

# KEY POINTS

## Section 1.3 Equivalent Expressions

- When are expressions equivalent?
- Evaluating expressions to see when they are equal
- Constructing expressions

## Section 1.4 Equivalent Equations

- When are equations equivalent?
- Valid operations on equations
- Isolating variables
- The difference between equivalent equations and equivalent expressions.

# Warm - Up

Section 1.3  
Equivalent  
Expressions

Write about how expressions and equations are similar and different.

# Share Out

Section 1.3  
Equivalent  
Expressions

## Similarities

Equations have expressions  
Show process  
Both have variables  
Both have numbers

## Differences

Equations have = sign  
Expressions don't have = sign  
Equations are solved  
Expressions are evaluated

# Examples

## Example #1

You are given two expressions that you have to determine if they are equal or not.

### Section 1.3

### Equivalent Expressions

$$t = 0$$

$$t = 4$$

$$\frac{t}{2} = \frac{0}{2} = 0$$

$$= \frac{4}{2} = 2$$

$$\frac{1}{2}t = \frac{1}{2}(0) = 0$$

$$= \frac{1}{2}(4) = 2$$

How can we determine if these two expressions are equal?

Substitute a value in  
Set equal to each other to solve for  $t$ .  
Simplify terms

# Examples

Using what we know determine if the following expressions are equivalent or not.

Section 1.3  
Equivalent  
Expressions

$$\begin{aligned} a &= 3 \\ b &= 6 \\ c &= 3 \end{aligned}$$

$$\sqrt{x+y}$$

$$\sqrt{16+9}$$

$$\sqrt{25} = 5$$

$$\frac{a}{b+c} = \frac{3}{6+3} = \frac{3 \div 3}{9 \div 3} = \frac{1}{3}$$

$$\sqrt{x} + \sqrt{y}$$

$$\sqrt{16} + \sqrt{9}$$

$$4 + 3 = 7$$

$$\frac{a}{b} + \frac{a}{c} = \frac{3}{6} + \left(\frac{3}{3}\right)^2 = \frac{3}{6} + \frac{6}{6} = \frac{9 \div 3}{6 \div 3} = \frac{3}{2}$$

# Examples

Using what we know determine if the following expressions are equivalent or not.

Section 1.3  
Equivalent  
Expressions

$$\frac{(9+6x)}{3}$$

$$2 \cdot x^2$$

$$(9 + 6x) / 3$$

$$x=3$$

$$(9+18)/3$$

$$9 =$$

$$2x^2$$

$$x=3$$

$$2(3)^2$$

$$2(9) = 18$$

$$18 \neq 36$$

$$3 + 6x$$

$$3 + 18$$

$$21$$

$$(2x)^2 = (2 \cdot x)^2$$

$$(2(3))^2$$

$$6^2 = 36$$

# Examples

## Section 1.3 Equivalent Expressions

Example #2

Italian coffee costs 7 dollars per pound and Kenyan coffee costs 10 dollars per pound. Write an expression for the total amount spent on these coffees if you buy  $m$  pounds of Italian coffee and  $n$  pounds of Kenyan coffee.

$$7m + 10n$$

1, 2, 3

$$n + (n+1) + (n+2)$$

Write an expression for the sum of three consecutive integers, if the first integer is  $n$ .

$$n + m + p$$

$$3n + 2m - 5p$$

$$10n + 200 + 30p$$

$$n + n + n$$

$$(1)n + 2n + 3n$$

# Examples

## Section 1.3 Equivalent Expressions

When we say that two expressions, such as  $x + x$  and  $2x$ , are equivalent we are really saying: "For all numbers  $x$ , we have  $x + x = 2x$ ." This statement looks like an equation.

In order to distinguish this use of equations, we refer to  $x + x = 2x$  as an **identity**.

An **identity** is really a special equation, one that is satisfied by all values of the variables

$$\begin{array}{ll} x=2 & x=100 \\ 2+2=2(2) & 100+100=2(100) \\ 4=4 & 200=200 \end{array}$$



# Practice

## Section 1.3 Equivalent Expressions

Find a value for  $x$  that will show the two expressions are not equivalent

$$2(x+4)$$

$$2x + 8 \quad \text{and} \quad x + 4$$

$$x=2$$

$$\begin{array}{l} 2(2)+8 \\ 4+8 \\ 12 \end{array}$$

$$\begin{array}{l} 2+4 \\ 6 \end{array}$$

$$\begin{array}{l} 2(10)+8 \\ 28 \end{array}$$

$$\begin{array}{l} 10+4 \\ 14 \end{array}$$

Are the expressions equivalent?

$$x=6$$

$$y=3$$

$$z=2$$

$$(x - y) + z$$

$$\begin{array}{l} (6-3)+2 \\ 3+2 \\ 5 \end{array}$$

and

$$x - (y + z)$$

$$\begin{array}{l} 6-(3+2) \\ 6(5) \\ 1 \end{array}$$

# Practice

## Section 1.3 Equivalent Expressions

Are the following equations identities?

$$3x + 1x = 4x \quad 4x = 4x$$

$$3x + x = 4x$$

$$x = 3$$

$$\begin{array}{r} 9 + 3 \\ \hline 12 = 12 \end{array}$$

$$2x^2 + 3x^4 = 5x^6$$

$$x = 2$$

$$2(2)^2 + 3(2)^4 = 5(2^6)$$

$$2(4) + 3(16) = 5(64)$$

$$8 + 48$$

$$56 \neq 320$$

# Key Points

## Section 1.3 Equivalent Expressions

- When are expressions equivalent?
- Evaluating expressions to see when they are equal
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## Section 1.4 Equivalent Equations

- When are equations equivalent?
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- Isolating variables
- The difference between equivalent equations and equivalent expressions.

# Discussion

## Section 1.4 Equivalent Equations

If you are given the equation  $3x + 12 = 36$ , how can we make it a simpler equation?

$$\begin{array}{r} 3x + 12 = 36 \\ -12 \quad -12 \\ \hline 3x = 24 \\ \frac{3x}{3} = \frac{24}{3} \\ x = 8 \end{array}$$

$$\begin{array}{l} 3(8) + 12 = 36 \\ 24 + 12 = 36 \\ 36 = 36 \checkmark \end{array}$$

# Discussion

## Section 1.4 Equivalent Equations

What we have done is something called **isolating the variable**.

What does isolating the variable allow us to do?

To find a value that makes our equation true.

# Examples

## Section 1.4 Equivalent Equations

Without solving explain why each pair of equations have the same solution.

a.  $\frac{4(w-2)^2}{4} = \frac{6}{4} \quad (w-2)^2 = \frac{6}{4}$

b.  $12 \cdot \frac{x-4}{12} = -3 \cdot 12 \quad \frac{x-4}{12} = \frac{-36}{12}$

c.  $\frac{y^4}{-14} + 3y + 4 = \frac{y^4}{-14} + 2 \quad y^4 + 3y + 4 = 2 + y^4$

# Vocabulary

## Section 1.4 Equivalent Equations

What we have just done is found a way to make two equations equivalent.

### EQUIVALENT EQUATIONS

We say two equations are *equivalent* if they have exactly the same solutions

# Examples

## Section 1.4 Equivalent Equations

In the following equations we are going to isolate the variable, using reverse operations.

1.  $5x - 4 = 26$

$$+4 \quad +4$$

$$\frac{5x}{5} = \frac{30}{5}$$

$$x = 6$$



# Examples

## Section 1.4 Equivalent Equations

In the following equations we are going to isolate the variable, using reverse operations.

2.  $\frac{1}{6}(8+x) = 10$

$$\frac{1}{6}(8+x) = 10$$

$$\frac{1}{6} \frac{(8+x)}{1} = 10$$

$$\times \frac{1}{6} \frac{1(8+x)}{6} = 10 \cdot 6$$

$$\begin{array}{r} 8+x = 60 \\ -8 \quad -8 \\ \hline x = 52 \end{array}$$

$$\cancel{\frac{6}{1} \cdot \frac{1}{6}} (8+x) = 10 \cdot \frac{6}{1}$$

$$\begin{array}{r} 8+x = 60 \\ -8 \quad -8 \end{array}$$

$$x = 52$$

# Examples

## Section 1.4 Equivalent Equations

In the following equations we are going to isolate the variable, using reverse operations.

3.  $\frac{x-3}{7} = 1$

$$7 \cdot \frac{x-3}{7} = 1 \cdot 7$$

$$x-3 = 7$$

$$x = 7 + 3$$

$$x = 10$$

# General Info

## Section 1.4 Equivalent Equations

We can transform an equation into an equivalent equation using any operation that does not change the balance between the two sides.

- Adding or subtracting the same number to both sides
- Multiplying or dividing both sides by the same number, provided that it is not zero
- Replacing any expression in an equation by an equivalent expression

# Homework

Section 1.3  
Equivalent  
Expressions

Pages 16 - 17  
# 2 - 12 even, 20 - 23, 34, 37

Section 1.4  
Equivalent  
Equations

Pages 23 - 24  
# 2 - 16 even, 17 - 27 odd, 35 - 44















