Solve for x: $3x^3+5x^2=2x \rightarrow 3x^3+5x^2-2x=0$

$\rightarrow x(3x^2+5x-2)=0$ *

$\boxed{x=0}$

* $3x^2+5x-2=0 \rightarrow$ · to -6

+ to 5

6, -1

$\rightarrow \underbrace{3x^2+6x}\ \underbrace{-x-2}=0 \rightarrow 3x(x+2)-1(x+2)=0$

$3x-1=0 \rightarrow \boxed{x=\frac{1}{3}}$

$\rightarrow (3x-1)(x+2)=0$

$x+2=0 \rightarrow \boxed{x=-2}$

OR, the other way around gives same answer:

$\rightarrow (3x^2-1x)(+6x-2)=0 \rightarrow \underline{x}(\underline{3x-1})\underline{+2}(3x-1)$

$(x+2)(3x-1)=0$

$x+2=0 \rightarrow \boxed{x=-2}$

$3x-1=0 \rightarrow \boxed{x=\frac{1}{3}}$

Solve for x: $$\frac{10}{x^2-4x} = 1 + \frac{1}{x-4}$$

$$\rightarrow \frac{10}{x^2-4x} - \frac{1}{x-4} = 1 \rightarrow \frac{10}{x(x-4)} - \frac{1 \cdot x}{(x-4)x} = 1$$

$$\rightarrow \frac{10}{x(x-4)} - \frac{x}{x(x-4)} = 1 \rightarrow \frac{10-x}{x(x-4)} = 1$$

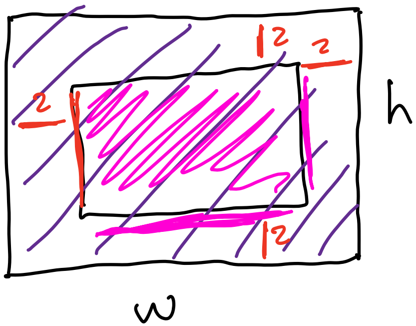
$$\rightarrow \frac{10-x}{(x^2-4x)} = 1 \rightarrow 10 - x = x^2 - 4x \rightarrow x^2 - 4x + x - 10 = 0$$

$$\rightarrow x^2 - 3x - 10 = 0 \rightarrow \begin{array}{l} \cdot \text{ to } -10 \\ + \text{ to } -3 \end{array} \quad -5, 2 \rightarrow (x-5)(x+2) = 0$$

$$x - 5 = 0 \rightarrow \boxed{x = 5}$$

$$x + 2 = 0 \rightarrow \boxed{x = -2}$$

A rectangular frame is 3 inches wider than it is tall. The area of the frame is 238 square inches. If the frame is 2 inches thick all around, what is the area of the picture that fits inside the frame?



height = h

width = $w = h+3$

$A = 238$

$A = hw$

$\rightarrow 238 = h(h+3) \rightarrow 238 = h^2 + 3h \rightarrow h^2 + 3h - 238 = 0$

$h = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $\quad a = 1 \quad b = 3 \quad c = -238$

$\rightarrow h = \dfrac{-3 \pm \sqrt{9 - 4(-238)}}{2} \rightarrow h = \dfrac{-3 \pm \sqrt{961}}{2} \rightarrow h = \dfrac{-3 \pm 31}{2}$

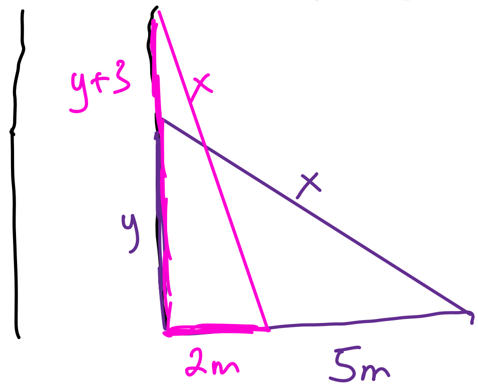
$h = 14$

$\cancel{h = -17}$

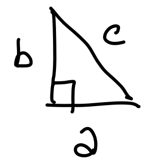
$\boxed{h = 14}$ $\quad w = 14 + 3 \rightarrow \boxed{w = 17}$

$$\boxed{\begin{array}{l} \text{Inside:} \\ h = 10 \qquad w = 13 \\ \text{Area} = 130 \ \text{in}^2 \end{array}}$$

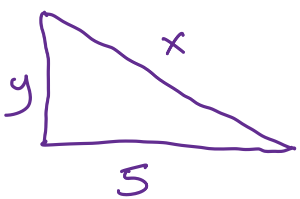
Two identical ladders are leaning against a wall. The base of the first ladder is 5m away from the base of the wall. The base of the second ladder is 2m away from the base of the wall, and it reaches 3m higher up the wall than the first ladder. How long are the ladders?



Pythagoras (plagiarizing the Babylonians):



$a^2+b^2=c^2$



$\underbrace{5^2+y^2}=x^2$

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

If these are both equal to the same thing, x^2, they also have to be equal to each other. If we set them equal, then we have an equation in only one variable, y, and can solve for it.

$25 + y^2 = 4 + (y+3)(y+3) \rightarrow 25 + \cancel{y^2} = 4 + \cancel{y^2} + 6y + 9$

$\rightarrow 6y + 9 + 4 - 25 = 0 \rightarrow 6y - 12 = 0 \rightarrow \frac{6y}{6} = \frac{12}{6}$

$\rightarrow \boxed{y = 2}$

Now, plug the value for y into either one of the triangle equations. Both will work, but here I'll use the first (purple) one:

$5^2 + y^2 = x^2 \rightarrow 25 + 4 = x^2 \rightarrow x^2 = 29$

$\boxed{x = \sqrt{29}}$ $\quad x \approx 5.385$

The ladders are approx. 5.385 m long.

Completing the Square:

$x^2 + 8x - 7$

- divide middle term by 2 = 4
- then square it = 16

$x^2 + 8x + 16 - 7 - 16$

→ · to 16   4, 4
+ to 8

If you're looking for these numbers for an expression that you used the above process to get, they will be the same number! Not only that, they will be the number you already found when you divided the middle term by 2.

→ $\overbrace{(x+4)(x+4)} - 23 \rightarrow \boxed{(x+4)^2 - 23}$

//

$\dfrac{2x^2 + 10x + 3}{2} = \dfrac{0}{2}$

→ $x^2 + 5x + \frac{3}{2} = 0$

→ $x^2 + 5x + \left(\frac{5}{2}\right)^2 + \frac{3}{2} - \left(\frac{5}{2}\right)^2$

* recall that: $\left(\frac{5}{2}\right)^2 = \frac{5^2}{2^2}$

→ $\overbrace{x^2 + 5x + \frac{25}{4}} + \frac{3}{2} - \frac{25}{4}$ →

· to $\frac{25}{4}$
+ to 5

We don't need to think up these numbers! We already know they will be the same number twice, and that number will be half the middle term. So: $\frac{5}{2}$

$$\left(x+\frac{5}{2}\right)^2+\frac{6}{4}-\frac{25}{4} \longrightarrow \boxed{\left(x+\frac{5}{2}\right)^2-\frac{19}{4}=0}$$