

## Algebra - Solving Equations

An equation has an equals sign and a variable or unknown.

An expression does not have a equals sign

eg  $4x + 9$  (equation will be solved)

$4x + 1$  expression (simplify if possible)

### Methods of solving

#### A) Guess and check

eg  $4x = 24$   
↳ means 4 times x

guess  $x = 6$

check  $4 \times 6 = 24$  ✓  
so  $x = 6$

eg  $x - 5 = 30$

guess  $x = 35$

check  $35 - 5 = 30$

so  $x = 35$

#### B) Inverse or opposite operations

The equation must remain balanced.

What we do to one side, we must do to the other

To solve we use or opposite operations

We always write the variable with the answer

Opposite of add is subtract

Opposite of subtract is add

Opposite of multiply is divide

Opposite of divide is multiply

$$4) \begin{array}{r} x + 5 = 7 \\ -5 \quad -5 \\ \hline x = -12 \end{array}$$

$$5) \begin{array}{r} 5x = 40 \\ \div 5 \quad \div 5 \\ \hline x = 8 \end{array}$$

$$6) \begin{array}{r} 4x = 9 \\ \div 4 \quad \div 4 \\ \hline x = \frac{9}{4} \\ x = 2\frac{1}{4} \end{array}$$

$$7) \begin{array}{r} 12x = 8 \\ \div 12 \quad \div 12 \\ \hline x = \frac{8}{12} \\ x = \frac{2}{3} \end{array}$$

\* Solving equations with integers

$$1) \begin{array}{r} -5q = -25 \\ \div 5 \quad \div 5 \\ \hline q = 5 \end{array}$$

$$2) \begin{array}{r} -b = 80 \\ b = -80 \end{array}$$

(opposite of b so opposite of 80)

$$3) \begin{array}{r} 75 = -3f \\ \div 3 \quad \div 3 \\ \hline -25 = f \\ f = -25 \end{array}$$

Examples (Division)

$$1) \begin{array}{r} t = -1 \\ 7 \\ \times 7 \quad \times 7 \\ \hline t = -7 \end{array}$$

$$2) \begin{array}{r} d = -11 \\ -3 \\ \times 3 \quad \times 3 \\ \hline d = 33 \end{array}$$

$$3) \begin{array}{r} -\frac{k}{2} = -1 \\ \times 2 \quad \times 2 \\ \hline k = 2 \end{array}$$

( $-\frac{k}{2}$  same as  $\frac{k}{-2}$ )

## Solving two step Equations

### A) Equations with variable both sides

#### Example

$$\begin{array}{r} 8x = 5x + 12 \\ -5x \quad -5x \end{array}$$

$$\begin{array}{r} 3x = 12 \\ \div 3 \quad \div 3 \end{array}$$

$$x = 4$$

We 'undo' the variable first by adding or subtracting  
next solve the one step equation that is left.

### B) Equations with variable one side only

#### Examples

$$\begin{array}{r} 1) 4x + 5 = 23 \\ -5 \quad -5 \end{array}$$

$$\begin{array}{r} 4x = 20 \\ \div 4 \quad \div 4 \end{array}$$

$$x = 5$$

$$2) \frac{x}{3} - 9 = 8$$

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$$\begin{array}{r} \frac{x}{3} = 17 \\ \times 3 \quad \times 3 \end{array}$$

$$x = 51$$

first step is to add or subtract

Second step is multiply or divide.

## Writing Equations

Use the information in the problem to write and solve an equation

The equation needs a variable and an equals sign

### Example

- 1) The highest temp in summer is five times the lowest temp. Let lowest temp be  $x$ . If the highest temp is  $30^\circ$  write and solve an equation to find the lowest temp

$$5x = 30$$

$$\rightarrow$$

$$x = 6^\circ$$