WARM UP: Each bag contains the **same number** of gold coins. **Determine** how many coins are in each bag.

3 bags and 1 stack of 6 coins

1 bag and 4 stacks of 6 coins

Step1 : Remove 1 bag from BOTH SIDES
Step2 : Remove 1 stack of coins from BOTH SIDES
Step3 : Divide coins between both bags EVENLY.

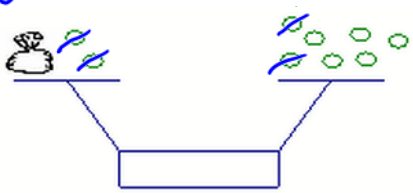
2 bags = 18 coins
1 bag = 18 ÷ 2
= 9 coins

SOLVING THE UNKNOWN ALGEBRAICALLY

Determine how many coins are in the bag.
Let 'x' represent **each bag** and each coin will have a value of **one**.

LEFT SIDE RIGHT SIDE

1 bag and 2 coins 7 coins

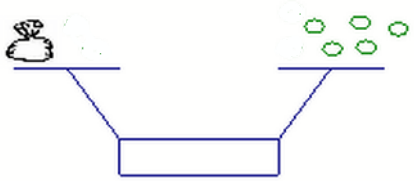


1 bag and 2 coins ⟶ 7 coins

LEFT SIDE: $x + 2$ RIGHT SIDE: 7

equation $x + 2 = 7$ to isolate x (bag)

$-2 \quad -2$ subtract (remove) 2 (coins) from BOTH SIDES



$x = 5$

∴ The solution to this equation is 5.

GOLDEN RULE OF ALGEBRA

PERFORM THE SAME OPERATION(S) TO BOTH SIDES

SOLVING ONE-STEP EQUATIONS

JUST perform the inverse (opposite) operation.

Solve each of the following equations:

Addition	Subtraction	Multiplication	Division	Square
$x + 5 = 9$ $-5 \quad -5$ $x = 4$	$x - 1 = 3$ $+1 \quad +1$ $x = 4$	$\frac{2x}{2} = \frac{10}{2}$ $x = 5$	$\frac{x}{2} = 6$ $x \div 2 = 6 \times 2$ $x = 12$	$\sqrt{x^2} = \sqrt{9}$ $x = 3$
$x + 10 = 31$ $-10 \quad -10$ $x = 21$	$x - 8 = 2$ $+8 \quad +8$ $x = 10$	$\frac{5x}{5} = \frac{40}{5}$ $x = 8$	$3 \cdot \frac{x}{3} = -2 \cdot 3$ $x = -6$	$\sqrt{x^2} = \sqrt{36}$ $x = 6$

SOLVING TWO-STEP EQUATIONS

Use Reverse Order of Operations
S or A \ M or D \ E \ B

***Solve** the following equations:*

1) Teacher	Your Turn	
$2x + 8 = 20$ $-8 \quad -8$ $\frac{2x}{2} = \frac{12}{2}$ $x = 6$ 1) Subtract 8 from both sides 2) divide both sides by 2	a) $3x - 10 = 11$ $+10 \quad +10$ $\frac{3x}{3} = \frac{21}{3}$ $x = 7$	b) $25 = 5 + 5x$ $25 = 5x + 5$ $-5 \quad -5$ $\frac{20}{5} = \frac{5x}{5}$ $4 = x$ $x = 4$
2) Teacher	**Your Turn**	
$5 - x = 11$ $-5 \quad -5$ $\frac{-1x}{-1} = \frac{6}{-1}$ $x = -6$ 1) Subtract 5 from both sides 2) ÷ both sides by −1	a) $10 - x = 22$ $-10 \quad -10$ $\frac{-x}{-1} = \frac{12}{-1}$ $x = -12$	b) $-22 = -x - 11$ $-11 \quad +11$ $\frac{-33}{-1} = \frac{-1x}{-1}$ $33 = x$ $x = 33$
3) Teacher	**Your Turn**	
$+7 - 3x = 19$ $-7 \quad -7$ $\frac{-3x}{-3} = \frac{12}{-3}$ $x = -4$ 1) subtract 7 from both sides 2) ÷ both sides by −3	a) $-2x - 8 = 10$ $+8 \quad +8$ $\frac{-2x}{-2} = \frac{18}{-2}$ $x = -9$	b) $131 = 11 - 5x$ $-11 \quad -11$ $\frac{120}{-5} = \frac{-5x}{-5}$ $-24 = x \rightarrow x = -24$
4) Teacher	**Your Turn**	
$\frac{x}{3} - 2 = -4$ $+2 \quad +2$ $3 \cdot \frac{x}{3} = -2 \cdot 3$ $x = -6$ 1) Add to both sides 2) multiply both sides by 3	a) $9 + \frac{x}{5} = 11$ $-9 \quad -9$ $5 \cdot \frac{x}{5} = 2 \cdot 5$ $x = 10$ * Subtract 9 from both sides * multiply both sides by 5	b) $10 = 2 - \frac{x}{2}$ $-2 \quad -2$ $2 \cdot 8 = \frac{-x}{2} \cdot 2$ $\frac{16}{-1} = \frac{-x}{-1}$ $x = -16$ subtract 2 multiply by 2 divide by −1
5) Teacher	**Your Turn**	
$x^2 - 5 = 44$ $+5 \quad +5$ $\sqrt{x^2} = \sqrt{49}$ $x = 7$ 1) add 5 to both sides 2) square root both sides	a) $12 + x^2 = 21$ $-12 \quad -12$ $\sqrt{x^2} = \sqrt{9}$ $x = 3$ * subtract 12 from both sides * square root both sides	b) $165 = -4 + x^2$ $+4 \quad +4$ $\sqrt{169} = \sqrt{x^2}$ $13 = x$ $x = 13$ * add 4 to both sides * sq root both sides
6) Teacher	**Your Turn**	
$2x^2 - 5 = 13$ $+5 \quad +5$ $\frac{2x^2}{2} = \frac{18}{2}$ $\sqrt{x^2} = \sqrt{9}$ $x = 3$ 1) add 5 to both sides 2) divide both sides by 2 3) square root both sides	a) $4x^2 - 10 = 26$ $+10 \quad +10$ $\frac{4x^2}{4} = \frac{36}{4}$ $\sqrt{x^2} = \sqrt{9}$ $x = 3$ * add 10 to both sides * divide both sides by 4 * sq root both sides	b) $-306 = -6 - 3x^2$ $+6 \quad +6$ $\frac{-300}{-3} = \frac{-3x^2}{-3}$ $100 = x^2$ $10 = x$ $x = 10$ * add 6 to both sides * ÷ both sides by −3 * $\sqrt{}$ both sides.

PRACTICE

1. Mr. Forster solved the following equation. Explain, using full sentences, what he did to get each line of his solution.

Mr. Forster's Work	What He Did
$15 - 5x = 10$	*Original Question*
$-5x = -5$	Subtracted 15 from both sides
$x = 1$	Divided both sides by -5

2. Make up an equation with two operations that has a solution of x = 5.

$2x - 3 = 7$ subtract 3 from both sides
$2x = 10$ double both sides
$x = 5$ start from the end

OR

$x^2 - 5 = 20$
$x^2 = 25$
$x = 5$

3. Mike is currently 8 years older than Janet. Mike's age can be calculated by using the equation below where m represents Mike's age. Calculate their ages.

Step 1
$2m - 8 = 30$
$+8 \quad +8$
$\frac{2m}{2} = \frac{38}{2}$
$m = 19$

Step 2
If Mike is 19 years old, then Janet is 11 years old.

THINKING

4. A triangle has a perimeter of 240 cm. The three side lengths are x, 2x + 40 and x + 60. What are the side lengths of this triangle?

Sum of all sides = perimeter
$x + 2x + 40 + x + 60 = 240$
$x + 2x + x + 40 + 60 = 240$
$4x + 100 = 240$
$-100 \quad -100$
$\frac{4x}{4} = \frac{140}{4}$
$x = 35$ cm

∴ Side x is 35 cm
Side (2x+40) is $2(35) + 40 = 110$ cm
Side (x+60) is $35 + 60 = 95$ cm.