Chapter 1.2.1: Linear Expressions

MAT 1275CO
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Linear Expressions with One Variable

An expression that can be written as

$$Ax + B$$

with A and B numbers, is called a **linear expression (with one variable)**, or more specifically, a **linear expression in** x. Ax and B are called **terms**. A is called the coefficient of x and B is called the constant coefficient.

Examples:Decide if the following are linear expressions. If so, identify A and B such that $Ax + B$ is a linear expression.

- $\frac{2}{5}x - 6$
- $x \cdot x - 2x$
- 5
- $4y$

Linear Expressions with One Variable

Not all linear expressions look like $Ax + B$ but those that don't can be written so that any evaluation for the original and $Ax + B$ for well chosen A and B is the same for any value of x.

Examples:

- Find A and B such that $(3x - 2) - (-2x + 7)$ can be rewritten as $Ax + B$.
- Evaluate $(3x - 2) - (-2x + 7)$ and the rewritten form at $x = 0$ and $x = -2$.
- Show that $3(-3x + 2) - 2(x - 1) + 4x$ is a linear expression.

Applications of Linear Expressions with One Variable

Linear expressions have various applications.

Examples:

- If a string has length L and we cut off 2 in, what is the remaining length in terms of L? Use the formula to find the length remaining if we cut 2 in off a string of length 10 in.
- Write an expression that gives the perimeter of a square whose side is length x. Use the expression to find the perimeter of a square with side lengths 4 cm.

Linear Expressions with Two Variables

Sometimes there is more than one unknown quantity or more than one quantity that has varying values. This leads us to consider the simplest type of expression with two variables, namely, a linear expression. An example of a linear expression with two variables is

$$x + 5y - 7.$$

An expression that can be written as $Ax + By + C$ with A and B real numbers, not both zero, is called a **linear expression (with two variables)**, or more specifically, a **linear expression in x and y**.

Examples:

- Evaluate the linear expression $x + 5y - 7$ at $x = 4$ and $y = -2$.
- Evaluate the linear expression $2a - 3b - 2$ at $x = 8$ and $y = \frac{1}{3}$.

Linear Expressions with Two Variables

We can add two linear expressions to get another linear expression. To do this, we collect like terms.

Examples:Simplify.

- We can distribute multiplication over addition and subtraction.
  $3(2x - 6y + 2) + 3x - 3y$
- The 'opposite' of an expression is the one obtained by negating each term. To subtract an expression, we add its opposite.
  $7x + 15y + 4 - (2x - 7y - 1)$
- $6(a - 2b) - 3(2a - b + 5)$

Applications of Linear Expressions with Two Variables

Draw an appropriate picture and express the following quantities in terms of appropriate variables.

- The perimeter of a rectangle of length L and width W.
- The perimeter of an isosceles triangle with two sides of length x and one of length y.

NOTE:

- This idea can be extended in a clear way to more than two variables.
- We have also used the variables x, y, a, and b most often but it doesn't matter what you name the variables.