**MARCH 11, 2019**

**UNIT 6: LINEAR RELATIONS**

# 4.1: WRITING EQUATIONS TO DESCRIBE PATTERNS

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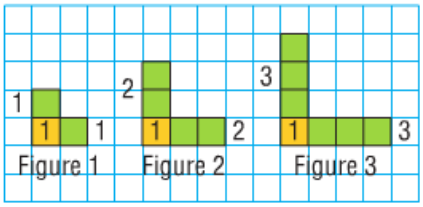
***MATH 9***

## WHAT'S THE POINT OF TODAY'S LESSON?

**We will begin working on the Math 9 Specific Curriculum Outcome (SCO) "Patterns and Relations 1" OR "PR1" which states:**

**"Generalize a pattern arising from a problem-solving context using linear equations and verify by substitution."**

# CHAPTER 4: LINEAR RELATIONS

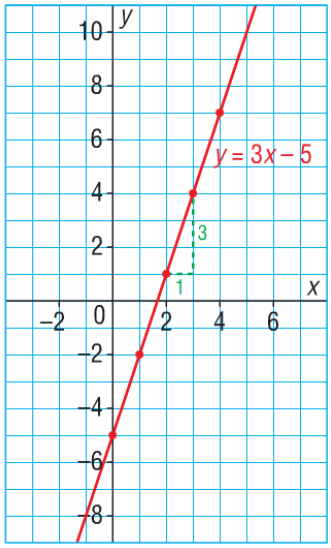



$b = 1 + 2f$

$b = 1 + 2(100)$
$= 1 + 200$
$= 201$

| x | y |
|---|---|
| 0 | −5 |
| 1 | −2 |
| 2 | 1 |
| 3 | 4 |
| 4 | 7 |

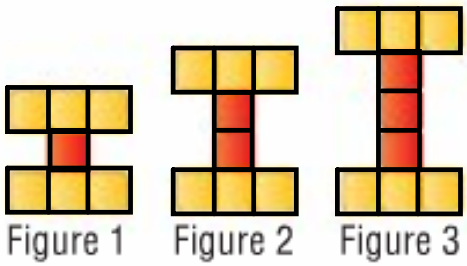
+1 +3 +1 +3 +1 +3 +1 +3



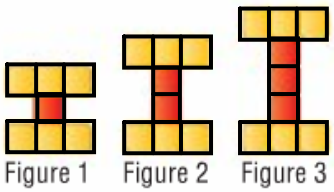

**PLEASE TURN TO PAGE 150 IN *MMS9*.**

## SECTION 4.1: WRITING EQUATIONS TO DESCRIBE PATTERNS

**Here is a pattern made from square tiles:**




1. **What stays the same in each figure?** 6
2. **What changes?** upright




3. **How can we determine the number of square tiles in any figure in the pattern?**

$n = 6 + f$

4. **How many tiles would there be in figure 15?**

$n = 6 + f$
$= 6 + 15$
$= 21$

5. **Suppose there are 33 tiles in a figure. What is its figure number?**

$n = 6 + f$
$-6 \quad -6$
$33 = 6 + f$
$27 = f$

**A banquet hall has small square tables that seat 1 person on each side. The tables can be pushed together to form longer tables.**


1. **Sketch the next 2 arrangements in the pattern.**

2. **What stays the same in each arrangement? What changes?**

1. 

4 tables

5 tables

2. What stays the same in each arrangement? What changes? # on sides 2 on the end.

$p = 2 + 2t$

3. What strategies can you use to determine the number of people at 6 tables? 10? 25?

6 tables
$p = 2 + 2(6)$
$= 2 + 12$
$= 14$

10 tables
$p = 2 + 2t$
$= 2 + 2(10)$
$= 2 + 20$
$= 22$

25 tables
$p = 2 + 2t$
$= 2 + 2(25)$
$= 2 + 50$
$= 52$

**Compare and discuss your strategies with your neighbour(s). (2 minutes)**

**Did anyone you spoke with come up with an equation to relate the number of people, "p", to the number of tables, "t"? If not, please try to do so together now. Remember, an equation has an "=" sign in the middle. Test out your equation to make sure it works. (2 minutes)**

**EQUATION:** $p = 2t + 2$

**Use this equation to determine:**

**a) the number of people at 30 tables**

$p = 2t + 2$
$= 2(30) + 2$
$= 60 + 2$
$= 62$ people seated at 30 tables

**b) the number of tables needed to seat 30 people**

$p = 2t + 2$
$30 - 2 = 2t + 2 - 2$
$\frac{28}{2} = \frac{2t}{2}$
$t = 14$
14 tables are needed to seat 30 people.

**a) the number of people at 30 tables**

$$\begin{aligned} p &= 2t + 2 \\ p &= 2(30) + 2 \\ p &= 60 + 2 \\ p &= 62 \end{aligned}$$

**There are 62 people at 30 tables.**

**b) the number of tables needed to seat 30 people**

$$
\begin{aligned}
p &= 2t + 2 \\
30 &= 2t + 2 \\
30 - 2 &= 2t + 2 - 2 \\
\frac{28}{2} &= \frac{2t}{2} \\
14 &= t
\end{aligned}
$$

**14 tables are needed to seat 30 people.**

**A landscape designer uses wooden boards as edging for the plots in an herb garden.**


**The number of boards ("b") is related to the number of plots ("p"). This relationship can be represented in different ways:**

- **using pictures** ✓
- **using a table of values** ✓
- **using an equation** ✓

| plot | boards |
|---|---|
| 1 | 4 |
| 2 | 7 |
| 3 | 10 |
| 4 | 13 |

$b = 3p + 1$

**Let's determine the equation using a table of values:**

| Number of Plots, *p* | Number of Boards, *b* |
|---|---|
| 1 | 4 |
| 2 | 7 |
| 3 | 10 |
| 4 | 13 |

**Repeated addition of 3 is the same as multiplication by 3. Maybe b = 3p is a good place to start to determine the equation.**

**EQUATION: b = 3p + 1**

| Number of Plots, *p* | Number of Boards, *b* |
|---|---|
| 1 | 3(1) + 1 = 4 |
| 2 | 3(2) + 1 = 7 |
| 3 | 3(3) + 1 = 10 |
| 4 | 3(4) + 1 = 13 |

**Since the left side equals the right side of the equation each time, the equation is correct. Please turn to page 156 in *MMS9* to see how this equation also ties into the pattern in the pictures of the herb garden plots.**

**An airplane is cruising at a height of 10 000 m. It descends to land. The table below shows the height of the plane every minute after it began its descent.**

| Time ($t$ minutes) | Height ($h$ metres) |
|---|---|
| 0 | 10 000 |
| 1 | 9 700 |
| 2 | 9 400 |
| 3 | 9 100 |
| 4 | 8 800 |

**a) Write an expression for the height in terms of the time since the plane began its descent.**

use 0 $-300t + 10\,000$ $-300(1)+10000 = 9700$

$-300(2)+10000 = 9400$

**b) Write an equation that relates the height of the plane, $h$, to the time, $t$, since it began its descent.**

$h = -300t + 10000$

**c) What is the height of the plane after 15 min.?**

$h = -300t + 10000$

$= -300(15) + 10000$

$= -4500 + 10000$

$= 5500$ m

**d) How long after beginning its descent does the plane land?**

$h = -300t + 10\,000$

$-10000 \quad 0 = -300t + 10000 - 10000$

$\frac{-10\,000}{-300} = \frac{-300t}{-300}$

$33.\overline{3}$ min $= t$

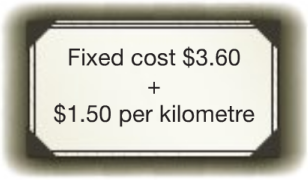
**a) 10 000 - 300t**

**b) h = 10 000 - 300t**

**c) h = 10 000 - 300t**
**h = 10 000 - 300(15)**
**h = 10 000 - 4 500**
**h = 5 500 m**

**d)**
$$h = 10\,000 - 300t$$
$$0 = 10\,000 - 300t$$
$$0 + 300t = 10\,000 - 300t + 300t$$
$$\frac{300t}{300} = \frac{10\,000}{300}$$
$$t = 33.\overline{3}$$
$$t \doteq 33.3 \text{ min.}$$

**I called "Kelly's Cabs" for a taxi. The cost of a ride is shown on a poster in the cab:**




**a) Write an expression for the fare in terms of fixedcost and the cost per km, *d*.**

$3.60 + 1.50d$

**b) Write an equation that relates the fare, *f*, to the distance travelled, *d*.**

$f = 3.60 + 1.50d$

**c) What is the fare for an 11 km ride?**

$f = 3.60 + 1.50d$
$= 3.60 + 1.5(11)$
$= 3.60 + 16.5$
$= \$20.10$

**d) What is the distance traveled if the fare is $35.10 ?**

$f = 3.60 + 1.50d$
$35.10 = 3.60 + 1.50d$
$-3.60 \quad -3.60$
$\frac{31.50}{1.5} = \frac{1.5d}{1.5}$
$21\text{Km} = d$

**a)** $1.50d + 3.60$

**b)** $f = 1.50d + 3.60$

**c)**
$f = 1.50(11) + 3.60$
$f = 16.50 + 3.60$
$f = 20.10$

**The fare for an 11 km ride is $20.10 .**

**d)**
$f = 1.50d + 3.60$
$35.10 = 1.50d + 3.60$
$35.10 - 3.60 = 1.50d + 3.60 - 3.60$
$\frac{31.50}{1.50} = \frac{1.50d}{1.50}$
$21 = d$

**The distance traveled is 21 km.**

PLEASE TURN TO PAGE 158 IN *MMS9.*

*"Discuss the Ideas":*

1. diagrams, words, tables of values, expressions, equations

2. Diagrams provide good visual representation, but are difficult to use when patterns need to be extended.

   Words will explain the relationship but may not be helpful in solving problems about the relationship.

   Tables of values provide an organized way of presenting the relationship, and the change can be easily identified, but they are not useful in determining a value that extends well beyond the information in the table.

   Expressions and equations are more difficult to find initially but help solve problems quickly once they are determined.

3. a) Substitution of a matching pair of values into the equation. Make sure the left side (LS) equals the right side (RS).

   b) Check the increase or decrease in the table first, then check the constant.

# DETERMINE THE EQUATION ASSOCIATED WITH THE RELATIONSHIP IN THE FOLLOWING TABLE OF VALUES:

| x | y |
|---|---|
| 10 | 24 |
| 11 | 26 |
| 12 | 28 |
| 13 | 30 |
| 14 | 32 |

+1 +1 +1 +1 +2 +2 +2 +2

**EQUATION: $y = 2x + 4$**

# HOMEWORK QUESTIONS???

# (PAGE 159, #4 TO #7)

## DETERMINE THE EQUATION ASSOCIATED WITH THE RELATIONSHIP IN THE FOLLOWING TABLE OF VALUES:

| x | y |
|---|---|
| 10 | 500 |
| 11 | 450 |
| 12 | 400 |
| 13 | 350 |
| 14 | 300 |

**EQUATION:**

# CONCEPT REINFORCEMENT:

***MMS9:***

**PAGE 159: ALL! (#4 to #10)**
**PAGE 160: ALL! (#11 to #14)**
**PAGE 161: #15 to #17**
**PAGE 162: ALL! (#19 to #21)**
**PAGE 181: #1 and #2**
**PAGE 201: #1 to #3**