

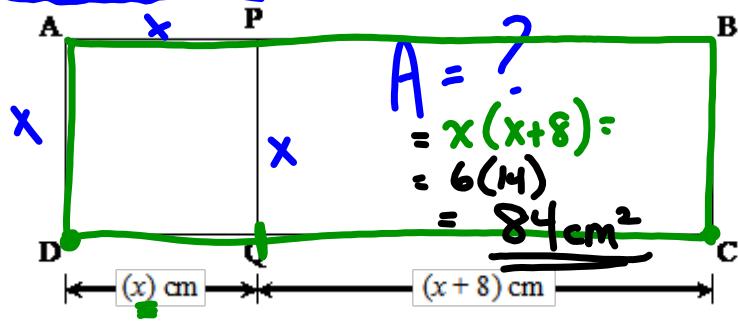
Example: In the figure, \overline{PQ} divides rectangle $ABCD$ into two quadrilaterals: square $APQD$ and rectangle $PBCQ$. [The area of rectangle $ABCD$ is 120cm^2]
 In addition, $mDQ = (x)\text{cm}$ and $mQC = (x+8)\text{cm}$.

$(2x+8) \cdot x = A$ What is the numerical area of rectangle $PBCQ$?

$$\begin{aligned} x(2x+8) &= 120 \\ 2x^2 + 8x &= 120 \\ 2x^2 + 8x - 120 &= 0 \end{aligned}$$

factor

$$\frac{2(x^2 + 4x - 60)}{2} = 0$$



$$\begin{aligned} x + x + 8 &= 120 \\ 2x + 8 &= 120 \\ 2x &= 112 \\ x &= 56 \end{aligned}$$

$x = 6$ or $x = -10$

$\therefore x = 6$ Does not make sense

Today, a father is 2 years older than triple his son's age.

Five years ago, the product of their ages was 420. How old is the father now?

multiply

① 2 unknowns (variables)

② 2 times

| | Today | Past |
|--------------|---------------|-----------------------|
| Son's age | $p = 15$ | $p - 5$ |
| Father's age | $3p + 2 = 47$ | $3p + 2 - 5 = 3p - 3$ |

$$(p-5)(3p-3) = 420$$

$$3p^2 - 18p + 15 = 420$$

$$3p^2 - 18p - 405 = 0$$

$$3(p^2 - 6p - 135) = 0$$

$$p^2 - 6p - 135 = 0$$

$$(p+9)(p-15) = 0$$

$$p+9=0 \quad \text{or} \quad p-15=0$$

$$p=-9$$

Reject

$$\boxed{p=15}$$

Today, a mother's age is two years more than double her son's age. In ten years, the product of their ages will be 2040. How old are they today?

| | Present | Future |
|--------------|----------|-----------|
| Mother's age | $2x + 2$ | $2x + 12$ |
| Son's age | x | $x + 10$ |

$$(2x+12)(x+10) = 2040$$

$$2x^2 + 32x + 120 = 2040$$

$$2x^2 + 32x + 120 - 2040 = 2040 - 2040$$

$$\frac{2x^2 + 32x - 1920}{2} = 0$$

$$x^2 + 16x - 960 = 0$$

$$(x-24)(x+40) = 0$$

$$x - 24 = 0 \quad \text{or} \quad x + 40 = 0$$

$$x = 24$$

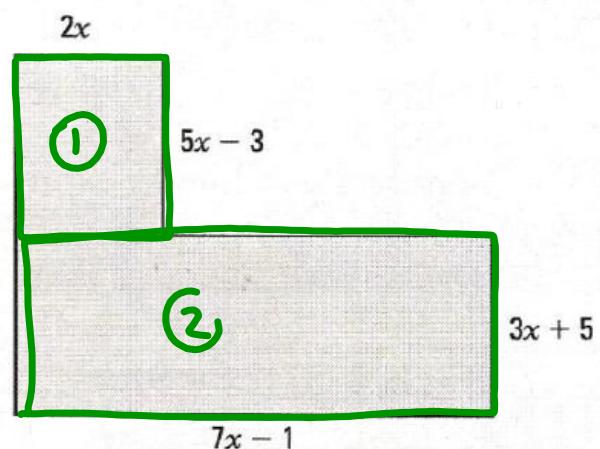
$$x = -40$$

Son is 24, mom is 50.

The Quadratic Formula

The area of this figure is equal to 103.75cm^2 .

Determine the numerical length of each side .



$$\underbrace{2x(5x-3)}_{\textcircled{1}} + \underbrace{(3x+5)(7x-1)}_{\textcircled{2}} = 103.75$$

$$\cancel{10x^2} - \cancel{6x} + \cancel{21x^2} - \cancel{3x} + \cancel{35x} - 5 = 103.75$$

$$31x^2 + 26x - 5 = 103.75$$

$$31x^2 + 26x - 108.75 = 0$$

$$31x^2 + 26x - 108.75 = 0$$

$$m \times n = -3371.25$$

$$m + n = 26$$

The quadratic formula provides a solution to any quadratic (second-degree) equation.

$$\Rightarrow \underline{\underline{ax^2 + bx + c = 0}} \equiv$$

quadratic
=
2nd degree

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Example: $ax^2 + bx + c = 0$

$$\begin{matrix} 31x^2 \\ a \end{matrix} + \begin{matrix} 26x \\ b \end{matrix} - \begin{matrix} 108.75 \\ c \end{matrix} = 0$$

$$x = \frac{-26 \pm \sqrt{26^2 - 4(31)(-108.75)}}{2(31)} = \frac{-26 \pm \sqrt{14161}}{62}$$

$$x = \frac{-26 \pm \sqrt{14161}}{62} = \frac{-26 \pm 119}{62}$$

1 $x = \frac{-26 + 119}{62}$

2 $x = \frac{-26 - 119}{62}$

$x = \frac{93}{62} = 1.5$

$x = \frac{-145}{62} \approx -2.34$

$\therefore x = 1.5$

$$2x = 3$$

$$8x + 2 = 14$$

$$5x - 3 = 4.5$$

$$5x - 1 = 6.5$$

$$3x + 5 = 9.5$$

$$7x - 1 = 9.5$$

Example:

Solve

$$15x^2 - 2x - 8 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{2 \pm \sqrt{(-2)^2 - 4(15)(-8)}}{2(15)}$$

$$\sqrt{4 - 4(15) - 8}$$

$$x = \frac{2 \pm \sqrt{4 + 480}}{30}$$

$$x = \frac{2 \pm \sqrt{484}}{30}$$

$$x = \frac{2 \pm 22}{30}$$

$$x = \frac{2 + 22}{30} = \frac{24}{30} = \frac{4}{5} \quad \text{or} \quad x = \frac{2 - 22}{30} = \frac{-20}{30} = -\frac{2}{3}$$