

$$y = 6x + 35$$

$$y = 6(8) + 35$$

$$y = \$83$$

Who is correct? How do you know? What mistake did the other person make?

11. Describe to a partner how you could determine the 59th value in the number sequence 4, 1, -2, -5, -8, ...

| x | y |
|---|----|
| 0 | 4 |
| 1 | 1 |
| 2 | -2 |
| 3 | -5 |
| 4 | -8 |

$$y = -3x + 4$$

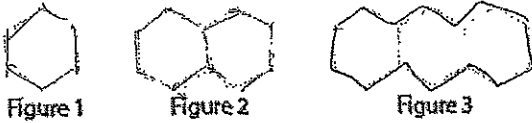
$$y = -3(59) + 4$$

$$y = -177 + 4$$

$$y = -173$$



12. Rob is in charge of arranging hexagonal tables for a parent-night presentation. The tables each seat six people. They can be connected to form longer tables.



| # of tables | x | y | number of seats |
|-------------|---|----|-----------------|
| 0 | 0 | 2 | |
| 1 | 1 | 6 | +4 |
| 2 | 2 | 10 | +4 |
| 3 | 3 | 14 | +4 |
| 4 | 4 | 18 | |
| 5 | 5 | 22 | |

$y = 4x + 2$

(c) $y = 4x + 2$
 $y = 4(5) + 2$
 $y = 22$

- a) Develop an equation to model the pattern. Identify each term.
 b) How many parents can sit at a row of 5 tables? 22
 c) Use another representation to verify your answer for part b).
 d) A group of 30 people want to sit together. How many tables must Rob join together to seat them?

(d) $y = 4x + 2$
 $30 = 4x + 2$
 $28 = 4x$
 $\frac{28}{4} = \frac{4x}{4}$
 $7 = x$

7 Tables are needed

13. A school pays \$125 to design a T-shirt. It costs an additional \$15 to make each T-shirt.

a) Copy and complete the table using this information.

| Number of T-Shirts | Cost (\$) |
|--------------------|-----------|
| 0 | 125 |
| 5 | 200 |
| 10 | 275 |
| 15 | 350 |
| 35 | 650 |
| 55 | 950 |

+5
+5
+5

+75

$C = \frac{75}{5}x$

$C = 15x + 125$

$C = 15(35) + 125$

$950 = 15x + 125$
 $825 = 15x$
 $\frac{825}{15} = \frac{15x}{15}$
 $55 = x$

b) Develop an equation to determine the cost of the T-shirts. Explain the meaning of the numerical coefficient.

c) What would it cost to make 378 T-shirts? $C = 15(378) + 125$

$C = \$5795$

d) If the school spent \$2345 for T-shirts, how many T-shirts were ordered? $2345 = 15(x) + 125$ $x = 148$

e) The school council has \$1800 available to spend. How many T-shirts can they order? Will they have any money left over? Explain.

$1800 = 15x + 125$

$1675 = 15x$

$111\frac{67}{3} = x$

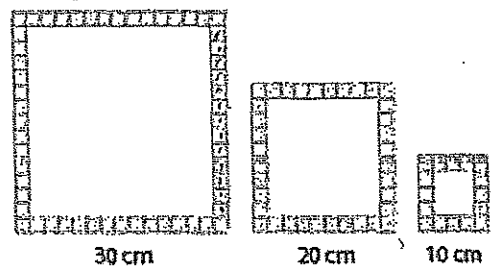
They can order 111 T-shirts

$C = 15(111) + 125$

$C = 1790$

$1800 - 1790 = \$10$
 left over

14. An art store sells square picture frames with a border of tiles that each measure 2 cm by 2 cm. The smallest frame is 10 cm by 10 cm and has 16 tiles.



| side length | # of tiles |
|-------------|------------|
| 10 | 16 |
| 20 | 36 |
| 30 | 56 |

$y = \frac{20x - 4}{10}$

(a) $y = 2x - 4$

$\frac{20}{10}$

a) Develop an equation to determine the number of tiles needed for each side length of frame.

b) How many tiles are needed to make a frame that is 50 cm by 50 cm?

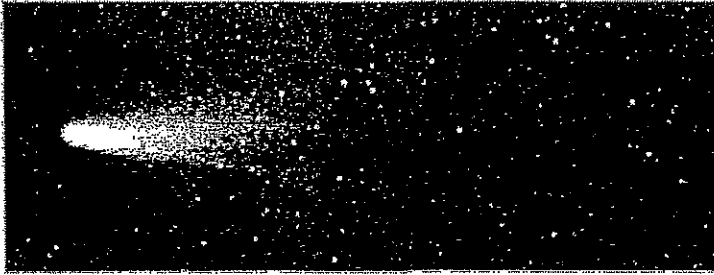
(b) $y = 2(50) - 4$
 $y = 96$

c) What are the dimensions of a square frame made with 196 tiles?

(c) $196 = 2x - 4$
 $200 = 2x$
 $100 = x$

100 cm x 100 cm

15. Halley's Comet was named after Edmund Halley. He predicted that the comet would appear in 1758. The comet appears approximately every 76 years.



(a)

| x | y |
|---|------|
| 1 | 1758 |
| 2 | 1834 |
| 3 | 1910 |
| 4 | 1986 |
| 5 | 2062 |
| 6 | 2138 |
| 7 | 2214 |

- a) Use a table to show the years of the next six sightings after 1758.
 b) When will Halley's Comet appear in your lifetime? How old will you be?
 c) Write an equation to predict the years when Halley's Comet will appear.
 d) Will Halley's Comet appear in the year 2370? How did you arrive at your answer?

(b) 2061
 (c) $y = 76x + 1682$
 (d) $2370 = 76x + 1682$
 $688 = 76x$
 $x = 9.05$

Extend

16. a) Find the pattern that expresses all the numbers that are 1 more than a multiple of 3.
 b) What is the 42nd number?
 c) How can your pattern test to see whether 45 678 is 1 more than a multiple of 3?

(a) $y = 3n + 1$

(b) $y = 3(42) + 1$
 $y = 127$

(c) $45678 = 3x + 1$
 $45677 = 3x$
 $15225.6 = x$

No!
 not a
 multiple
 of 3

17. a) Lodgepole pine trees need to be spaced 2.2 m apart. How long is a row of n trees? Write the equation.
 b) A pathway is 100 m long. You want to plant a line of lodgepole pine trees along both sides of the pathway. How many trees will you need? Will the trees be evenly spaced along the entire pathway?

$y = 2.2n$
 $100 = 2.2n$
 $45.5 = n$



18. a) Make a table of values for the first 5 terms of the number pattern -27, -18, -7, 6,
 b) Is the pattern linear? Explain how you know.
 c) Develop an equation to determine the value of each term in the number pattern.
 d) What is the value of the 103rd term?
 e) Which term has a value of 398?

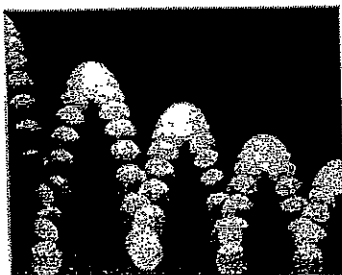
| term(+) | n |
|---------|-----|
| 1 | -27 |
| 2 | -18 |
| 3 | -7 |
| 4 | 6 |
| 5 | 21 |

b) Not linear - difference btwn consecutive pair of numbers is not the same

c) $n = t^2 + 6t - 34$?

- d) 11 193
 e) 18

19. A ball is dropped from a height of 2 m. The ball bounces to a height $\frac{2}{3}$ of the height it was dropped from. Each subsequent bounce is $\frac{2}{3}$ of the height of the previous bounce.



$$2 \times \frac{2}{3}$$

$$\frac{4}{3}$$

$$\frac{8}{9}$$

$$\frac{16}{27}$$

$$\frac{32}{81}$$

$$\frac{64}{243}$$

- Make a table of values for the first 5 bounce heights in the pattern.
- Is the pattern linear? Explain how you know.
- What equation can you use to determine the bounce height in relation to the number of bounces?
- What is the height of the 4th bounce?
- Which bounce has a height of approximately 0.117 m?

| X | Y |
|---|------------------|
| 1 | $\frac{4}{3}$ m |
| 2 | $\frac{8}{9}$ |
| 3 | $\frac{16}{27}$ |
| 4 | $\frac{32}{81}$ |
| 5 | $\frac{64}{243}$ |

$\left. \begin{matrix} \frac{4}{3} \\ \frac{8}{9} \end{matrix} \right\} \times \frac{2}{3}$
 $\left. \begin{matrix} \frac{8}{9} \\ \frac{16}{27} \end{matrix} \right\} \times \frac{2}{3}$
 $\left. \begin{matrix} \frac{16}{27} \\ \frac{32}{81} \end{matrix} \right\} \times \frac{2}{3}$
 $\left. \begin{matrix} \frac{32}{81} \\ \frac{64}{243} \end{matrix} \right\} \times \frac{2}{3}$

$$Y = \frac{2}{3}x + \frac{2}{3}$$

$$Y = \frac{2}{3}(2) + \frac{2}{3} \times$$

not linear

$$h = 2 \left(\frac{2}{3} \right)^b$$

← bounce #

| X | Y |
|---|------------------|
| 1 | $\frac{4}{3}$ |
| 2 | $\frac{8}{9}$ |
| 3 | $\frac{16}{27}$ |
| 4 | $\frac{32}{81}$ |
| 5 | $\frac{64}{243}$ |

$\left. \begin{matrix} \frac{4}{3} \\ \frac{8}{9} \end{matrix} \right\} - \frac{4}{9}$
 $\left. \begin{matrix} \frac{8}{9} \\ \frac{16}{27} \end{matrix} \right\} - \frac{8}{27}$
 $\left. \begin{matrix} \frac{16}{27} \\ \frac{32}{81} \end{matrix} \right\} - \frac{16}{81}$