

1.3

Algebraic Expressions

Focus Use a variable to represent a set of numbers.

We can use symbols to represent a pattern.

Explore



Tehya won some money in a competition.

She has two choices as to how she gets paid.

Choice 1: \$20 per week for one year

Choice 2: \$400 cash now plus \$12 per week for one year

Which method would pay Tehya more money?

For what reasons might Tehya choose each method of payment?



Reflect & Share

Work with another pair of classmates.

For each choice, describe a rule you can use to calculate the total money

Tehya has received at any time during the year.

Connect

We can use a variable to represent a number in an expression.

For example, we know there are 100 cm in 1 m.



We can write 1×100 cm in 1 m.

There are 2×100 cm in 2 m.

There are 3×100 cm in 3 m.

Recall that a variable is a letter, such as n , that represents a quantity that can vary.

To write an expression for the number of centimetres in any number of metres,

we say there are $n \times 100$ cm in n metres.

n is a variable.

n represents any number we choose.

We can use any letter, such as n or x , as a variable.

The expression $n \times 100$ is written as $100n$.

$100n$ is an **algebraic expression**.

Variables are written in italics so they are not confused with units of measurement.

Here are some other algebraic expressions, and their meanings.

In each case, n represents the number.

- Three more than a number: $3 + n$ or $n + 3$
- Seven times a number: $7n$
- Eight less than a number: $n - 8$
- A number divided by 20: $\frac{n}{20}$

$7n$ means $7 \times n$.

When we replace a variable with a number in an algebraic expression, we *evaluate* the expression. That is, we find the value of the expression for a particular value of the variable.

Example

Write each algebraic expression in words.

Then evaluate for the value of the variable given.

- a) $5k + 2$ for $k = 3$ b) $32 - \frac{x}{4}$ for $x = 20$

A Solution

- a) $5k + 2$ means 5 times a number, then add 2.

Replace k with 3 in the expression $5k + 2$.

Then use the order of operations.

$$\begin{aligned} 5k + 2 &= 5 \times 3 + 2 && \text{Multiply first.} \\ &= 15 + 2 && \text{Add.} \\ &= 17 \end{aligned}$$

- b) $32 - \frac{x}{4}$ means 32 minus a number divided by 4.

Replace x with 20 in the expression $32 - \frac{x}{4}$.

Then use the order of operations.

$$\begin{aligned} 32 - \frac{x}{4} &= 32 - \frac{20}{4} && \text{Divide first.} \\ &= 32 - 5 && \text{Subtract.} \\ &= 27 \end{aligned}$$

$\frac{x}{4}$ means $x \div 4$.

In the expression $5k + 2$,

- 5 is the **numerical coefficient** of the variable.
- 2 is the **constant term**.
- k is the *variable*.

The variable represents any number in a set of numbers.

Practice

1. Identify the numerical coefficient, the variable, and the constant term in each algebraic expression.
a) $3x + 2$ b) $5n$ c) $w + 3$ d) $2p + 4$
2. An algebraic expression has variable p , numerical coefficient 7, and constant term 9.
Write as many different algebraic expressions as you can that fit this description.
3. Write an algebraic expression for each phrase.
 - a) six more than a number
 - b) a number multiplied by eight
 - c) a number decreased by six
 - d) a number divided by four
4. A person earns \$4 for each hour he spends baby-sitting.
 - a) Find the money earned for each time.
 - i) 5 h
 - ii) 8 h
 - b) Write an algebraic expression you could use to find the money earned in t hours.
5. Write an algebraic expression for each sentence.
 - a) Double a number and add three.
 - b) Subtract five from a number, then multiply by two.
 - c) Divide a number by seven, then add six.
 - d) A number is subtracted from twenty-eight.
 - e) Twenty-eight is subtracted from a number.
6. a) Write an algebraic expression for each phrase.
 - i) four more than a number
 - ii) a number added to four
 - iii) four less than a number
 - iv) a number subtracted from fourb) How are the expressions in part a alike?
How are they different?



7. Evaluate each expression by replacing x with 4.

a) $x + 5$

b) $3x$

c) $2x - 1$

d) $\frac{x}{2}$

e) $3x + 1$

f) $20 - 2x$

8. Evaluate each expression by replacing z with 7.

a) $z + 12$

b) $10 - z$

c) $5z$

d) $3z - 3$

e) $35 - 2z$

f) $3 + \frac{z}{7}$

9. **Assessment Focus** Jason works at a local fish and chips restaurant.

He earns \$7/h during the week, and \$9/h on the weekend.

a) Jason works 8 h during the week and 12 h on the weekend.

Write an expression for his earnings.

b) Jason works x hours during the week and 5 h on the weekend.

Write an expression for his earnings.

c) Jason needs \$115 to buy sports equipment. He worked 5 h on the weekend.

How many hours does Jason have to work during the week to have the money he needs?



10. **Take It Further** A value of n is substituted in each expression to get the number in the box.

Find each value of n .

a) $5n$

30

b) $3n - 1$

11

c) $4n + 7$

15

d) $5n - 4$

11

e) $4 + 6n$

40

f) $\frac{n}{8}$

5

Reflect

Explain why it is important to use the order of operations when evaluating an algebraic expression.

Use an example in your explanation.