2.4: Applications of Linear Equations

Note Title 10/2/2017

Example: One number is four more than twice another. Their sum is 22. Find the numbers.

"one number": $2x+4$

"another number": x

one number → compare to → another

x

Sum $=$ 22

$(2x+4) + x = 22$

$2x + 4 + x = 22$

$3x + 4 = 22$

$-4 \quad -4$

$3x = 18$

$\frac{3x}{3} = \frac{18}{3}$

$x = 6$

another number: $x = 6$

one number: $2x+4$

Substitute $x=6$: $2(6)+4$

$= 12+4 = 16$

Answer in a complete sentence: The numbers are 6 and 16.

Check your answer:

Example: One number is five more than twice another. If their sum is decreased by 10, the result is 22. Find the numbers.

"another number": x

"one number": $2x+5$

one number $\xrightarrow[\text{to}]{\text{compare}}$ another

x

$$(\text{Sum}) - 10 = 22$$

$$x + 2x + 5 - 10 = 22$$

$$3x + 5 = 32$$

$-5 \qquad -5$

$$3x = 27$$

$$\frac{3x}{3} = \frac{27}{3}$$

$$x = 9$$

another number: $x = 9$

one number: $2x+5$

substitute $x = 9 \Rightarrow 2(9)+5$

$= 18+5$

$= 23$

The numbers are 9 and 23.

Example: Five times the sum of a number and seven is thirty. Find the number.

x = unknown number

$$5(\text{sum}) = 30$$

$$5(x+7) = 30$$

$$5x + 35 = 30$$

$$-35 \quad -35$$

$$5x = -5$$

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

$$x = -1$$

The unknown number is -1.

Example: Find four consecutive integers whose sum is 74.

Recall:

Natural numbers: 1, 2, 3, 4, 5, ... (counting numbers)

whole numbers: 0, 1, 2, 3, 4, 5, ...

Integers: ..., -3, -2, -1, 0, 1, 2, 3, 4, ...

1st integer: x

2nd integer: $x+1$

3rd integer: $x+2$

4th integer: $x+3$

Sum = 74

$$x + (x+1) + (x+2) + (x+3) = 74$$

$$x + x + 1 + x + 2 + x + 3 = 74$$

$$4x + 6 = 74$$

$$4x = 68$$

$$\frac{4x}{4} = \frac{68}{4}$$

$$x = 17$$

1st integer: $x = 17$

2nd: $x+1$

substitute $x = 17 \Rightarrow 17 + 1 = 18$

3rd: $x+2$

$x = 17 \Rightarrow 17 + 2 = 19$

4th: $x+3$

$x = 17 \Rightarrow 17 + 3 = 20$

The integers are 17, 18, 19, 20.

Check:

consecutive integers? Yes ✓

Sum is 74? $17 + 18 + 19 + 20$

$35 + 39 = 74$ ✓

Example: Find three consecutive even integers whose sum is 120.

1st integer: x

2nd integer: $x+2$

3rd integer: $x+4$

$$x + x+2 + x+4 = 120$$

$$3x + 6 = 120$$

$$3x = 114$$

$$\frac{3x}{3} = \frac{114}{3}$$

$$x = 38$$

$$3\overline{)114}\quad 38,\ 9,\ 24,\ 24,\ 0$$

1st integer: $x = 38$

2nd: $x+2$

$x = 38 \Rightarrow 38 + 2 = 40$

3rd: $x+4$

$x = 38 \Rightarrow 38 + 4 = 42$

The integers are 38, 40, 42.

Note: consecutive integers

x

$x+1$

$x+2$

$x+3$ etc

consecutive even integers:

x

$x+2$

$x+4$

$x+6$ etc

consecutive odd integers:

x

$x+2$

$x+4$

$x+6$ etc

2.4.6

Example: A pipe is 125 inches in length and must be cut so that one piece is 15" shorter than the other piece. How long are the pieces?

other piece: x

one piece $x-15$

one piece —compare to→ other piece

x

$$x + x - 15 = 125$$

$$+15 \quad +15$$

$$2x = 140$$

$$\frac{2x}{2} = \frac{140}{2}$$

$$x = 70$$

other piece: $x = 70$"

one piece: $x - 15$

$= 70 - 15 = 55$"

The pieces are 55" and 70" long

End of 2.4