Using Square Roots to Solve Quadratic Equations

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PRE-CALCULUS 11
QUADRATIC EQUATIONS
USING SQUARE ROOTS TO SOLVE QUADRATIC EQUATIONS

A. Definitions

1. **quadratic equation:** an equation that contains a squared variable. $ax^2+bx+c=0$
2. **completing the square:** a method of solving a quadratic equation that is not easily factored.
3. **roots/zeros:** the answer(s) to a quadratic equation.

B. Solving Quadratic Equations Using Square Roots

To Solve

a) Isolate the squared term.

b) Take positive and negative root.

1) $2x^2 - 1 = 5$

$+1 \quad +1$

$\frac{2x^2}{2} = \frac{6}{2}$

$\pm\sqrt{x^2} = \pm\sqrt{3}$

$x = \pm\sqrt{3}$

or

$x = \sqrt{3}, -\sqrt{3}$

2) $(x-4)^2 = 12$

$\pm\sqrt{(x-4)^2} = \pm\sqrt{12}$ $\quad \sqrt{4}\cdot\sqrt{3}$

$x - 4 = \pm 2\sqrt{3}$

$+4 \quad +4$

$x = 4 \pm 2\sqrt{3}$

or

$x = 4+2\sqrt{3}, \; 4-2\sqrt{3}$

C. Solving Equations by Completing the Square when a = 1

Some quadratic equations are easy to solve because they factor nicely and lead to simple answers (integers or fractions). For other, more complicated equations that don't factor easily we can use a method called completing the square to help determine the answer to the quadratic equation.

Completing The Square Method

a) Move the "c" value to the opposite side of the equation.

b) Make the left side into a perfect square trinomial. Balance both sides

c) Factor the perfect square trinomial

d) Isolate the squared term and solve.

1) $x^2 - 6x + 3 = 0$

$-3 \quad -3$

$x^2 - 6x = -3$

$x^2 - 6x + 9 = -3 + 9$

$\pm\sqrt{(x-3)^2} = \pm\sqrt{6}$

$x - 3 = \pm\sqrt{6}$

$+3 \quad +3$

$\boxed{x = 3 \pm \sqrt{6}}$

2) $x^2 - 10x - 1 = 0$

$+1 \quad +1$

$x^2 - 10x = 1$

$x^2 - 10x + 25 = 1 + 25$

$\pm\sqrt{(x-5)^2} = \pm\sqrt{26}$

$x - 5 = \pm\sqrt{26}$

$+5 \quad +5$

$\boxed{x = 5 \pm \sqrt{26}}$

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

$+1 \quad +1$

$x^2 + 3x = 1$

$x^2 + 3x + \frac{9}{4} = 1 + \frac{9}{4}$

$\pm\sqrt{\left(x + \frac{3}{2}\right)^2} = \pm\sqrt{\frac{13}{4}}$

$x + \frac{3}{2} = \frac{\pm\sqrt{13}}{2}$

$-\frac{3}{2} \quad -\frac{3}{2}$

$x = -\frac{3}{2} \pm \frac{\sqrt{13}}{2}$

$\boxed{x = \frac{-3 \pm \sqrt{13}}{2}}$

Assignment: Pg. 206 #4 - 8