Algebra I | Monday 4-22-13 | Class Notes

# Ch. 8-8 Completing the Square

Concept: if your quadratic is factorable and a perfect square trinomial, it is easy to solve because you can just take the square root of both sides

PST = anything

Ex
$$x^2 + 6x + 9 = 4$$

$$(x+3)^2 = 4$$

$$\sqrt{(x+3)^2} = \sqrt{4}$$

$$x + 3 = \pm 2$$

$$x = -3 \pm 2$$

$$x = \{-3+2, -3-2\}$$

$$x = \{-1, -5\}$$

Here is the good news – you can turn any quadratic into a perfect square trinomial!! This process is known as "Completing the square"

Steps:

1. Put into standard form for quadratic equation.
2. Create placeholder for new 3rd term by moving the "c" term to right side.
3. If a is not +1, divide all terams by a to make it +1.
4. Complete the square the taking $\frac{b}{2}$ and putting $\left(\frac{b}{2}\right)^2$ as 3rd term,
   * don't forget GRE
5. take PST & square root both sides
6. Do checks!

Ex $3x^2 - 10x = -3$

$3x^2 - 10x + 3 = 0$ SF, NO GCF

$3x^2 - 10x + \{\ \} = -3 + \{\ \}$ "Double your bubble, to stay out of trouble"

$\uparrow$

$a \neq 1 \therefore \div$ by 3

$\frac{3x^2}{3} - \frac{10}{3}x + \{\ \} = \frac{-3}{3} + \{\ \}$

$x^2 - \frac{10}{3}x + \left\{\left(\frac{5}{3}\right)^2\right\} = -1 + \left\{\frac{25}{9}\right\}$

NOTE

$\frac{-9}{9} + \frac{25}{9} = \frac{16}{9}$

$\frac{10}{3} \cdot \frac{1}{2} = \frac{10}{6} = \frac{5}{3}$

THIS "completes the square" you now have A PST on left

$$\left(x - \frac{5}{3}\right)^2 = \frac{16}{9}$$

$$\sqrt{\left(x - \frac{5}{3}\right)^2} = \pm\sqrt{\frac{16}{9}} = \pm\frac{4}{3}$$

DON'T FORGET $\pm$

$$x - \frac{5}{3} = \pm\frac{4}{3}$$

$$x = \frac{5}{3} \pm \frac{4}{3}$$

$$\boxed{x = \left\{\frac{9}{3}, \frac{1}{3}\right\} = \left\{3, \frac{1}{3}\right\}}$$

(Ex) SAME AS ONE ON prior page but done how I would really SHOW it:

$$3x^2 - 10x = -3$$

$$\frac{3}{3}x^2 - \frac{10}{3}x + \left(\frac{5}{3}\right)^2 = \frac{-3}{3} + \frac{25}{9}$$

$$\left(x - \frac{5}{3}\right)^2 = \frac{16}{9}$$

$$x - \frac{5}{3} = \pm\frac{4}{3}$$

$$\boxed{x = \frac{5}{3} \pm \frac{4}{3} = \left\{3, \frac{1}{3}\right\}}$$

BTW, THE original QUADRATIC WAS factorable. CTS works whether it is or NOT.

Ex $x^2 - 2x - 2 = 0$

$$x^2 - 2x + 1^2 = 2 + 1$$

$\frac{b}{2} = \frac{2}{2} = 1$

$$(x-1)^2 = 3$$

$$x - 1 = \pm\sqrt{3}$$

$$x = 1 \pm \sqrt{3}$$

$\therefore$ $\boxed{x = \{1+\sqrt{3},\ 1-\sqrt{3}\}}$ EXACT

$\therefore$ $\approx 2.7321$ $\approx \bar{\ }0.7321$ Approx

NOTES: use EXACT Answers for checks, if you have irrational conjugates, for this class, you only need to check ONE. Tip: use + one

if you get a $\ominus$ under the $\sqrt{\ominus}$, STOP, Answer is $\boxed{\text{No Real Solution}}$

CK $x+\sqrt{3}$

$$(1+\sqrt{3})^2 - 2(1+\sqrt{3}) - 2 \stackrel{?}{=} 0$$

$$(1+\sqrt{3})(1+\sqrt{3}) - 2 - 2\sqrt{3} - 2 \stackrel{?}{=} 0$$

$$1^2 + 1\sqrt{3} + 1\sqrt{3} + 3 - 4 - 2\sqrt{3} \stackrel{?}{=} 0$$

$$2\sqrt{3} + 4 - 4 - 2\sqrt{3} \stackrel{?}{=} 0 \checkmark$$

(3) $-58 - 16x = -2x^2$

$$\frac{2x^2}{2} - \frac{16x}{2} - \frac{58}{2} = 0$$

$$x^2 - 8x + 4^2 = 29 + 16$$

$$(x-4)^2 = 45$$

$$x - 4 = \pm\sqrt{\underset{9\ 5}{45}} = \pm 3\sqrt{5}$$

$$\boxed{x = 4 \pm 3\sqrt{5}}$$

or $x = \{4+3\sqrt{5},\ 4-3\sqrt{5}\}$

CK $(4+3\sqrt{5})$

$$-58 - 16(4+3\sqrt{5}) \stackrel{?}{=} -2(4+3\sqrt{5})(4+3\sqrt{5})$$

$$-58 - 64 - 48\sqrt{5} \stackrel{?}{=} -2[16 + 24\sqrt{5} + 45]$$

$$-122 - 48\sqrt{5} \stackrel{?}{=} -122 - 48\sqrt{5} \checkmark$$

(6) $-6N = -5 - N^2$

$$N^2 - 6N + \{3^2\} = -5 + \{9\}$$

$$(N-3)^2 = 4$$

$$N - 3 = \pm 2$$

$$N = 3 \pm 2$$

$$\boxed{N = \{5, 1\}}$$

CK ✓

$N = 5$