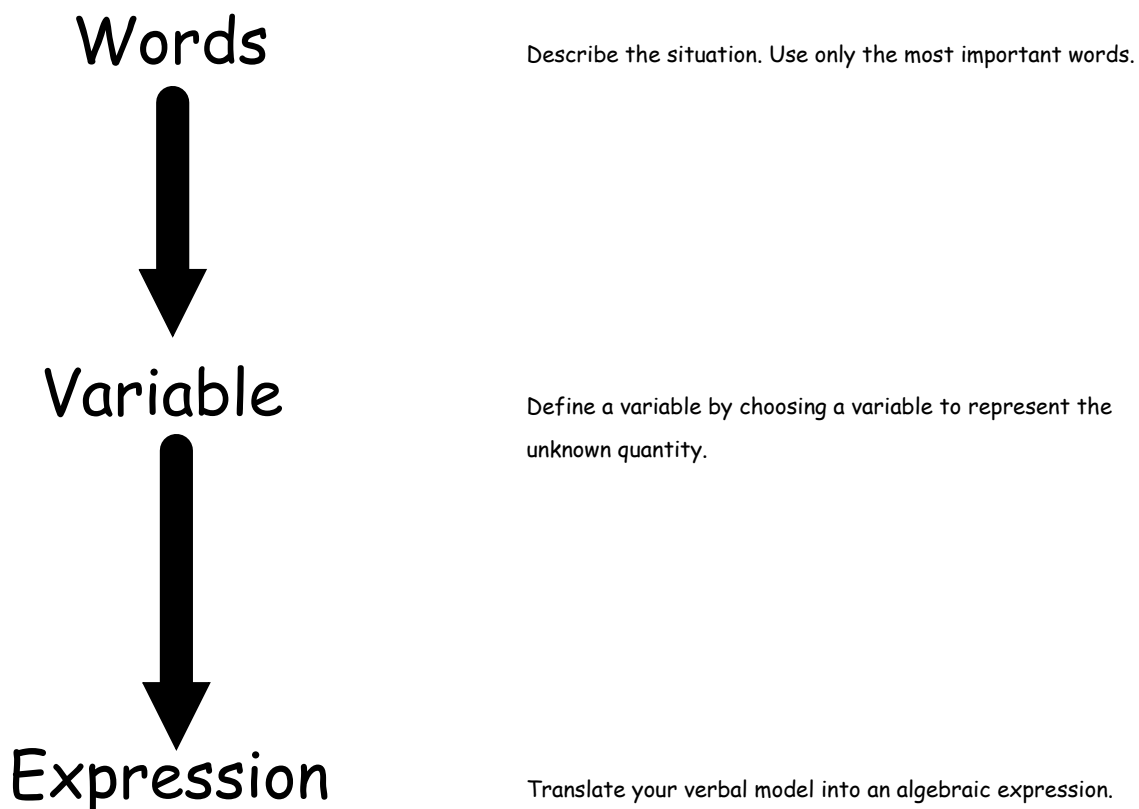


1.3 Variables & Expressions

ALGEBRA is a branch of mathematics that uses symbols. A variable is often used in algebra. A **VARIABLE** is a letter or symbol used to represent an unknown value.
Any letter can be used as a variable.

An expression like " $5m + 6$ " is an **ALGEBRAIC EXPRESSION** because it contains at least one variable and at least one mathematical operation.

The first step in translating verbal phrases into algebraic expressions is to choose a variable and a quantity for the variable to represent. This is called **DEFINING A VARIABLE**.
All of the steps involved in writing algebraic expressions are shown below:



Example: Translate each phrase into an algebraic expression.

a.) three dollars more than the cost of the sandwich

Let a be the cost of the sandwich

$$3 + a$$

b.) the difference of six times a number and 10

Let y be a number

$$6y - 10$$

c.) Mari had \$2 and made \$6 an hour babysitting

Let e be the hours babysitting.

$$2 + 6e$$

$$\text{or } 6e + 2$$

To evaluate an algebraic expression, replace the variable (or variables) with known values and then use the order of operations. When you replace a variable with a number, you are using the **SUBSTITUTION PROPERTY OF EQUALITY**.

Substitution Property of Equality

If two quantities are equal, then one quantity can be replaced by the other.

For all numbers a & b , if $a = b$, then a may be replaced by b .

Example: Evaluate each expression if $a = 4$, $b = 8$, and $c = 12$.

a.) $3a + 2c$

$$\begin{aligned} & 3 \cdot 4 + 2 \cdot 12 \\ & \underbrace{12} + 2 \cdot 12 \\ & 12 + 24 = \mathbf{36} \end{aligned}$$

b.) $\frac{ab}{12} = \frac{(4)(8)}{12}$

$$= \frac{32 \div 4}{12 \div 4}$$

$$= \frac{8}{3} \text{ or } 2\frac{2}{3}$$

c.) $c + (5b - 2a)$

$$\begin{aligned} & 12 + (5 \cdot 8 - 2 \cdot 4) \\ & 12 + (40 - 2 \cdot 4) \\ & 12 + (40 - 8) \\ & 12 + 32 = \mathbf{44} \end{aligned}$$

Example: A company rents a houseboat for \$200 plus an extra \$30 per day.

a.) Write an expression that can be used to find the total cost to rent a houseboat.

Let k be the number of days.

$$\boxed{200 + 30k}$$

b.) Suppose the Gregoran family wants to rent a houseboat for six days. What will be the total cost?

$$k = 6$$

$$200 + 30k$$

$$200 + 30(6)$$

$$200 + 180 = \mathbf{380}$$