

# Section 0.7

## Equations, in particular Linear Equations

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## Definition

A **linear equation** in one variable  $x$  is an equation of the form

$$ax + b = 0, \quad a \neq 0, b \text{ are real numbers}$$

- It is called *linear* equation because the graph of the function  $y = ax + b$  is a **line**.

## Example

Solve the equation  $5x - 6 = 3x$ .

## Example

(open brackets method) Solve the equation  $2(p + 4) = 7p + 2$ .

## Example

(Clearing the denominator method)

Solve the equation  $\frac{7x+3}{2} - \frac{9x-8}{4} = 6$ .

Solution: We multiply by everything in the denominator to clear it, so we multiply by 2 first to get

## 2. Literal Equations

### Example

Solve  $I = Prt$  for the variable  $t$  (i.e., isolate  $t$ ).

Solution: Here we deal with the other variables as constant and we try to make  $t$  in one side alone. Hence

$$\begin{aligned}I &= Prt \\ \frac{I}{Pr} &= \frac{Prt}{Pr} \\ \frac{I}{Pr} &= t\end{aligned}$$



## Example

Solve  $C = 2(\ell + w)$  for the variable  $w$

Solution: Here we deal with the other variables as constant and we try to make  $w$  in one side alone. Hence

$$C = 2(\ell + w)$$

$$\frac{C}{2} = \frac{2(\ell + w)}{2}$$

$$\frac{C}{2} = \ell + w$$

$$\frac{C}{2} - \ell = w$$

## 2. Fractional Equations

### Example

Solve  $\frac{3}{x} + 5 = 2$  for the variable  $x$

Solution: Here we multiple everything by the number in the denominator which is  $x$ . Hence

$$x \left( \frac{3}{x} \right) + x(5) = x(2)$$

$$3 + 5x = 2x$$

$$5x - 2x = -3 \rightarrow 3x = -3 \rightarrow x = -1$$

Solution Set =  $\{-1\}$ .

## Example

Solve  $\frac{3x+4}{x+2} - \frac{3x-5}{x-4} = \frac{12}{x^2-2x-8}$ .

Solution: We need to clear the denominator, but let us factor first  $x^2 - 2x - 8$  which will be

$$x^2 - 2x - 8 =$$

So we need to multiple by only by  $(x + 2)(x - 4)$ !

$$(x + 2)(x - 4) \frac{3x + 4}{x + 2} - (x + 2)(x - 4) \frac{3x - 5}{x - 4} = (x + 2)(x - 4) \frac{12}{(x + 2)(x - 4)}$$

$$(3x + 4)(x - 4) - (3x - 5)(x + 2) = 12$$

$$3x^2 - 8x - 16 - 3x^2 - x + 10 = 12$$

continue...

$$3x^2 - 8x - 16 - 3x^2 - x + 10 = 12$$

$$-9x = 18$$

$$x = -2$$

Solution Set= $\{-2\}$ .

#### 4. Radical Expression

##### Example

Solve  $\sqrt{x+3} = 2$  for the variable  $x$ .

Solution: To cancel the radical, take the square of both sides

$$(\sqrt{x+3})^2 = (2)^2$$

$$x + 3 = 4$$

$$x = 1$$

Solution Set =  $\{1\}$ .

## Example

Solve  $\sqrt{x} - \sqrt{x+1} = 1$ .