

P5: Solving Quadratic Equations

Graphically, Numerically and Algebraically

Standard Form: $ax^2 + bx + c = 0$

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

Ways to solve:

- Factoring
- Quadratic formula
- Graphing
- Completing the square

Ex: $2x^2 - 3x - 2 = 0$ (factoring)

$$\left(\frac{2x^2}{x} + \frac{x}{x}\right) \left(\frac{-4x}{-2} - \frac{2}{2}\right) = 0$$

$$\begin{array}{r} -4 \\ \hline 1, -4 \\ \hline 2, 2 \end{array}$$

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

$$(2x+1)(x-2) = 0$$

$$\begin{array}{r} 2x+1=0 \\ -1 \quad -1 \\ \hline 2x = -1 \\ \frac{2}{2} \quad \frac{2}{2} \\ \hline x = -\frac{1}{2} \end{array}$$

$$\begin{array}{r} x-2=0 \\ +2 \quad +2 \\ \hline x = 2 \end{array}$$

Ex: $2x^2 - 3x - 2 = 0$ (quad formula)

$$a = 2 \quad b = -3 \quad c = -2$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{3 \pm \sqrt{9 - 4(2)(-2)}}{2(2)}$$

$$x = \frac{3 \pm \sqrt{25}}{4}$$

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

$$x = \frac{3+5}{4} = \frac{8}{4} = 2$$

$$x = \frac{3-5}{4} = \frac{-2}{4} = -\frac{1}{2}$$

$$\text{Ex: } \sqrt{(2x-1)^2 = 9} \rightarrow (2x-1)^2 - 9 = 0$$

$$\begin{array}{r} 2x-1 = \pm 3 \\ +1 \quad +1 \\ \hline \end{array}$$

$$\frac{2x}{2} = \frac{\pm 3 + 1}{2}$$

$$x = \frac{\pm 3 + 1}{2}$$

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

$$x = \frac{-3+1}{2} = \frac{-2}{2} = \boxed{-1}$$

$$\text{Ex } \frac{4x^2}{4} - \frac{20x}{4} + \frac{17}{4} = 0 \quad (\text{completing the square})$$

$$\frac{4}{4} (x^2 - 5x + \frac{17}{4}) = \frac{0}{4} \quad *a=1$$

$$x^2 - 5x + \frac{17}{4} = 0$$

$$(x^2 - 5x + \frac{25}{4}) = -\frac{17}{4} + \frac{25}{4}$$

$$(\frac{-5}{2})^2 = \frac{25}{4}$$

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

$$x - \frac{5}{2} = \pm \sqrt{2}$$

$$x = \pm \sqrt{2} + \frac{5}{2}$$

$$x = \sqrt{2} + \frac{5}{2}$$

$$x = -\sqrt{2} + \frac{5}{2}$$

$$\text{Ex: } x^2 + 6x + 9 = 0$$

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

$$\sqrt{(x+3)^2} = \sqrt{0}$$

$$x+3 = 0$$

$$x = -3$$