

7/15/2023

Multistep Problems (linear)
Review for Exam #2

Three-step problem:

$$3x + 1 = x + 5$$

Goal: is to get x by itself:

1st: get the x-term by itself (and any constant on the other side of the equal sign)

(combine the x-terms)

x-terms on one side, constants on the other

2nd: get x alone (get rid of the multipliers)

$$3x + 1 = x + 5$$

$$3x + 1 - 1 = x + 5 - 1$$

$$3x = x + 4$$

$$3x - x = x - x + 4$$

$$2x = 4$$

$$\frac{2x}{2} = \frac{4}{2}$$

$$x = 2$$

Check: $3(2)+1=7$, and $2+5=7$ (checks out)

Multi-step problems generally:

Typically require more simplification before applying properties of equality.

Sometimes, problems with fractions, may requires us to apply properties of equality, in order to make simplifying easier.

$$3x + 5x + 4 - x + 7 = 88$$

- 1) Combine like terms (simplify)
- 2) Then apply our two properties of equality

$$(3 + 5 - 1)x + (4 + 7) = 88$$

$$7x + 11 = 88$$

$$7x + 11 - 11 = 88 - 11$$

$$7x = 77$$

$$\frac{7x}{7} = \frac{77}{7}$$

$$x = 11$$

Check: $3(11)+5(11)+4-11+7=33+55+4-11+7=88$ (checks out)

Example.

$$4(2x + 3) = 28$$

Recall the distributive property:

$$a(b + c) = ab + ac$$

$$4(2x) + 4(3) = 28$$

$$8x + 12 = 28$$

$$8x + 12 - 12 = 28 - 12$$

$$8x = 16$$

$$\frac{8x}{8} = \frac{16}{8}$$

$$x = 2$$

Check: $4[2(2)+3]=4(4+3)=4(7)=28$ (checks out)

$$4(2x + 3) = 28$$

$$\frac{4(2x + 3)}{4} = \frac{28}{4}$$

$$2x + 3 = 7$$

$$2x + 3 - 3 = 7 - 3$$

$$2x = 4$$

$$\frac{2x}{2} = \frac{4}{2}$$

$$x = 2$$

These are the same answer.

Example.

$$2(4x - 5) = -3(2x + 1)$$

$$2(4x) + (2)(-5) = (-3)(2x) + (-3)(1)$$

$$8x - 10 = -6x - 3$$

$$8x - 10 + 10 = -6x - 3 + 10$$

$$8x = -6x + 7$$

$$8x + 6x = -6x + 6x + 7$$

$$14x = 7$$

$$\frac{14x}{14} = \frac{7}{14}$$

$$x = \frac{1}{2}$$

Check: $2 \left[4 \left(\frac{1}{2} \right) - 5 \right] = 2(2 - 5) = 2(-3) = -6$

$-3 \left[2 \left(\frac{1}{2} \right) + 1 \right] = -3[1 + 1] = -3(2) = -6$ checks out

Example.

$$\frac{1}{2}x - 3 = 2 - \frac{3}{4}x$$

Eliminate the fractions in the equation by using multiplication rule: multiply by the common denominator.

Multiply by 4:

$$4 \left(\frac{1}{2}x - 3 \right) = 4 \left(2 - \frac{3}{4}x \right)$$

$$4 \left(\frac{1}{2}x \right) - 3(4) = 4(2) - 4 \left(\frac{3}{4}x \right)$$

$$2x - 12 = 8 - 3x$$

$$2x - 12 + 12 = 8 + 12 - 3x$$

$$2x = 20 - 3x$$

$$2x + 3x = 20 - 3x + 3x$$

$$5x = 20$$

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

$$x = 4$$

Check: $\frac{1}{2}(4) - 3 = 2 - 3 = -1$

$2 - \frac{3}{4}(4) = 2 - 3 = -1$ checks out.

Always go back to the original equation before you did any work.

$$1 + 3\left(\frac{1}{2}x + 1\right) = \frac{1}{3}(2x - 4) - 5$$

$$1 + 3\left(\frac{1}{2}x\right) + 3(1) = \left(\frac{1}{3}\right)(2x) - \left(\frac{1}{3}\right)(4) - 5$$

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

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

$$6\left(\frac{3}{2}x + 4\right) = 6\left(\frac{2}{3}x - \frac{4}{3} - 5\right)$$

$$6\left(\frac{3}{2}x\right) + 6(4) = 6\left(\frac{2}{3}x\right) - 6\left(\frac{4}{3}\right) - 6(5)$$

$$\cancel{3} \frac{\cancel{6}}{1} \left(\frac{\cancel{3}}{\cancel{2}}x\right) + 6(4) = \cancel{2} \frac{\cancel{6}}{1} \left(\frac{\cancel{2}}{\cancel{3}}x\right) - \cancel{2} \frac{\cancel{6}}{1} \left(\frac{\cancel{4}}{\cancel{3}}\right) - 6(5)$$

$$9x + 24 = 4x - 8 - 30$$

$$9x + 24 = 4x - 38$$

$$9x + 24 - 24 = 4x - 38 - 24$$

$$9x = 4x - 62$$

$$9x - 4x = 4x - 4x - 62$$

$$5x = -62$$

$$\frac{5x}{5} = -\frac{62}{5}$$

$$x = -\frac{62}{5} = -12.4$$

You should never do this when there is a repeating decimal.

$$1 + 3\left(\frac{1}{2}x + 1\right) = \frac{1}{3}(2x - 4) - 5$$

$$\text{Check: } 1 + 3\left[\frac{1}{2}(-12.4) + 1\right] = 1 + 3(-6.2 + 1) = 1 + 3(-5.2) = 1 - 15.6 = -14.6$$

$$\frac{1}{3}[2(-12.4) - 4] - 5 = \frac{1}{3}(-24.8 - 4) - 5 = \frac{1}{3}(-28.8) - 5 = -9.6 - 5 = -14.6 \text{ checks}$$

Exam #2.

No meeting on Friday. You can use it to take the exam.