Math 9
Ch. 4 – Linear Relations

Name: ____________________
Block: _____

4.1 – Writing Equations to Describe Patterns

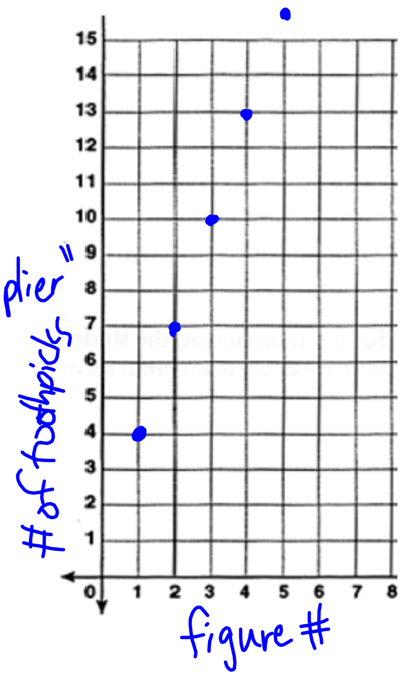
Ex. 1: Look at the following pattern made with toothpicks:

We can record the number of toothpicks in each figure in a table of values

or in a graph:

x: Figure number (f)	y: Number of toothpicks (t)
0	1
1	4
2	7
3	10
4	13
5	16

(+1 between consecutive figure numbers; −3 from 4 back to 1; +3 between consecutive numbers of toothpicks — "multiplier")



(a) Describe the patterns in the table.

As the figure # increases by 1, the # of toothpicks increases by 3.

Since a steady increase in the figure number (+1) produces a steady change in the number of toothpicks (+3), the points fall on a straight line when graphed. So, this is called a linear relation.

(b) Write an equation that relates t to f.

$$t = 3f + 1$$

3 ← multiplier; 1 ← # of toothpicks if figure # was zero

(c) If the pattern continued, how many toothpicks would be in the 24th figure?

$t = 3f + 1$

$f = 24$

$t = 3(24) + 1$

$t = 73$ toothpicks

(d) What figure number has 100 toothpicks?

$t = 100$

$t = 3f + 1$

$100 = 3f + 1$

$-1 \quad -1$

$\frac{99}{3} = \frac{3f}{3} \Rightarrow f = 33$ ∴ figure 33

Ex. 2: Write an equation that relates distance from home to driving time given the following data:

Driving time (t)	Distance from home (d)
0	14
+1 → 1 min	11 km
2 min	8 km
+1 → 3 min	5 km

−3 ← multiplier

−3

$d = -3t + 14$

check: $d = -3(3) + 14 = -9 + 14 = 5$ ✓

Ex. 3: A large pizza with tomato sauce and cheese costs \$13.95. Each additional topping costs \$1.50.

Number of extra toppings (t)	Cost (C)
0	13.95
+1 → 1	15.45
2	16.95
+1 → 3	18.45

+1.50

+1.50

(a) Write an equation that relates cost (C) to the number of additional toppings (t).

$C = 1.50t + 13.95$

(b) A pizza costs \$30.45. How many toppings does it have?

$C = 30.45$ $\quad 30.45 = 1.50t + 13.95$

$-13.95 \qquad -13.95$

$\frac{16.50}{1.50} = \frac{1.50t}{1.50}$

$11 = t$ ∴ 11 toppings