4.1 Writing Equations To Describe Patterns

FOCUS **Use equations to describe and solve problems involving patterns.**

Example 1 Writing an Equation to Represent a Written Pattern

Here is a pattern made with sticks.

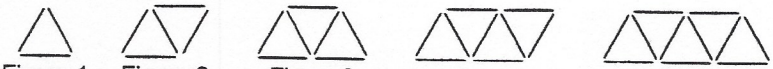


Figure 1 Figure 2 Figure 3 Figure 4 Figure 5

a) Write an equation that relates the number of sticks to the figure number.

b) What is the number of sticks in the 10th figure?

Solution

a) Record the number of sticks in each figure in a table.

Figure Number, f	Number of Sticks, n
1	3
2	5
3	7
4	9
5	11

+1, +1, +1, +1 (between the Figure Number values)

+2, +2, +2, +2 (between the Number of Sticks values)

As the figure number increases by 1, the number of sticks increases by 2. Repeated addition of 2 is the same as multiplication by 2.

So, the equation $n = 2f$ may represent the relationship.

Check whether the equation is correct.
When $f = 1$, $n = 2(1) = 2$
This is 1 less than 3.
So, add 1.
$2(1) + 1 = 3$

So, an equation is: $n = 2f + 1$

Figure Number, f	Number of Sticks, n
1	$2(1) + 1 = 3$
2	$2(2) + 1 = 5$
3	$2(3) + 1 = 7$
4	$2(4) + 1 = 9$
5	$2(5) + 1 = 11$

$2f + 1$ represents the number of sticks for any figure number f.

b) To find the number of sticks in the 10th figure, substitute $f = 10$ in the equation:

$n = 2f + 1$
$= 2(10) + 1$
$= 20 + 1$
$= 21$

There are 21 sticks in the 10th figure.

Check

1. For the table below:

Number of Swings, s	Number of Hits, h
1	5
2	9
3	13
4	17

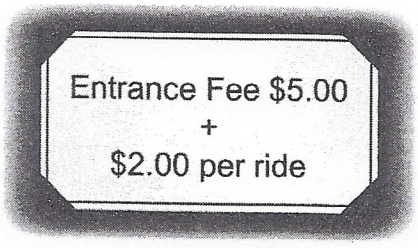
a) Describe the number of hits in terms of the number of swings.
The number of hits is _____ times the number of swings, plus _____.

b) Write an equation to describe the relationship.
$h =$ _____$s +$ _____

c) Use your equation to find h when $s = 10$.
$h =$ _____
_____
_____

Example 2 Writing an Equation to Represent a Situation

Teagan goes to a carnival. The cost for a ride is shown on a poster at the entrance.



a) Write an equation that relates the total cost, C dollars, to the number of rides, r.

b) Teagan goes on 4 rides. What is his total cost?

Solution

a) The cost is \$5.00, plus \$2.00 per ride.
That is, the cost is: $5.00 + 2.00 \times$ (number of rides)
An equation is: $C = 5.00 + 2.00r$

b) Use the equation: $C = 5.00 + 2.00r$
Substitute: $r = 4$
$C = 5.00 + 2.00(4)$
$= 5.00 + 8.00$
$= 13.00$
Teagan's total cost is \$13.00.

Check

1. Marcel takes a summer job at a book packaging plant.
He gets paid \$50 a day, plus \$2 for every box packed.

a) Write an equation that relates the number of boxes packed to Marcel's pay for a day.
Let P represent his pay for one day, and let b represent the number of boxes packed.
$P =$ _____

b) Marcel packed 20 boxes one day. How much did he get paid?
$P =$ _____
$=$ _____
$=$ _____
Marcel got paid _____.

Practice

1. In each equation, find the value of T when $n = 6$.

a) $T = 8 + n$

$T = 8 +$ ____

$=$ _____

b) $T = 3n - 2$

$T = 3$____ $- 2$

$=$ _____

$=$ _____

c) $T = 12n + 9$

$T =$ _____

$=$ _____

$=$ _____

d) $T = 7n + 3$

$T =$ _____

$=$ _____

$=$ _____

2. a) This pattern of dots continues. Draw the next 2 figures in the pattern.

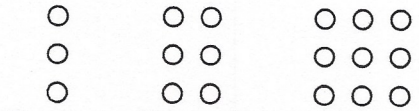


Figure 1 Figure 2 Figure 3 _____ Figure 4 _____ Figure 5

b) The pattern is represented in a table of values. Which expression below represents the number of dots in terms of the figure number?

i) $2f$

ii) $3f$

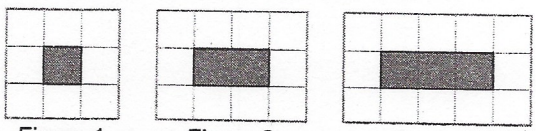
iii) $-3f$

iv) $3f + 1$

_____

Figure Number, f	Number of Dots, n
1	3
2	6
3	9
4	12
5	15

3. a) Look at the pattern of tiles below. Draw the next 2 figures in the pattern.



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