LESSON 18: The Discriminant

☐ Quadratic formula for the solution of a quadratic equation in standard form

\[ x_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a} \quad \text{OR} \quad x_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a} \]

☐ The discriminant: \( b^2 - 4ac = 0 \)

☐ Three scenarios for \( x \)-intercepts of parabola
- No \( x \)-intercepts: no real solution to equation \( ax^2 + bx + c = 0 \)
- One \( x \)-intercept: One solution to equation \( ax^2 + bx + c = 0 \)
- Two \( x \)-intercepts: Two solution to equation \( ax^2 + bx + c = 0 \)
  - Rational Solutions
  - Irrational Solutions

☐ Classification of solutions of quadratic equation using discriminant

---

UPWARD FACING PARABOLA

[Diagrams for upward facing parabolas with no, one, and two \( x \)-intercepts]

DOWNWARD FACING PARABOLA

[Diagrams for downward facing parabolas with no, one, and two \( x \)-intercepts]
1A. Solve the quadratic equation below using the quadratic formula. Be sure to specifically identify the discriminant of the quadratic formula.

\[ x^2 = 4x - 4 \]

Consider the graph of the quadratic function \( y_1 = x^2 - 4x + 4 \) given below.

1B. How many x-intercepts does the quadratic function \( y_1 = x^2 - 4x + 4 \) have?

1C. Look at the discriminant from part 1A and the quadratic formula, why does your answer to 1B make sense?
2A. Solve the quadratic equation below using the quadratic formula. Be sure to specifically identify the discriminant of the quadratic formula.

\[ 2p^2 = 12 - 5p \]

Consider the graph of the quadratic function \( y_1 = 2x^2 + 5x - 12 \) given below.

2B. How many x-intercepts does the quadratic function \( y_1 = 2x^2 + 5x - 12 \) have?

2C. Look at the discriminant from part 2A and the quadratic formula. Why does your answer to 2B make sense?
3. Solve the quadratic equation below using the quadratic formula. Be sure to specifically identify the discriminant of the quadratic formula.

\[-t^2 = 2t + 3\]

Consider the graph of the quadratic function \(y_1 = -x^2 - 2x - 3\) given below.

3B. How many x-intercepts does the quadratic function \(y_1 = -x^2 - 2x - 3\) have?

3C. Look at the discriminant from part 2A and the quadratic formula. Why does your answer to 2B make sense?