

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

Both have variables
Both have numbers

Differences

Expressions no = sign
Equations have = sign
Expressions are evaluated
Equations are solved

Examples

Example #1

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

Section 1.3

Equivalent Expressions

$$\begin{aligned} \frac{t}{2} &= \frac{0}{2} = 0 & \frac{1}{2}t &= \frac{1}{2}(0) = 0 \\ &= \frac{4}{2} = 2 & &= \frac{1}{2}(4) = 2 \end{aligned}$$

How can we determine if these two expressions are equal?

Substitute values to check and see
elimination; set equal to each other

$$t = 0$$

$$t = 4$$

Examples

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

Section 1.3

Equivalent Expressions

$$a=5 \quad b=10 \quad c=20$$

$$\frac{5}{30} = \frac{1}{6}$$

$$\frac{5}{10} + \frac{5}{20}$$

$$\frac{10}{20} + \frac{5}{20} = \frac{15}{20} = \frac{3}{4}$$

$$\sqrt{4+2} = \sqrt{6}$$

$$\sqrt{x+y}$$

$$x=9 \quad y=25$$

$$\sqrt{9+25} = \sqrt{34} = 5.8$$

$$\frac{a}{b+c}$$

$$\frac{10}{25} = 2.5$$

$$\frac{a}{b} + \frac{a}{c}$$

$$\frac{10}{5} = 2$$

$$\frac{10}{20} = .5$$

$$\sqrt{4} + \sqrt{2} = 2 + \sqrt{2}$$

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

$$\sqrt{9} + \sqrt{25}$$

$$3 + 5 = 8$$

$$9 = 10$$

$$8 = 5$$

$$c = 20$$

$$2 + 5 = (2.5)$$

Examples

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

Section 1.3
Equivalent
Expressions

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

$$3 + 6x$$

$$x=2$$

$$(9 + 6(2)) / 3$$

$$9 + 12 / 3 = 7$$

$$3 + 6(2)$$

$$3 + 12 = 15$$

$$x=5$$

$$2x^2$$

$$2(5)^2$$

$$2(25)$$

$$50$$

$$(2x)^2$$

$$(2 \cdot 5)^2$$

$$(10)^2$$

$$100$$

\neq

Warm-Up

Section 1.3 Equivalent Expressions

Write a sentence explaining what it means for two expressions to be equivalent.

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.

Examples

Example #3

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

Section 1.3
Equivalent
Expressions

Examples

Section 1.3 Equivalent Expressions

Example #4

To convert from miles to kilometers, Abby doubles the number of miles, m , then decreases the result by 20%. Renato first divides the number of miles by 5, and then multiplies the result by 8.

- Write an algebraic expression for each method.
- Use your answer from part (a) to decide if the two methods give the same answer.

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

Practice

Section 1.3 Equivalent Expressions

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

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

Are the expressions equivalent?

$$(x - y) + z \quad \text{and} \quad x - (y + z)$$

Practice

Section 1.3 Equivalent Expressions

Are the following equations identities?

$$3x + x = 4x$$

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

Homework

Section 1.3
Equivalent
Expressions

Pages 16 - 17

1 - 14, 15 - 17, 20 - 24, 29, 31, 34 - 37

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 1.4
Equivalent
Equations

Is $2x^2 + 3x^2 = 5x^2$ an identity ? Why or why not ?

Discussion

Section 1.4
Equivalent
Equations

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

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?

Examples

Section 1.4 Equivalent Equations

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

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

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

c. $y^4 + 3y + 4 = y^4 + 2$ $3y + 4 = 2$

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

Which operation should we use to solve each equation?

$$x + 5 = 20$$

$$5x = 20$$

$$\frac{x}{5} = 20$$

Take-Away

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. This includes:

- *Adding or subtracting* the same number to both sides
- *Multiplying or dividing* both sides by the same number, provided it is NOT 0.
- Replacing any expression in an equation by an equivalent expression.

Warning!! Dividing both sides by an expression that might be 0, will cause you to have false solutions or no solutions.

Examples

Section 1.4 Equivalent Equations

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

1. $5x - 4 = 26$

Examples

Section 1.4 Equivalent Equations

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

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

Examples

Section 1.4 Equivalent Equations

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

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

Practice

Section 1.4
Equivalent
Equations

Given the equation $2(x + 3) = 50$, find the solution.

Practice

Section 1.4
Equivalent
Equations

Use the given equation, and explain the steps you would take in order to solve it. Then solve it!

$$\frac{1}{z} = 2.5$$

Homework

Section 1.4
Equivalent
Equations

Pages 23 - 24

1, 3, 6, 11, 12, 15, 16, 25 - 31 odd, 35 - 46