

2-4: Solving Multi-Step Equations

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EXERCISE 1

SHOPPING Hiroshi is buying a pair of water skis that are on sale for $\frac{2}{3}$ of the original price. After he uses a \$25 gift card, the total cost before taxes is \$115. What was the original price of the skis? Write an equation for the problem. Then solve the equation.

Words: two-thirds of the price minus 25 is 115.

Variable: let p = original price of the skis.

Equation: $\frac{2}{3} \cdot p - 25 = 115$

Solve: $\frac{2}{3}p - 25 = 115$ original equation

$$\frac{2}{3}p - 25 + 25 = 115 + 25$$

$$\frac{2}{3}p = 140$$

$$\frac{3}{2} \left(\frac{2}{3}p \right) = \frac{3}{2}(140)$$

$$p = 210$$

Addition Property
Additive Identity,
substitution / simplify
multiplicative inverse,
multiplication property
substitution / simplify

Answer: The original price of the skis was \$210.

1A. RETAIL A music store has sold $\frac{3}{5}$ of their hip-hop CDs, but 10 were returned. Now the store has 62 hip-hop CDs. How many were there originally? $X = \text{CDs}$

$$\frac{5}{5} - \frac{3}{5} = \frac{2}{5} = \text{CDs remaining}$$

whole - sold

$$\frac{2}{5} \cdot X + 10 = 62$$

$$\begin{array}{r} .4x + 10 = 62 \\ \downarrow \quad \downarrow \quad | \quad \downarrow \\ .4x \quad -10 \quad | \quad -10 \\ \hline .4x \quad = \quad 52 \\ \downarrow \quad \downarrow \\ .4 \quad .4 \end{array}$$

$$X = 130$$

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- 1B. **READING** Len read $\frac{3}{4}$ of a graphic novel over the weekend. Monday, he read 22 more pages. If he has read 220 pages, how many pages does the book have?

$P = \text{pages}$

$$\frac{3}{4} \cdot P + 22 = 220$$

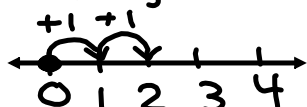
$$\begin{array}{r} 0.75P + 22 = 220 \\ -22 \quad -22 \\ \hline 0.75P = 198 \end{array}$$

$$\begin{array}{r} 0.75P = 198 \\ \hline 0.75 \quad 0.75 \\ P = 264 \end{array}$$

Consecutive integers are integers in counting order, such as 4, 5, and 6 or n , $n+1$, and $n+2$. Counting by two will result in *consecutive even integers* if the starting integer n is even and *consecutive odd integers* if the starting integer n is odd.

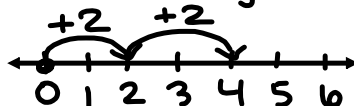
TYPE	WORDS	SYMBOLS	EXAMPLE
Consecutive integers	Integers that come in counting order.	$n, n+1, n+2, \dots$	$\dots, -2, -1, 0, 1, 2, \dots$
Consecutive even integers	Even integer followed by the next even integer.	$n, n+2, n+4, \dots$	$\dots, -2, 0, 2, 4, \dots$
Consecutive odd integers	Odd integer followed by the next odd integer.	$n, n+2, n+4, \dots$	$\dots, -1, 1, 3, 5, \dots$

Consecutive integers



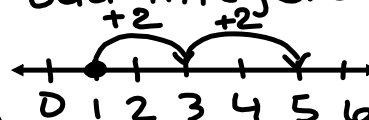
$n = 1^{\text{st}}$ integer
 $n+1 = 2^{\text{nd}}$ integer
 $n+1+1 = n+2$
 $= 3^{\text{rd}}$ integer

consecutive even integers



$n = 1^{\text{st}}$ even int.
 $n+2 = 2^{\text{nd}}$ even int.
 $n+2+2 = n+4$
 $= 3^{\text{rd}}$ even int.

consecutive odd integers



$n = 1^{\text{st}}$ odd int.
 $n+2 = 2^{\text{nd}}$ odd int.
 $n+2+2 = n+4$
 $= 3^{\text{rd}}$ odd int.

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EXERCISE 2

Write an equation for the following problem. Then solve the equation and answer the problem.

Find three consecutive odd integers with a sum of -51. *Go up by 2*

Let n = the least (smallest) odd integer. *(1st odd)* *+* *(2nd odd)* *(3rd odd)*

Then, $n+2$ = the next greater (bigger) odd integer, and $n+4$ = the greatest (biggest) of the three odd integers.

Words: *+* The sum of three consecutive odd integers is -51.

Equation: *(1st odd) + (2nd odd) + (3rd odd)*
 $n + (n+2) + (n+4) = -51$

Solve: $n + (n+2) + (n+4) = -51$ original equation

$$3n + 6 = -51$$

$$3n + \cancel{6} = -51 - 6$$

$$3n = -57$$

$$\cancel{3}n = \frac{-57}{\cancel{3}}$$

$$n = -19$$

If $n = -19$, then $n+2 = -19 + 2 = -17$ and $n+4 = -19 + 4 = -15$.

Answer: The three consecutive odd integers are -19, -17, and -15.

Combined like terms
Subtraction property
substitution/simplify
division property
substitution/simplify

2A. Write an equation and solve the problem.

Find three consecutive integers with a sum of 21. *go by 1*

n = 1st integer

$n+1$ = 2nd integer

$n+2$ = 3rd integer

$$1st = 6$$

$$2nd = 6+1 = 7$$

$$3rd = 6+2 = 8$$

$$(1st) + (2nd) + (3rd) = 21$$

$$n + n+1 + n+2 = 21$$

$$\begin{array}{r} 3n + 3 = 21 \\ \downarrow \quad \downarrow \quad \downarrow \\ \hline 3n \quad = 18 \\ \hline \cancel{3} \quad \quad \quad \cancel{3} \end{array}$$

$$n = 6$$

The integers are
6, 7, 8.

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2B. Write an equation and solve the problem.

Find three consecutive even integers with a sum of 84. Go up by 2

$$n = \text{1st even} \quad (\text{1st even}) + (\text{2nd even}) + (\text{3rd even}) = 84$$

$$n+2 = \text{2nd even}$$

$$n+4 = \text{3rd even}$$

$$n + n+2 + n+4 = 84$$

$$\begin{array}{r} 3n+6=84 \\ -6 \quad | \quad -6 \\ \hline \end{array}$$

$$\text{1st even} = 26$$

$$\text{2nd even} = 26+2 = 28$$

$$\text{3rd even} = 26+4 = 30$$

$$\begin{array}{r} 3n = 78 \\ \hline 3 \quad \quad 3 \end{array}$$

$$n = 26$$

The consecutive
even integers are
26, 28, 30.