

- Introduction to Simple Equations
- Setting Up of an Equation
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- Solving Equations with Brackets
- Applications of Simple Equations to Practical Situations

Introduction to Simple Equations

Simple equations involve expressions with variables and constants connected by an equality sign. They represent conditions where two expressions have equal values. For example, if Sara thinks of a number x , multiplying it by 4 and adding 5 gives $4x + 5$. If the result is 65, the equation is:

$$4x + 5 = 65$$

Solving this equation finds the value of x that satisfies the condition.

Formula Derivation

Given an expression $ax + b$ equal to a number c , the equation is:

$$ax + b = c$$

To solve for x , subtract b from both sides:

$$ax = c - b$$

Then divide both sides by a :

$$x = \frac{c - b}{a}$$

Worked Illustration

For $4x + 5 = 65$:

- Subtract 5 from both sides: $4x = 60$
- Divide both sides by 4: $x = 15$

Solved Example

Find the number x if $10y - 20 = 50$:

- Add 20 to both sides: $10y = 70$
- Divide both sides by 10: $y = 7$

Practice Set

- **Level 1 – Easy:** Solve $3x + 4 = 19$.
- **Level 2 – Moderate:** Solve $5y - 7 = 18$.
- **Level 3 – Challenging:** Solve $7z + 3 = 2z + 28$.

Answer Key

- Level 1: $3x = 15 \Rightarrow x = 5$
- Level 2: $5y = 25 \Rightarrow y = 5$
- Level 3: Subtract $2z$ from both sides: $5z + 3 = 28$, subtract 3: $5z = 25$, divide by 5:
 $z = 5$

Quick Reference

Step	Operation	Purpose
1	Subtract/Add same number on both sides	Isolate variable term
2	Divide/Multiply both sides by same non-zero number	Solve for variable

Glossary

- **Variable:** A symbol representing an unknown number.
- **Equation:** A mathematical statement showing equality between two expressions.
- **Expression:** A combination of variables and constants using operations.
- **Solution:** The value of the variable that satisfies the equation.
- **Transpose:** Moving a term from one side of an equation to the other with sign change.

Setting Up of an Equation

To set up an equation from a word problem, identify the unknown number and represent it by a variable, say x . Translate the problem statement into an algebraic expression and form an equation by equating it to the given value.

Formula Derivation

For example, if a number x is multiplied by 4 and 5 is added, the expression is $4x + 5$. If the result is 65, the equation is:

$$4x + 5 = 65$$

Similarly, if a number y is multiplied by 10 and 20 is subtracted, and the result is 50, the equation is:

$$10y - 20 = 50$$

Worked Illustration

Translate the statement: "The sum of three times a number and 11 is 32" into an equation.

- Let the number be x .
- Three times the number is $3x$.
- Sum with 11 is $3x + 11$.
- Set equal to 32: $3x + 11 = 32$.

Solved Example

Convert "One fourth of m is 3 more than 7" into an equation.

- One fourth of m is $\frac{m}{4}$.
- It is 3 more than 7 means $\frac{m}{4} - 7 = 3$.

Practice Set

- **Level 1 – Easy:** Write equation for "Five times a number minus 5 is 7".
- **Level 2 – Moderate:** Write equation for "One third of a number plus 5 is 8".
- **Level 3 – Challenging:** Write equation for "Twice a number decreased by 4 equals three times the number increased by 2".

Answer Key

- Level 1: $5x - 5 = 7$
- Level 2: $\frac{n}{3} + 5 = 8$
- Level 3: $2x - 4 = 3x + 2$

Quick Reference

Phrase	Mathematical Expression
Three times a number	$3x$
Sum of a and b	$a + b$
Difference between a and b	$a - b$
One fourth of a number m	$\frac{m}{4}$

Glossary

- **Translate:** Converting words into mathematical expressions.
- **Expression:** Combination of variables and constants.
- **Equation:** Statement of equality between two expressions.
- **Variable:** Symbol representing unknown quantity.

Solving Simple Equations

Solving an equation means finding the value of the variable that makes the equation true. The key principle is to perform the same operation on both sides of the equation to maintain equality.

Formula Derivation

Given an equation $ax + b = c$, solve for x by:

- Subtracting b from both sides: $ax = c - b$
- Dividing both sides by a : $x = \frac{c-b}{a}$

Worked Illustration

Solve $x + 3 = 8$:

- Subtract 3 from both sides: $x + 3 - 3 = 8 - 3$
- Simplify: $x = 5$

Solved Example

Solve $3n + 7 = 25$:

- Subtract 7 from both sides: $3n = 18$
- Divide both sides by 3: $n = 6$

Practice Set

- **Level 1 – Easy:** Solve $5y = 35$.
- **Level 2 – Moderate:** Solve $\frac{m}{2} = 5$.
- **Level 3 – Challenging:** Solve $4x + 5 = 65$.

Answer Key

- Level 1: $y = 7$
- Level 2: $m = 10$
- Level 3: $x = 15$

Quick Reference

Operation	Effect
Add/Subtract same number on both sides	Maintains equality, isolates variable term
Multiply/Divide both sides by same non-zero number	Maintains equality, solves for variable
Transpose	Move term to other side with sign change

Glossary

- **Isolate:** To get the variable alone on one side of the equation.
- **Inverse operation:** Operation that reverses another (e.g., addition and subtraction).
- **Transpose:** Moving a term across the equality sign with sign change.

Solving Equations with Brackets

When equations contain brackets, first simplify by removing the brackets using division or expansion, then solve as usual.

Formula Derivation

Given $a(b + c) = d$, divide both sides by a to get:

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

Then transpose terms to isolate the variable.

Worked Illustration

Solve $4(m + 3) = 18$:

- Divide both sides by 4: $m + 3 = \frac{18}{4} = \frac{9}{2}$
- Transpose 3: $m = \frac{9}{2} - 3 = \frac{3}{2}$

Solved Example

Solve $-2(x + 3) = 8$:

- Divide both sides by -2 : $x + 3 = -4$
- Transpose 3: $x = -4 - 3 = -7$

Practice Set

- **Level 1 – Easy:** Solve $3(p - 2) = 9$.
- **Level 2 – Moderate:** Solve $5(x + 4) = 35$.
- **Level 3 – Challenging:** Solve $-4(y - 1) = 20$.

Answer Key

- Level 1: $p - 2 = 3 \Rightarrow p = 5$
- Level 2: $x + 4 = 7 \Rightarrow x = 3$
- Level 3: $y - 1 = -5 \Rightarrow y = -4$

Quick Reference

Step	Action
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1	Divide both sides by number outside bracket
2	Transpose terms to isolate variable
3	Solve resulting simple equation

Glossary

- **Bracket:** Parentheses grouping terms.
- **Divide:** Operation to remove multiplication.
- **Transpose:** Moving terms across equality with sign change.

Applications of Simple Equations to Practical Situations

Simple equations can model real-life problems by translating statements into equations and solving them.

Worked Illustration

Example: "The sum of three times a number and 11 is 32. Find the number."

- Let the number be x .
- Equation: $3x + 11 = 32$.
- Transpose 11: $3x = 21$.
- Divide by 3: $x = 7$.

Solved Example

Find a number such that one-fourth of it is 3 more than 7.

- Let the number be y .

- Equation: $\frac{y}{4} - 7 = 3$.
- Add 7: $\frac{y}{4} = 10$.
- Multiply by 4: $y = 40$.

Practice Set

- **Level 1 – Easy:** "Five times a number minus 5 is 7." Find the number.
- **Level 2 – Moderate:** "Raju's father's age is 5 years more than three times Raju's age. Father is 44 years old." Find Raju's age.
- **Level 3 – Challenging:** "A large box contains 8 small boxes plus 4 mangoes. Large box has 100 mangoes." Find mangoes in a small box.

Answer Key

- Level 1: $5x - 5 = 7 \Rightarrow 5x = 12 \Rightarrow x = \frac{12}{5}$
- Level 2: $3y + 5 = 44 \Rightarrow 3y = 39 \Rightarrow y = 13$
- Level 3: $8m + 4 = 100 \Rightarrow 8m = 96 \Rightarrow m = 12$

Quick Reference

Step	Action
1	Translate problem into equation
2	Solve equation step-by-step
3	Verify solution by substitution

Glossary

- **Modeling:** Representing real-world problems with equations.
- **Verification:** Checking solution by substituting back into equation.
- **Transpose:** Moving terms across equality with sign change.