

WARM UP:

Factor each of the following completely:

a) $9x^2 + 6x + 1$

$(3x+1)^2$

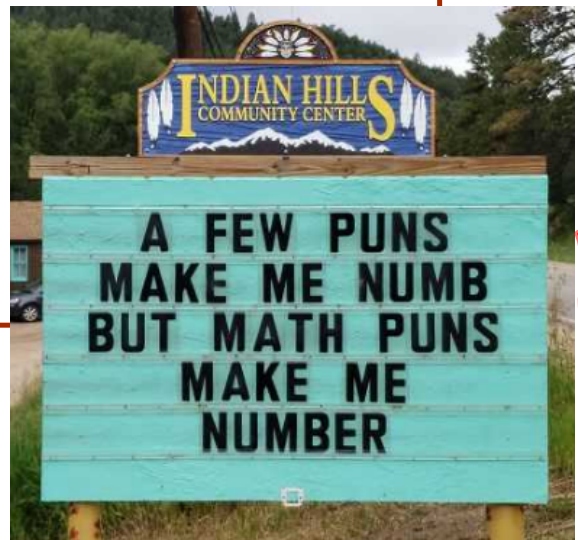
b) $7a^2 - 7b^2$

c) $-y^2 - 10y - 9$

a) $(3x+1)(3x+1)$

b) $7(a^2 - b^2)$
 $7(a+b)(a-b)$

c) $-1(y^2 + 10y + 9)$
 $-1(y+9)(y+1)$



Completing the Square

Procedure:

Example: $4x^2 - 2x - 5 = 0$

① Isolate constant & divide by leading coefficient

$$\frac{1}{2} \left(\frac{-1}{2} \right) = \frac{-1}{4}$$

$$\left(\frac{-1}{4} \right)^2 = \frac{1}{16}$$

$$\frac{4x^2}{4} - \frac{2x}{4} = \frac{5}{4}$$

② Side Work
 a) $\frac{1}{2}$ (coefficient of x-term)
 b) Square that & add to both sides

$$x^2 - \frac{1}{2}x + \frac{1}{16} = \frac{5}{4} + \frac{1}{16}$$

$$\sqrt{\left(x - \frac{1}{4}\right)^2} = \sqrt{\frac{21}{16}}$$

③ Factor left $(x \pm \text{step 2a})^2$ & simplify right

$$x - \frac{1}{4} = \pm \frac{\sqrt{21}}{4}$$

④ Square Root & solve for x

$$x = \frac{1}{4} \pm \frac{\sqrt{21}}{4}$$

Quick 4 minute video on how to Complete the Square.

<https://www.youtube.com/watch?v=zKV5ZqYIAMQ>

More examples: $(x+7)(x-1) = 0$

1) $x^2 + 6x - 7 = 0$ $x = -7, 1$ 2) $x^2 + 6x + 10 = 0$

$$x^2 + 6x + \underline{9} = 7 + \underline{9}$$

$$\sqrt{(x+3)^2} = \sqrt{16}$$

$$x+3 = \pm 4$$

$$\begin{array}{r} -3 \quad -3 \\ \hline x = -3 \pm 4 \end{array}$$

$$\begin{array}{l} \frac{1}{2}(6) = \boxed{3} \\ (3)^2 = \boxed{9} \end{array}$$

$$\begin{array}{l} \rightarrow -3 + 4 = 1 \\ \searrow -3 - 4 = -7 \end{array}$$

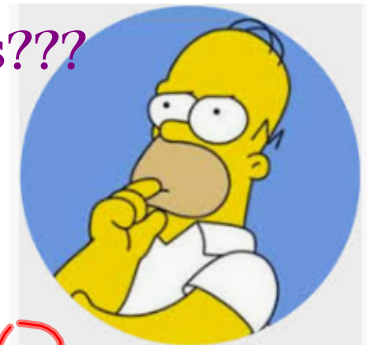
3) $3x^2 - 4x - 5 = 0$

4) $x^2 + 10x + 21 = 0$

What does this look like on the regents???

The roots of the equation $x^2 + 2x + 5 = 0$ are

- ~~1)~~ -3 and 1
- ~~2)~~ -1, only
- 3) $-1 + 2i$ and $-1 - 2i$
- 4) $-1 + 4i$ and $-1 - 4i$



$$\frac{1}{2}(2) = 1$$

$$(1)^2 = 1$$

$$x^2 + 2x + 5 = 0$$

$$x^2 + 2x + \underline{1} = -5 + \underline{1}$$

$$\sqrt{(x+1)^2} = \pm\sqrt{-4}$$

$$x+1 = \pm 2i$$

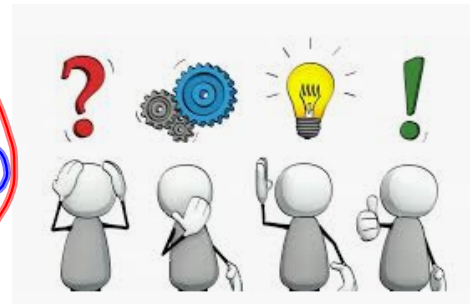
$$x = -1 \pm 2i$$

The solutions to the equation $\frac{1}{2}x^2 = -6x + 20$ are

- 1) $-6 \pm 2i$
- 2) $-6 + 2\sqrt{19}$
- 3) $6 \pm 2i$
- 4) $6 \pm 2\sqrt{19}$

$2(0) = \frac{1}{2}x^2 - 6x + 20$

$D = x^2 - 12x + 40$



$\frac{1}{2}(-12) = -6$

$(-6)^2 = 36$

$x^2 - 12x + 36 = -40 + 36$

$\sqrt{(x-6)^2} = \sqrt{-4}$

$x - 6 = \pm 2i$

$+6 \quad +6$

Homework: p. 192 #2, 24-25

Writing About Mathematics

2. Phillip said that the equation $0 = x^2 - 6x + 1$ can be solved by adding 8 to both sides of the equation. Do you agree with Phillip? Explain why or why not.

In 9–26, solve each quadratic equation by completing the square. Express the answer in simplest radical form.

24. $4x^2 - 20x + 9 = 0$

25. $\frac{1}{2}x^2 + x - 3 = 0$