

2.5: Applications of Linear Equations (cont'd)

Note Title

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Example (2.5 #28)

One side of a triangle is 6 meters longer than twice the shortest side. The third side is 9 meters longer than the shortest side. The perimeter is 75 meters. Find the lengths of all three sides.

one side: $2x+6$

shortest side: x

3rd side: $x+9$

To get perimeter, we add all the side lengths:

one side $\xrightarrow{\text{compare to}}$ shortest side
3rd side $\xrightarrow{\text{compare to}}$ x

$$(2x+6) + (x) + (x+9) = 75$$

$$2x+6 + x + x+9 = 75$$

$$4x + 15 = 75$$

$$4x = 60$$

$$\frac{4x}{4} = \frac{60}{4}$$

$$x = 15$$

shortest side: $x = 15$

One side: $2x+6$

$$x=15 \Rightarrow 2(15)+6 = 30+6 = 36$$

3rd side: $x+9$

$$x=15 \Rightarrow 15+9 = 24$$

Write your answer in a complete sentence.

The side lengths are 15 m, 36 m and 24 m.

Check: shortest side: 15 m
twice shortest side: 30 m
6 m longer: 36 m

1st sentence checks

short side: 15 m
9 m longer: 24 m
2nd sentence checks

Check:
Perimeter:
15
36
+ 24
75 ✓
3rd sentence

Example: Mary has \$3.00 in nickels, dimes and quarters. If she 2 has twice as many dimes as quarters, and five more nickels than dimes, how many of each type of coin does she have?

number of nickels: $2x+5$
 # of dimes: $2x$
 # of quarters: x

of nickels $\xrightarrow[\text{to}]{\text{compare}}$ # of dimes $\xrightarrow[\text{to}]{\text{compare}}$ # of qtrs
 $2x$ x

$$\$0.05(2x+5) + \$0.10(2x) + \$0.25(x) = \$3.00$$

value of all nickels

value of all dimes

value of all qtrs

Multiply both sides by 100 to clear the decimals:

$$5(2x+5) + 10(2x) + 25x = 300$$

$$10x + 25 + 20x + 25x = 300$$

$$55x + 25 = 300$$

$$55x = 275$$

$$\frac{55x}{55} = \frac{275}{55}$$

$$x = 5$$

$$\begin{array}{r} 275 \\ 55 \overline{) 275} \\ \underline{275} \\ 0 \end{array}$$

of qtrs: $x=5$

of nickels: $2x+5$

$$x=5 \Rightarrow 2(5)+5 = 10+5 = 15$$

of dimes: $2x$

$$x=5 \Rightarrow 2(5) = 10$$

$$\begin{array}{r} 275 \\ 55 \overline{) 275} \\ \underline{275} \\ 0 \end{array}$$

She has 5 quarters, 15 nickels, and 10 dimes.

Check: 1st sentence: 5 qtrs = \$1.25

15 nickels: \$0.75

10 dimes: \$1.00

\$3.00 ✓

2nd sentence:

twice as many dimes as qtrs? Yes | 5 more nickels than dimes? Yes ✓

Ex: Joe has \$2.25 in nickels, dimes, and quarters (3)
 If the number of nickels is four times the number of dimes,
 and there are two more dimes than quarters, how many
 coins of each type does he have?

of nickels: $4(x+2) = 4x+8$ # of nickels $\xrightarrow[\text{to}]{\text{compare}}$ # of dimes $\xrightarrow[\text{to}]{\text{compare}}$ # of qtrs
 # of dimes: $x+2$
 # of quarters: x

$$\$0.05(4x+8) + \$0.10(x+2) + \$0.25(x) = \$2.25$$

multiply by 100:

$$5(4x+8) + 10(x+2) + 25x = 225$$

$$20x + 40 + 10x + 20 + 25x = 225$$

$$55x + 60 = 225$$

$$55x = 165$$

$$\frac{55x}{55} = \frac{165}{55}$$

$$x = 3$$

$$\begin{array}{r} 2 \\ 55 \\ \underline{5} \\ 276 \\ \underline{1} \\ 55 \\ \underline{3} \\ 165 \end{array}$$

of qtrs: $x=3$

of nickels: $4x+8$

$$x=3 \Rightarrow 4(3)+8 = 12+8 = 20$$

of dimes: $x+2$

$$x=3 \Rightarrow 3+2 = 5$$

Joe has 20 nickels, 5 dimes,
and 3 quarters.

1st sentence: $20 \text{ nickels} \Rightarrow \1.00
 $5 \text{ dimes} \Rightarrow \0.50
 $3 \text{ qtrs} \Rightarrow \0.75
 $\underline{\hspace{1cm}} \$2.25 \checkmark$

2nd sentence:

nickels is 4 times # of dimes? Yes ✓

2 more dimes than qtrs? Yes ✓

2.6: Applications of Linear Eqs, Part II

(4)

eqns = equations

Consecutive integer problems

Ex: Find four consecutive integers whose sum is 74.

1st integer: x

2nd integer: $x+1$

3rd integer: $x+2$

4th integer: $x+3$

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

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

$$4x + 6 = 74$$

$$4x = 68$$

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

$$x = 17$$

$$\begin{array}{r} 17 \\ 4 \overline{) 68} \\ \underline{4} \\ 28 \\ \underline{28} \\ 0 \end{array}$$

1st integer: $x = 17$

2nd int: $x+1$

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

3rd integer: $x+2$

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

4th integer: $x+3$

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

The integers are 17, 18, 19, and 20.

Check: Consecutive? yes

$$\begin{array}{r} 17 \\ 18 \\ 19 \\ + 20 \\ \hline 74 \quad \checkmark \end{array}$$

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

1st integer: x

2nd integer: $x+2$

3rd integer: $x+4$

$$x + (x+2) + (x+4) = 120$$

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

$$3x + 6 = 120$$

$$3x = 114$$

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

$$x = 38$$

$$\begin{array}{r} 38 \\ 3 \overline{)114} \\ \underline{9} \\ 24 \\ \underline{24} \\ 0 \end{array}$$

1st integer: $x = 38$

2nd integer: $x+2$

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

3rd integer: $x+4$

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

check consecutive?

even?

sum

$$38 + 40 + 42 = 78 + 42 = 120 \checkmark$$

The integers are 38, 40, and 42.

Note:

consecutive odd integers:

1st integer: x

2nd integer: $x+2$

3rd integer: $x+4$

$\vdots$
 $x+6$ etc