Toony's Lecture

Solving EQUATIONS

AN EQUATION STATES THAT TWO QUANTITIES ARE EQUAL.

\[ 8 = 8 \] AN IDENTITY EQUATION

\[ 5 + 3 = 8 \] A FACTUAL EQUATION (Conveys A FACT)

Given \( 5 + x = 8 \) AN UNSOLVED EQUATION \( \text{FIND THE UNKNOWN!} \)

THE WAY TO SOLVE, SUBTRACT A "5" FROM BOTH SIDES

\[ 5 - 5 + x = 8 - 5 \]

\[ x = 3 \] we don't even need to write this step, BUT IS OK!

The goal of solving is to ISOLATE the VARIABLE BY GETTING RID OF ALL NUMBERS on SAME SIDE with it.

Given \( x - 11 = 4 \)

\[ x - 11 + 11 = 4 + 11 \] ADD 11 on both sides to cancel the -11 on the side with x

\[ x = 15 \]

Now consider the EQUATION

\[ 3x = 21 \] must get rid of the 3 multiplying the x

We DIVIDE (Both sides) to get rid of the 3 multiplying

\[ \frac{3x}{3} = \frac{21}{3} \]

\[ x = 7 \]

Special case (Fractions)

\[ -\frac{2}{3} x = 10 \]

To get rid of a Fraction we use the Reciprocal and multiply it (on both sides!)

(i)
\[
\frac{-\frac{3}{2}}{\frac{-3}{3} \times \frac{1}{1}} = \frac{\frac{5}{1}}{\frac{-3}{2}}
\]

\[
\Rightarrow \quad x = -\frac{15}{1}
\]

\[
\Rightarrow \quad x = -15
\]

Next Level of Equations

\[
3x - 5 = 16
\]

\[
\overline{\text{mult. 3}} \quad \overline{\text{subtract 5}}
\]

\text{Use}

\text{OSADME} \quad \text{Exponent}

\text{Opposite of}

\Rightarrow \text{But If You See Parenthesis, Get Rid of Them First with Distributive Rule.}
3x - 5 + 5 = 16 + 5 \leftarrow \text{ADD 5 to cancel the subtract}
\[
3x = 21
\]
\[
\frac{3x}{3} = \frac{21}{3}
\]
\[
x = 7
\]
\[3(7) - 5 = 16
\]
\[21 - 5 = 16
\]
\[16 = 16
\]

2nd Level of this type of Problem has multiple (two or more) variables terms

example \[5y + 3 = 2y + 15\] cancel the 2y on the right side!

\[5y - 2y + 3 = 2y - 2y + 15\]

\[
-3y + 3 = 15
\]
\[
-3y + 3 - 3 = 15 - 3 \quad \text{cancel the 3 adding by subtracting 3 on both sides}
\]
\[
3y = 12
\]
\[
\frac{3y}{3} = \frac{12}{3}
\]
\[
y = 4
\]

Short cut for getting like terms together

⇒ Jump Rule ⇒ A term can jump across to other side as long as you change the sign to opposite

\[5y + 3 = 2y + 15\]
\[\overset{\text{Jump}}{5y - 2y = 15 - 3}\]
\[3y = 12
\]
\[
\frac{3y}{3} = \frac{12}{3}
\]
\[
y = 4
\]
Another example using Jump Rule:

\[ 10 - 3x = 2x - 8x + 40 \]

Jump \[ \Rightarrow \]

\[ 10 - 40 = 2x - 8x + 3x \]

\[ = 2x + 3x = 5x - 8x \]

This side has negative gang winds!

\[ -30 = -3x \]

\[ \frac{-30}{-3} = -3 \]

\[ 10 = x \]

Getting rid of Parentheses => use Distributive Law

\[ 5(t + 3) + 9 = 3(t - 2) + 6 \]

\[ 5t + 15 + 9 = 3t - 6 + 6 \]

\[ 5t + 24 = 3t \]

Jump \[ \Rightarrow \]

\[ 5t - 3t = -3t \]

\[ 2t = -24 \]

\[ \frac{2t}{2} = \frac{-24}{2} \]

\[ t = -12 \]
Last Piece of Complexity \( \Rightarrow \) Fractions in the Equation

\[
\frac{7}{8}x - \frac{1}{4} + \frac{3}{4}x = \frac{1}{16} + x
\]

\[
\text{Use Common Denom for } (8, 4, 16) = 16
\]

Multiply a 16 times all terms on both sides

\[
\frac{2}{16} \left( \frac{7}{8}x \right) - \frac{4}{16} \left( \frac{1}{4} \right) + \frac{4}{16} \left( \frac{3}{4}x \right) = \frac{1}{16} \left( \frac{1}{16} \right) + 16 \left( x \right)
\]

\[
\Rightarrow 14x - 4 + 12x = 1 + 16x
\]

\[
\underline{26x - 4 = 1 + 16x}
\]

\[
\begin{align*}
26x - 16x & = 1 + 4 \\
10x & = 5 \\
\frac{10x}{10} & = \frac{5}{10} \\
x & = \frac{5}{10} = \frac{1}{2}
\end{align*}
\]

In class work

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\# 68) Solve

\[
\frac{3}{5}x + \frac{7}{10} = x - \frac{4}{5}
\]
MATH 73
Homework Problems From the Book

1.5
01
03
10
16
27
45
50
51
58
61
63
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