

2.4 The Discriminant

What is the Discriminant?

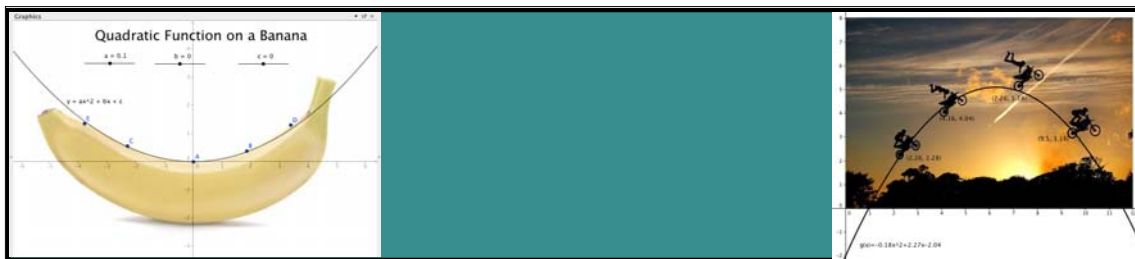
The discriminant is  $b^2 - 4ac$ , which comes from the Quadratic Formula.

The Discriminant tells us...

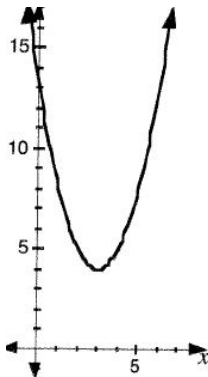
# solutions/roots/zeros/x-int.



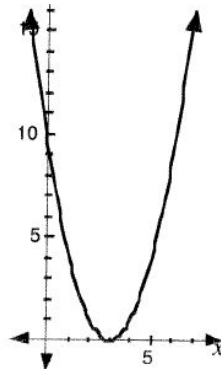
| Discriminant                    | # of Solutions |
|---------------------------------|----------------|
| $b^2 - 4ac < 0$ <i>negative</i> | 0              |
| $b^2 - 4ac = 0$                 | 1              |
| $b^2 - 4ac > 0$ <i>positive</i> | 2              |



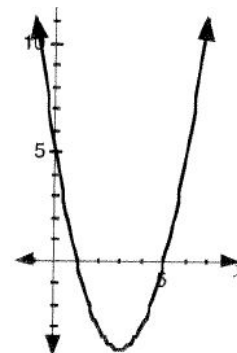
No Real Roots



One Real Root



Two Real Roots



Ex.) Use the discriminant to determine the number of solutions for each quadratic.

$$5x^2 - 8x + 6 = 0$$

$$b^2 - 4ac$$

$$= (-8)^2 - 4(5)(6)$$

$$= -56$$

no roots

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

$$(-2)^2 - 4(1)(-3)$$

$$= 16$$

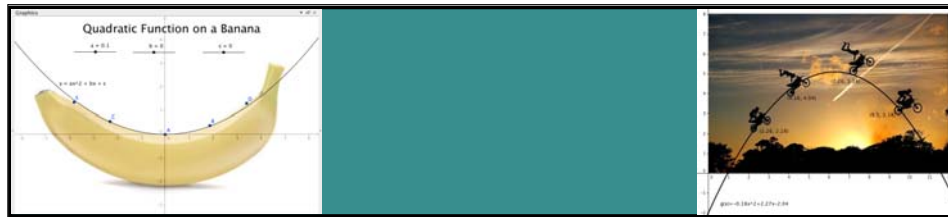
2 solutions

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

$$(-2)^2 - 4(1)(1)$$

$$= 0$$

1 zero



Ex.) Determine the values of  $k$  for which the equation has two real roots.

$$3x^2 - 5x + k = 0$$

\*divide by  
neg. switch  
the inequality\*

$$b^2 - 4ac > 0$$

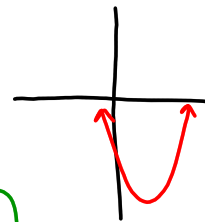
$$(-5)^2 - 4(3)(k) > 0$$

$$\cancel{25} - 12k > 0$$

$$-25 \qquad -25$$

$$\frac{-12k}{-12} > \frac{-25}{-12}$$

$$k < \frac{25}{12}$$



Summary:

When the discriminant is  $> 0$ , then the quadratic has 2 solution(s).

When the discriminant is  $= 0$ , then the quadratic has 1 solution(s).

When the discriminant is  $< 0$ , then the quadratic has 0 solution(s).