

# Unit 7: Linear Relations

## 1. Representing Patterns

→ Create a table of values for a pattern.

x	y
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→ Create a linear equation.

$$y = mx + b$$

• solve for  $m$  using:

$$m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$$

$y_1, y_2$  are  $y$ -coordinates

$x_2, x_1$  are  $x$ -coordinates

• solve for  $b$  by substitution using a third  $x$  &  $y$  coordinate.

Example equation:  $y = 3x + 5$  \* leave  $x$  &  $y$  as variables.  
 $\uparrow$   $\uparrow$   
 $m$   $b$

→ Verify the equation.

↳ Substitute for  $x$  and  $y$  then perform a "check".

## Examples:

1.



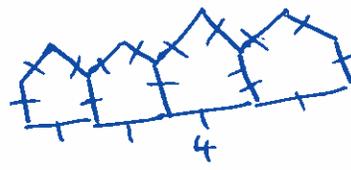
1



2



3



4

Fig.

a) Make a table of values for the pattern above.

Figure (x)	1	2	3	4
# of sides (y)	5	9	13	17

"Touching" sides count only as 1 side.

b) Describe the relationship between the number of pentagons and the number of sides.

# of pentagons: 1, 2, 3, 4 (increase by 1)

# of sides: 5, 9, 13, 17 (increase by 4)

As the number of pentagons increase by 1, the number of sides increase by 4.

c) Find a linear equation for this pattern.

	$x_1$	$x_2$	$x_3$	$x_4$
$x$	1	2	3	4
$y$	5	9	13	17
	$y_1$	$y_2$	$y_3$	$y_4$

$$m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$$

$$= \frac{(9 - 5)}{(2 - 1)}$$

$$= \frac{4}{1}$$

$$= 4$$

$$m = 2$$

\* BEDMAS  
Brackets 1st!

$$y = mx + b$$

$$y = 2x + b$$

Use a third point.  
( $x_3, y_3$ ) or  
( $x_4, y_4$ )

$$13 = 2(3) + b$$

$$13 = 6 + b$$

$$7 = b$$

$$y = mx + b$$

$$y = 2x + 7 \leftarrow \text{equation.}$$

$$\begin{array}{l} x - \text{Figure \#} \\ y - \text{\# of sides} \end{array} \leftarrow \text{"x" statement.}$$

d) How many sides would a shape with 18 pentagons have?

Sides =  $y$

pentagons =  $x = 18$

$$y = 2x + 7 \quad (\text{from c})$$

$$y = 2(18) + 7$$

$$y = 36 + 7$$

$$y = 43$$

18 pentagons would have 43 sides.

e) How many pentagons would yield 33 sides?

pentagons =  $x$

sides =  $y = 33$

$y = 2x + 7$

$33 = 2x + 7$

$$\begin{array}{r} 33 = 2x + 7 \\ -7 \quad -7 \\ \hline \end{array}$$

$26 = 2x$

$$\frac{26}{2} = \frac{2x}{2}$$

$13 = x$

13 pentagons would have 33 sides.

2. 5, 11, 17, ...

a) Make a table of values for the 1st 5 terms.

$x$ (term)	1	2	3	4	5
$y$ (value of term)	5	11	17	23	29

$\overset{+1}{\curvearrowright}$     $\overset{+1}{\curvearrowright}$   
 $\overset{+6}{\curvearrowright}$     $\overset{+6}{\curvearrowright}$

b) Find the equation for the pattern.

$y = mx + b$

$m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$

$= \frac{(29 - 5)}{(5 - 1)}$

$= \frac{24}{4}$

$= 6$

$y = 6x + b$

$11 = 6(2) + b$

$11 = 12 + b$

$11 = 12 + b$

$-12 \quad -12$

$-1 = b$

$y = 6x + b$

$y = 6x + (-1)$

$y = 6x - 1$

$y$  - value of term  
 $x$  - term number



c) What is the value of the 106<sup>th</sup> term?

$$y = 6x - 1$$

$$y = 6(106) - 1$$

$$y = 636 - 1$$

$$\boxed{y = 635}$$

The 106<sup>th</sup> term would be 635.

d) Which term would equal 311?

$$y = 6x - 1$$

$$311 = 6x - 1$$

$$311 = 6x - 1$$

+1                    +1

$$312 = 6x$$

$$\frac{312}{6} = \frac{6x}{6}$$

$$\boxed{52 = x}$$

The 52<sup>nd</sup> term would be 311.

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