# Notes Packet 3: Solving Equations

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Day 1: One Step Equations

What is the difference between **EXPRESSIONS** and **EQUATIONS**?

**EXPRESSIONS** | **EQUATIONS**
---|---

Things to remember:
- Your goal is to get the variable _____________________________!
- Do the same thing to __________________________ sides!
- Do the __________________________ (inverse operation) of what is being done in order to move terms across the equal sign.
- Combine like terms when they are on the __________________________ of the equal sign.
- Always undo ___________________________ or ___________________________ before multiplication and division!

Example 1.] Add or subtract to Isolate the Variable

1) \( a + 3 = 12 \)
2) \( -9 = x - 2 \)
3) \( 3x + 4 - 2x = 1 \) (*hint: CLT)
4) \( g + \frac{9}{4} = 5 \)
YOU TRY \(\rightarrow\) Add or subtract to Isolate the Variable

1) \(21 = x - 15\)  
2) \(y + 10.5 = -9.4\)  
3) \(c - \frac{1}{2} = \frac{3}{4}\)

Example 2.] Multiply or Divide to Isolate the Variable

1) \(14x = 42\)  
2) \(\frac{n}{-6} = \frac{8}{3}\)  
3) \(\frac{5}{3}h = \frac{10}{7}\)  
4) \(-1.5b = 7.5\)
YOU TRY ➔ Multiply or Divide to Isolate the Variable

1) \( \frac{4}{9}p = -\frac{8}{21} \)

2) \(-54 = -4x\)

3) \(\frac{3}{4}a = 12\)

4) \(-4.8 = -1.2m\)

A ratio uses division to compare two quantities. How to write "the ratio of a to b":

\[
\text{a to b} \quad \frac{a}{b} = \frac{a:b}{b}
\]

Example 3.] The volleyball team has 18 matches this season. Of the 18 matches, 10 of them are away matches and 8 are home matches.

(a) Write a ratio of away matches to home matches in simplest form.

(b) Write a ratio of home matches to total matches in simplest form.

A proportion is an equation that states that two ratios are equivalent.

\[
\frac{a}{b} = \frac{c}{d}
\]
Example 4.] Next year, the volleyball team will have 12 home matches, but the ratio of away matches and home matches will remain the same as this season. How many away matches will the team have next season?

Example 5.] Solve the following proportions

1) \( \frac{11}{6} = \frac{x}{30} \)

2) \( \frac{z}{24} = \frac{5}{9} \)

3) \( \frac{9}{2} = \frac{m}{12} \)

You Try → Solve the following proportions

1) \( \frac{5}{8} = \frac{t}{24} \)

2) \( \frac{v}{20} = \frac{5}{4} \)

3) \( \frac{d}{5} = \frac{90}{100} \)

End of Day 1...
Day 2: Solving Two and Multi-Step Equations

Warm-Up: Solve the following One Step Equation

1. \( 2x = 12 \)

2. \( -4 + y = 16 \)

Things to remember:

- Your goal is to get the variable __________________________!
- Do the same thing to _______ ____________ sides!
- Do the ________________ of what is being done in order to move terms across the equal sign.

Other Helpful Tips:

- Draw a _______________ line down through the equals sign.
- Multiply by the ____________, or reciprocal of a fraction in order to remove it.
- Move all the _________________ to one side and all the _____________ to the other.
- Distribute and _________________ like terms before moving things across the equals sign.
Example 1.] Solve the following two step equations

1) \( \frac{x}{2} + 5 = 11 \)  \hspace{1cm} 2) \( 5x + 9 = 24 \)

3) \( 4y - 4 = 16 \)  \hspace{1cm} 4) \( -1 = \frac{z}{3} - 7 \)

YOU TRY → Solve the following two step equations

1) \( -2g - 13 = 3 \)  \hspace{1cm} 2) \( -6 = \frac{z}{4} - 3 \)  \hspace{1cm} 3) \( 7 = \frac{5}{6}c - 8 \)

Example 2.] Solve the following equations by Combining Like Terms FIRST

1) \( p + 2p - 3 = 6 \)  \hspace{1cm} 2) \( 7a + 3 - 3a = -7 + 4a - 2a \)
YOU TRY→ Solving Equations by Combining Like Terms FIRST

1) \(-2 = 3y - 18 - 5y\)

Example 3.] Solve the following equations with distribution

1) \(7x + 2(x + 6) = 39\)
2) \(2w - 3(4 + w) = -18\)

YOU TRY→ Solving Equations with Distribution

1) \(6x - 2(x - 5) = 46\)

Example 4.] Solve the following equations by multiplying by the reciprocal

1) \(\frac{3}{2}(3x + 5) = -24\)
2) \(-\frac{4}{5}(4a - 1) = 28\)
YOU TRY ➔ Solving by Multiplying by the reciprocal

1) \( \frac{2}{5}(3r + 4) = 10 \)

Example 5.] Solve the following multi step equations

1) \( 6(2d - 1) + 13 = 19 \)
2) \( 15 = 6n - 3(2n - 5) \)
3) \( 10 + 2(2a + 1) = 7a - 3 \)

YOU TRY ➔ Solving Multi-step Equations

1) \( 17 = 2(3x + 1) - x \)
2) \( 23x - 3(5x + 12) = -64 \)
3) \( 5m - (4m - 1) = -12 \)
Example 6.] Solve the following equations

\[4(w + 8) = 2(w - 1) + 2w\]
\[-3(x - 5) = 8x + 15 - 5x\]

Example 7.] Solve the following proportions

\[\frac{9 - y}{44} = \frac{5}{22}\]
\[\frac{1}{9} = \frac{a}{a + 24}\]
Day 3: Literal Equations, More with Function Notation

Warm-Up Day 3: Solve the following One Step Equation

1. \(2x - 14 = -3x + 6\)

2. \(13k + 3(k + 11) = 8k - 7\)

3. \(\frac{2}{5}(10r - 50) = 6 - 2r\)

4. \(8 - 4w = \frac{1}{3}(6w - 12)\)

Example 1.] Solve for the indicated variable in the following equations.

Solve for \(C\): \(P = R - C\)  
Solve for \(m\): \(F = ma\)

Solve for \(R\): \(I = \frac{E}{R}\)
Solve for \( x \): \( ax - by = c \)

You Try ➔ Solve for the indicated variable in the following equations.

Solve for \( B \): \( V = \frac{1}{3}Bh \)

Solve for \( m \): \( y = mx + b \)

Solve for \( r \): \( I = P \cdot r \cdot t \)

Solve for \( l \): \( P = 2l + 2w \)

Example 2] Write the following equations in function notation.
***HINT: y must be by itself before you can write it in function notation!

\[4x + y = -10\] \[16 - 8y = 4x\] \[8x - 2y - 5 = 16\]

Example 3.] Verify whether the given value is a solution to the equation.

\[13 - 6x = 3x - 15; \quad x = -5?\] \[4x - 7 = 3x - 5; \quad x = -2?\]
Example 4.] Solve the following equations for the given variable.

Solve for \( x \): \( 12x = 4(x + 3) \)

Solve for \( c \): \( 5c - 4 - 2c + 1 = 8c + 2 \)
Day 4: Word Problems

1. **Altitude** An airplane was at a cruising altitude, then descended 2000 feet. If the airplane is at 18,000 feet now, what was the cruising altitude?

2. **Banner** You are working on a banner for Friday’s pep rally. The length of the banner is 3 times the width. The length is 15 feet. What is the width?
3. **Exercising** Every week, you run for cardiovascular fitness and lift weights for strength training. You spend about 3 of your weekly exercising time lifting weights. You exercise 12 hours a week. How much time do you spend lifting weights?

4. Cumberland Caverns in Tennessee is 44.4 kilometers long. This cave is 10.9 kilometers longer than Carlsbad Caverns in New Mexico. How long is Carlsbad Caverns?
5. Bocce is a lawn bowling game that originated in Italy. The bocce court below has an area of 1032 square feet. The width of the court is 12 feet. What is the length of the court?

6. In the 2002 Winter Olympics, Cartriona LeMay Doan won the 500-meter race. Her winning time was 74.75 seconds. Find her average speed to the nearest tenth of a meter per second.
7. Find three consecutive integers whose sum is 84.

8. A rectangle has a perimeter of 60 inches and a length of 22 inches. What is the width of the rectangle?
9. The triangle below has a perimeter of 20. Solve for \(x\).

[Diagram of a triangle with sides labeled \(x\), \(x+2\), and 8]

10. The sum of the angles of a triangle is 180°. Find the \(\text{m}\angle A\) and the \(\text{m}\angle B\).

[Diagram of a triangle with sides labeled \(x\), \(4x\), and 20]
11. The scale on a map is 1 inch to 12 miles. If the distance between two cities on a map is 5 inches how many miles apart are they?

12. The scale on a map is 2 inches to 6 miles. If the distance between two cities is 42 miles, how far apart are they in inches on the map?
13. A fitness center offers yoga classes for $10 per class and sells yoga mats for $19.95. A person paid a total of $139.95 to the fitness center for yoga classes and a mat. Find the number of yoga classes the person took.

14. You have quarters and nickels saved in a piggy bank. There is a total of $3.45 in quarters and nickels and there are 9 more nickels than quarters. How many quarters are in the piggy bank? How many nickels are in the piggy bank?