Warm Up (3/16/18) PARCC Practice

Consider the function $f(x) = 2x^2 + 6x - 8$.
What is the vertex form of $f(x)$?

Complete the Square

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

$b = 3$

$\frac{b}{2} = \frac{3}{2} = 1.5$

$(\frac{3}{2})^2 = \frac{9}{4} = 2.25$

$2((x^2 + 3x + 2.25) - 2.25 - 4)$

$2((x + 1.5)^2 - 2.25 - 4)$

$2(x + 1.5)^2 - 4.5 - 8$

$2(x + 1.5)^2 - 12.5$

A. $f(x) = 2(x - 3)^2 - 4$

B. $f(x) = 2(x + 3)^2 - 4$

C. $f(x) = 2(x - 1.5)^2 - 12.5$

D. $f(x) = 2(x + 1.5)^2 - 12.5$

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Module 4: Lesson 13

Solving Quadratic Equations by Completing the Square

Solve the following quadratic equations directly:

$-2 - 5x^2 = -22$

$+2 \quad +2$

$-5x^2 = -20$

$\frac{-5x^2}{-5} = \frac{-20}{-5}$

$\sqrt{x^2} = \sqrt{4}$

$x = 2$

$x = -2$

or

$x = \pm 2$

$-3(x^2 - 1) = -189$

$\frac{-3(x^2 - 1)}{-3} = \frac{-189}{-3}$

$x^2 - 1 = 63$

$+1 \quad +1$

$\sqrt{x^2} = \sqrt{64}$

$x = \pm 8$

Complete the square for the following expressions

x^2+6x+4

$b=-4$

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

$\left(\frac{b}{2}\right)^2=4$

$(x^2+6x+\_\_)-\_\_+4$

$(x^2+6x+9)-9+4$

$b=6$

$\frac{b}{2}=3$

$\left(\frac{b}{2}\right)^2=$

$(x+3)^2-9+4$

$(x+3)^2-5$

$=2x^2-8x+6$

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

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

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

$2(x-2)^2-2$

Solving Quadratic Equations by Completing the Square

1. Complete the square

2. Solve the equation directly (No need for factoring or using the quadratic formula)

Example

Solve the following equation by completing the square:

$12 = x^2 + 6x$

$b = 6$

$\frac{b}{2} = 3$

$\left(\frac{b}{2}\right)^2 = 9$

$12 = (x^2 + 6x + 9) - 9$

$12 = (x+3)^2 - 9$ Solve for x

$+9 \quad +9$

$\sqrt{21} = \sqrt{(x+3)^2}$

$\pm\sqrt{21} = x+3$

$-3 \quad -3$

$-3 \pm \sqrt{21} = x$

Exercises

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Solve each equation by completing the square.

1. $x^2 - 2x = 12$

$b = -2$

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

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

$(x^2 - 2x + \underline{1}) - \underline{1} = 12$

$(x-1)^2 - 1 = 12$

$+1 \quad +1$

$\sqrt{(x-1)^2} = \sqrt{13}$

$x - 1 = \pm\sqrt{13}$

$+1 \quad +1$

$x = 1 \pm \sqrt{13}$

Exercises

Solve each equation by completing the square.

2. $\frac{1}{2}r^2 - 6r = 2$

$a = \frac{1}{2}$, factor out $\frac{1}{2}$ (Everything will double)

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

Side work
$b = -12$
$\frac{b}{2} = -6$
$(\frac{b}{2})^2 = 36$

$\frac{1}{2}((r^2 - 12r + \_\_) - \_\_ = 2$

$\frac{1}{2}((r^2 - 12r + 36) - 36 = 2$

↳ this is now a perfect square. It can take the general form $(x + \frac{b}{2})^2$

$\frac{1}{2}((r-6)^2 - 36) = 2$

- Distribute $\frac{1}{2}$
- Solve for r

$\frac{1}{2}(r-6)^2 - 18 = 2$
$+18 \quad +18$

$2 \cdot (\frac{1}{2}(r-6)^2) = (20)2$

$\sqrt{(r-6)^2} = \sqrt{40}$

$r - 6 = \pm\sqrt{40}$
$+6 \quad +6$

$r = 6 \pm \sqrt{40}$

Exercises

Solve each equation by completing the square.

3. $2p^2 + 8p = 7$

$2(p^2+4p) = 7$

$2((p^2+4p+4)-4) = 7$

$2((p+2)^2-4) = 7$

$b = 4$

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

$\left(\frac{b}{2}\right)^2 = 4$

$2(p+2)^2 - 8 = 7$ ⟶ Now solve for p

$+8 \quad +8$

$\frac{2(p+2)^2}{2} = \frac{15}{2}$

$(p+2)^2 = \frac{15}{2}$

$\sqrt{(p+2)^2} = \sqrt{\frac{15}{2}}$

$p+2 = \pm\sqrt{\frac{15}{2}}$

$-2 \quad -2$

$p = -2 \pm \sqrt{\frac{15}{2}}$

Exercises

Solve each equation by completing the square.

4. $2y^2 + 3y - 5 = 4$

$2\left(\left(y^2 + \frac{3}{2}y + \_\_\_\right) - \_\_\_ - \frac{5}{2}\right) = 4$

$b: \frac{3}{2}, \frac{b}{2} = \frac{3}{4}, \left(\frac{b}{2}\right)^2 = \left(\frac{3}{2}\right)^2 = \frac{9}{16}$

$2\left(\left(y^2 + \frac{3}{2}y + \frac{9}{16}\right) - \frac{9}{16} - \frac{5}{2}\right) = 4$

$2\left(y + \frac{3}{4}\right)^2 - \frac{9}{8} - \frac{5}{1} = 4$

$2\left(y + \frac{3}{4}\right)^2 - \frac{49}{8} = 4$

$+\frac{49}{8} \quad +\frac{49}{8}$

$2\left(y + \frac{3}{4}\right)^2 = 4 + \frac{49}{8}$

$\frac{2\left(y + \frac{3}{4}\right)^2}{2} = \frac{\frac{81}{8}}{2}$

$\left(y + \frac{3}{4}\right)^2 = \frac{\frac{81}{8}}{2}$

$\sqrt{\left(y + \frac{3}{4}\right)^2} = \sqrt{\frac{81}{16}}$

$y + \frac{3}{4} = \pm\sqrt{\frac{81}{16}}$

$y + \frac{3}{4} = \pm\frac{9}{4}$

$y + \frac{3}{4} = \frac{9}{4}$ and $y + \frac{3}{4} = -\frac{9}{4}$

$-\frac{3}{4} \quad -\frac{3}{4}$ $\quad$ $-\frac{3}{4} \quad -\frac{3}{4}$

$y = \frac{9}{4} - \frac{3}{4}$ $\quad$ $y = -\frac{9}{4} - \frac{3}{4}$

$y = \frac{6}{4}$ $\quad$ $y = -\frac{12}{4}$

$y = \frac{3}{2}$ and $y = -3$

* Side work

$-\frac{9}{8} - \frac{5}{1} = -\frac{9}{8} - \frac{5}{1}\left(\frac{8}{8}\right)$

$= -\frac{9}{8} - \frac{40}{8} = \frac{-9-40}{8} = \frac{49}{8}$

* Side work

$\frac{4}{1} + \frac{49}{8} = \frac{4}{1}\left(\frac{8}{8}\right) + \frac{49}{8}$

$= \frac{32}{8} + \frac{49}{8} = \frac{32+49}{8} = \frac{81}{8}$

* Side work

$\frac{\frac{81}{8}}{2} = \frac{\frac{81}{8}}{\frac{2}{1}} = \frac{\frac{81}{8} \cdot \frac{1}{2}}{\frac{2}{1} \cdot \frac{1}{2}}$

$= \frac{\frac{81}{8} \cdot \frac{1}{2}}{\frac{2}{1} \cdot \frac{1}{2}} = \frac{81}{8} \cdot \frac{1}{2} = \frac{81}{16}$

* Side work

$\sqrt{\frac{81}{16}} = \frac{\sqrt{81}}{\sqrt{16}} = \frac{9}{4}$

$y = \frac{3}{2}$ and $y = -3$