

Definition & Properties of Equations

Name _____

Time _____

Score _____

- An **equation** is a statement formed by placing an equal sign (=) between two expressions.

Which of the following is an equation? (select all correct answers)

A. $y > 6$ ☒ B. $-3 = 9$ ☒ C. $x^2 = \frac{2}{3}x$ D. $m + 2n$

A is an inequality.

D is an algebraic expression.

Solve Equations

- Addition & Subtraction Properties
- Multiplication & Division Properties

Example:

$$x + 1 = 2$$

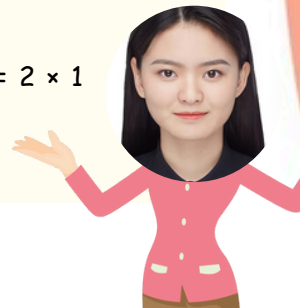
$$x + 1 - 1 = 2 - 1$$

$$x = 1$$

$$0.5x = 1$$

$$2 \times 0.5x = 2 \times 1$$

$$x = 2$$



Addition & Subtraction Properties

★ $x - 4 = 6$

★ $x + 5 = 12$

★ $x - 14 = 43$

★ $x + 72 = 49$

★ $-23 + x = 39$

★ $48 + x = -63$



Multiplication & Division Properties

★ $0.5x = 15$

★ $3x = 15$

★ $-0.25x = 12$

★ $7x = -84$



Challenge



$0.1x + 24 = -79$

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Move Terms to Solve Equations

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Move Like Terms Together

- Move the terms
- Combine like terms
- Find the value of "x".



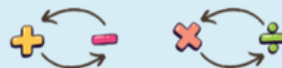
$$x + 8 = 9, x = \underline{\quad}$$

Step 1: ~~$x + 8 = 9$~~ ~~-8~~ ~~-8~~ Skip Step 1

Step 2: $x = 9 - 8$

Move the like terms together when solving an equation:

- Put the terms with "x" on one side and the numbers on the other side.
- After a term crosses the "=", the sign in front of this term will change to its reverse sign.



- Write the result as $x = \text{a number}$.



PreA Teacher
Alice Li

Move Like Terms Together

★ $2x + 3 = 11$

★ $5x - 4 = 16$

★ $x + 2 = 3x - 6$

★ $4x - 3 = x + 6$

★ $-7 + 2x = 4x - 1$

★ $179 + 13x = x + 23$

★ $5 + 0.35x = 0.1x + 17$

★ $278 + 4x = -226 - 20x$



Challenge

★ $4050(x - 3) = 2025(x + 1) + 6075$

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Proportional Equations

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The steps of solving fractional equations are the **same** as solving integer equations.

- Move the terms.
- Combine like terms.
- Find the value of "x".

Example

$$\frac{1}{2}x - \frac{1}{4} = \frac{1}{4}x + \frac{1}{2}$$

$$\frac{1}{2}x - \frac{1}{4}x = \frac{1}{2} + \frac{1}{4}$$

$$\frac{1}{4}x = \frac{3}{4}$$

$$x = 3$$

A better approach is to convert the fractional equation into an integer equation.

- If the denominator of the both sides are the same, then multiply both sides by the denominator.
- Otherwise, multiply both sides by the least common multiple.



Numerators need to be seen as a whole.



Solve Proportional Equations

$$\star \frac{2x}{3} = \frac{8}{3}$$

$$\star -\frac{5x}{12} = \frac{11}{13}$$

$$\star \frac{11}{7} = \frac{3x}{11}$$

$$\star \frac{4x}{51} = -\frac{19}{36}$$

$$\star \frac{3x-1}{24} = \frac{x+3}{108}$$

$$\star \frac{-x-5}{6} = \frac{9-2x}{216}$$



Challenge



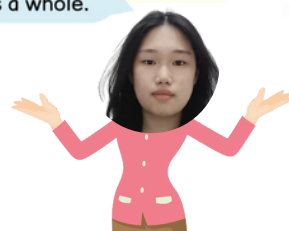
$$\frac{3x-1}{4} - \frac{2x+5}{3} = \frac{x-7}{6} + 1$$

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PreA Teacher Chew Qianru
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★ A farm has ducks (2 legs each) and cows (4 legs each). There are 35 heads and 94 legs in total. How many cows are there?

★ A parking lot has bicycles (2 wheels each) and cars (4 wheels each). There are 50 vehicles and 160 wheels in total. How many cars are parked?

★ Alex has 10¢ coins and 25¢ coins. There are 120 coins altogether, worth \$19.80 total. How many 25¢ coins are there?

★ A theater sold adult tickets (\$25 each) and child tickets (\$12 each). They sold 300 tickets and collected \$5,758. How many adult tickets were sold?

★ A stand sold regular lemonade (\$1.25) and strawberry lemonade (\$1.75). They sold 132 cups and made \$182.5. How many cups of regular lemonade were sold?

★ A bakery sold croissants (\$2.40 each) and Danish pastries (\$3.60 each). They sold 150 pastries and earned \$420.00. How many croissants were sold?



Challenge

★ A city implements tiered pricing for residential electricity usage, with the following rates:

- Tier 1: Monthly usage up to 500 kWh, charged at \$0.12/kWh
- Tier 2: Monthly usage over 500 kWh and up to 1,000 kWh, the excess portion charged at \$0.15/kWh
- Tier 3: Monthly usage over 1,000 kWh, the excess portion charged at \$0.20/kWh

If Tom's family paid \$177 for electricity in a month, what was their total electricity consumption (in kWh)?

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PreA Teacher Chloe Bai
Encouraging & Creative



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