Warm Up (3/12/18) PARCC Practice

If a is a non-zero, real number and $a(x-3)^2 - b = c$,

- Prove that $x = 3 \pm \sqrt{\frac{b+c}{a}}$. Show your work.

Solve for x

$$a(x-3)^2 - b = c$$
$$+b \quad +b$$
$$\frac{a(x-3)^2}{a} = \frac{c+b}{a}$$
$$\sqrt{(x-3)^2} = \pm\sqrt{\frac{c+b}{a}}$$
$$x-3 = \pm\sqrt{\frac{c+b}{a}}$$
$$+3 \quad +3$$
$$x = 3 \pm \sqrt{\frac{c+b}{a}}$$

Module 4: Lesson 11

Completing the Square (Part 1)

Pg. 70

Lesson Summary

Just as factoring a quadratic expression can be useful for solving a quadratic equation, completing the square also provides a form that facilitates solving a quadratic equation.

Completing the Square

The process of completing the square converts our expression from standard form to vertex form.

$(x-2)^2+3$

$(2,3)$

$(x+4)^2-12$ $(-4,-12)$

Standard Form

$f(x)=ax^2+bx+c$

Vertex Form

$f(x)=a(x-h)^2+k$

Vertex: $(-h, k)$

Exploratory Challenge

Find an expression equivalent to $x^2 + 8x + 3$ that includes a perfect square binomial.

↷ Become a perfect square

$(x^2 + 8x + 16) - 16 + 3$

$b = 8$, $\frac{b}{2} = 4$, $\left(\frac{b}{2}\right)^2 = 16$

$(x + \frac{b}{2})^2$

$(x + 4)^2 - 16 + 3$

$(x+4)^2 - 13$

Vertex: $(-4, -13)$

1. Rewrite the expression with two blank spaces. (The first blank is positive, the second blank is negative).

2. Put parenthesis around the first 3 terms.

3. Divide the "b" term by two and square it. This number will go in both blank spaces that we created.

4. We can now write the terms inside the parenthesis as a perfect square. It will take the form $\left(x + \frac{b}{2}\right)^2$

5. Combine the remaining terms

Exercises

Rewrite each expression by completing the square.

1. $a^2 - 4a + 15$

$(a^2 - 4a + 4) - 4 + 15$

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

$(a - 2)^2 - 4 + 15$

$\boxed{(a-2)^2 + 11}$

2. $n^2 - 2n - 15$ $b = -2$, $\frac{b}{2} = -1$, $\left(\frac{b}{2}\right)^2 = 1$

$(n^2 - 2n + \_) - \_ - 15$

$(n^2 - 2n + 1) - 1 - 15$

↳ A perfect square. Use the form $(x + \frac{b}{2})^2$

$\boxed{(n-1)^2 - 16}$

3. $c^2 + 20c - 40$ $b = 20$, $\frac{b}{2} = 10$, $\left(\frac{b}{2}\right)^2 = 100$

$(c^2 + 20c + \_) - \_ - 140$

$(c^2 + 20c + 100) - 100 - 140$

↳ A perfect square

$\boxed{(c+10)^2 - 240}$

4. $x^2 - 1000x + 60\,000$ $b = -1000$, $\frac{b}{2} = -500$, $\left(\frac{b}{2}\right)^2 = 250000$

$(x^2 - 1000x + \_) - \_ + 60\,000$

$(x^2 - 1000x + 250{,}000) - 250{,}000 + 60\,000$

↳ A perfect square

$(x - 500)^2 - 250{,}000 + 60{,}000$

$\boxed{(x - 500)^2 - 190{,}000}$