**UNIT 8: Linear Relationships and Linear Equations**

*TOPICS:*

* *9.1 Writing a Pattern Rule*
* *9.2 Evaluating an Expression to Solve a Problem*
* *9.4 Linear Relations and Their Graphs*
* *9.5 Solving Equations*
* *9.6 Solving Equations Using Models and Drawings*
* *9.7 Solving Equations by Graphing*

***NOTE: Content and assignments taken from Math Power 7***

**9.1 Writing a Pattern Rule**

A **relation** allows you to use one number to get information about another number.

Examples: Y = 3n

Johnny has $5 more than Jill

Two more than a number

Ex. 1) Using the figure on p376, complete the table below:

|  |  |  |  |
| --- | --- | --- | --- |
| Figure # | # green tiles | # orange tiles | Total # of tiles. |
| 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |
| 6 |  |  |  |

1. Use words to explain the relationship between the # of orange tiles in a figure and its figure number.
2. Using the variable n to represent the figure #, write an algebraic expression that tells us how to calculate the # of orange tiles.
3. Use words to explain the relationship between the total number of tiles and its figure number.
4. Write an algebraic expression telling us how to calculate the total # of tiles using the figure # n.

**Constant Term** – a quantity that does not change.

*A quantity that does not contain any variables. If there is no term, then the constant term is zero. Example: 3x + 5 C.T. = 5*

*4n C.T. = 0*

**Numerical Coefficient** – the number that is the multiplier of a variable.

*Example: 3x +5 N.C. = 3*

1. Identify the **constant term** and the **numerical coefficient** in your algebraic expression.

Ex. 2) A plumber charges $45 an hour for work done.

* 1. Fill the table below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| # hours worked | 0 | 1 | 2 | 3 |
| Money made |  |  |  |  |

* 1. Using words explain the relationship between number of hours worked and the amount of money made.
  2. Representing the amount of money with the variable A and the hours worked as n, write an algebraic expression.
  3. Constant term = Numerical Coefficient =

Ex. 3) Look at Figure 1-4 in example 2 on p378.

* 1. Using words, explain the relationship between the figure number and the total number of tiles.
  2. Using T to represent the figure number and n to represent the total number of tiles, write an algebraic expression.

ASSIGNMENT: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**9.2 Evaluating an Expression to Solve a Problem**

Ex. 1 Evaluate each expression for a = 3 and b = 5

1. 5a b.) 4 + a c.) 2b – a
2. 3b – 2 e.) 5a – 2b f.) 2(a + 2)

Ex. 2 Write an expression for each statement

1. $10 for each child to go into the movie
2. The hotdogs cost $2 each
3. It costs $30 per hour plus $50 for an electrician
4. The sweaters cost $35 each
5. The company charges $10 plus $2 per letter to write on a shirt.

Ex. 3 The grade 7 class is going on a school camping trip and needs to find the cheapest bus service.

***Company A charges $8 per student.***

***Company B charges $200 plus $3 per student.***

1. Write an expression representing what each company costs (M) for any number of students (n)

Company A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Company B \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. If there are 60 students going on the trip, using your expressions above, determine which company is cheaper.

***Cost of Company A*** ***Cost of Company B***

ASSIGNMENT: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**9.4 Linear Relationships and their Graphs**

**Linear Relation** – a relation whose plotted points lie on a straight line.

Linear Relations are represented by equations. Equations tell us how to get the **output value** from an **input value**.

Y = 3x + 2 The input value is x and the output value is y.

If we input a value of x = 5, then we get an output value of y = \_\_\_\_\_\_

x 🡪 independent variable (horizon) y 🡪 dependent variable (vertical)

Together the input and output value form a **coordinate point** (x, y).

We use **table of values** to organize our coordinate points.

Ex. 1) Graph the points in the table of values below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| x | 0 | 1 | 2 | 3 |
| 2x + 1 |  |  |  |  |

Ex. 2) Create a table of values for the equation y = 3x + 2, then graph.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| x |  |  |  |  |
| 3x + 2 |  |  |  |  |

Ex. 3) Graph each of the expressions below on the same set of axes.

y = x + 1 y = 2x + 1 y = 3x + 1

1. What changed in each graph?
2. How does changing the numerical coefficient affect the graph?

Ex. 4) Graph each of the expressions below on the same set of axes.

y = x + 1 y = x + 2 y = x + 3

1. What changed in each graph?
2. How does changing the constant term affect the graph?

ASSIGNMENT: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***9.5 Solving Equations***

**Equation** – a statement that expresses equivalence.

4 + 2 = 6 3x + 2 = 17 3(2 – 1) + 8 = 11

**Solutions** involve finding the value that makes an expression true.

If 4n = 12, then n = 3. Any other number would make the statement untrue.

To solve for the missing number, we are going to follow the rule, **“What you do to one side of the equation, you need to do from the other”**

If you subtract one from the left side, you will subtract one from the right side as well. If you multiple the left side by three you will multiply the right by 3 as well.

**Operation Opposite Operation**

- 2 + 2

+ 4 - 4

x 3 ÷ 3

÷ 5 x 5

Ex. 1) Solve each equation below.

1. n + 5 = 12 b.) m – 2.7 = 8 c.) 5p = 32

d.) = 11 e.) 6n + 2 = 14 f.) 31 = 3m – 5

Ex. 2) Look at the pattern below.

ooo, ooooo, ooooooo, ooooooooo

1. Create a table of values to describe pattern.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Figure # | 0 | 1 | 2 | 3 |
| # of circles |  |  |  |  |

1. Identify the constant term and numerical coefficient.
2. Write an expression showing the relationship between the figure number and number of circles.
3. How many circles are in figure #12?
4. 43 circles make up what figure number?

Ex. 3) Tommy is saving up to buy a bike. He has $200 now and saves $25 per week from a paper route.

1. Write an expression that shows how much money (N) he has in relation to how many weeks (w) he has worked.
2. How much does he have after 6 weeks?
3. How many weeks does he need to work before he can afford a $725 bike?

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***9.6 Solving Equations Using Models and Drawings***

Ex. 1) Write each sentence as an expression, then solve.

1. The sum of a number and 6 is 18
2. Eight less than a number is 16
3. Eleven is two more than three times a number.

Ex. 2) Andrea has $736 in her bank account. Every month $15 is taken out to pay for a phone.

1. Write an expression showing how much money she has in her accounts (N) after a certain number of weeks (w).
2. How much money does she have left after 6 months?
3. How many months until she has $601 left in her account?

Ex. 3) Jill is setting up for a big dinner. She joins tables to create longer tables. A single square table can fit one person per side.

1. Draw a picture.
2. Write an expression showing how many people (p) she can sit compared with the number of tables she joins together in a straight line (n).
3. How many people can she sit together if she joins 5 tables together?
4. How many tables does she need to sit 32 people?

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***9.7 Solving Equations by Graphing***

y-axis – dependent variable x-axis – independent variable

**Y-intercept** – where the line crosses the y-axis. This will be at the point where x =0.

**How to get information about an equation from the table of values**

Ex. 1) Consider the follow table.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| X | 0 | 1 | 2 | 3 |
| Y | 5 | 7 | 9 | 11 |

1. What is the numerical coefficient?
2. What is the constant term?
3. Does this graph slope in the positive direction or negative direction?

Ex. 2) Consider the follow table.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| X | 0 | 1 | 2 | 3 |
| Y | 8 | 5 | 2 | -1 |

1. What is the numerical coefficient?
2. What is the constant term?
3. Does this graph slope in the positive direction or negative direction?

**Solving equations from graphs**

Ex. 3) Jill works mowing lawns. She gets paid $50 per day plus $15 per lawn.

1. Create a table of values comparing how much she makes is a day (M) with how many lawns she cuts (n).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| n | 0 | 1 | 2 | 3 |
| M |  |  |  |  |

1. Graph the table of values.
2. Use the graph to determine how many lawns she needs to mow to make $125 per day?

Ex. 4) John is deciding how to charge his customers for landscaping jobs. Option (A) he charges then $80 per day plus $15 per hour. Option (B) he charges $25 per hour.

1. Create a table of values and graph both lines on the same graph.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| X | 0 | 1 | 2 | 3 |
| Option A |  |  |  |  |
| Option B |  |  |  |  |

1. If he works 6 hours, how much does he make using Option A?
2. If he works 6 hours, how much does he make using Option B?
3. Which is the better option if he is only working 6 hours?
4. When is Option B better than Option A?

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