

Key

4.6 Notes Day 2

When using the Quadratic Formula, if the value of the radical is negative, the solutions will be complex. Complex solutions always appear in conjugate pairs.

Solve using the Quadratic Formula:

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

$a=1$
 $b=-4$
 $c=13$
 $f(x) = x^2 - 4x + 13$
 $x = \frac{4 \pm \sqrt{16 - 4(1)(13)}}{2(1)}$
 $x = \frac{4 \pm \sqrt{-36}}{2}$
 $x = \frac{4 \pm 6i}{2}$
 $x = 2 \pm 3i$

$a=1$
 $b=-6$
 $c=10$
 $f(x) = x^2 - 6x + 10$
 $x = \frac{6 \pm \sqrt{36 - 4(1)(10)}}{2(1)}$
 $x = \frac{6 \pm \sqrt{-4}}{2}$
 $x = \frac{6 \pm 2i}{2}$
 $x = 3 \pm i$

$a=3$
 $b=5$
 $c=4$
 $f(x) = 3x^2 + 5x + 4$
 $x = \frac{-5 \pm \sqrt{25 - 4(3)(4)}}{2(3)}$
 $x = \frac{-5 \pm \sqrt{-23}}{6}$
 $x = \frac{-5 \pm i\sqrt{23}}{6}$
 $x = \frac{-5}{6} \pm \frac{\sqrt{23}}{6}i$

$a=1$
 $b=2$
 $c=4$
 $f(x) = x^2 + 2x + 4$
 $x = \frac{-2 \pm \sqrt{4 - 4(1)(4)}}{2(1)}$
 $x = \frac{-2 \pm \sqrt{-12}}{2}$
 $x = \frac{-2 \pm 2\sqrt{3}i}{2}$
 $x = -1 \pm i\sqrt{3}$

Discriminant:

$b^2 - 4ac$

expression under the radical sign

Tells you the number of solutions and the nature of your solutions.

$b^2 - 4ac > 0$	$b^2 - 4ac = 0$	$b^2 - 4ac < 0$
2 real	1 real	2 non-real
ex: $\sqrt{b^2 - 4ac}$ $\sqrt{16 - 4(1)(3)}$ $= \sqrt{4}$	ex: $\sqrt{b^2 - 4ac}$ $\sqrt{16 - 2(2)(4)}$ $= \sqrt{16 - 16}$ $= \sqrt{0} = 0$	ex: $\sqrt{b^2 - 4ac}$ $\sqrt{16 - 4(1)(6)}$ $= \sqrt{16 - 24}$ $= \sqrt{-8}$

* remember * $b^2 - 4ac \Rightarrow$ under the radical sign of quad. formula!

Ex: Find the type and number of solutions for each function:

$$f(x) = 3x^2 + 5x - 6$$

$$\begin{aligned} a &= 3 \\ b &= 5 \\ c &= -6 \\ b^2 - 4ac &= 25 - 4(3)(-6) \\ &= 25 + 72 \\ &= 97 \end{aligned}$$

2 real rational solutions

$$f(x) = x^2 - 6x + 11$$

$$\begin{aligned} a &= 1 \\ b &= -6 \\ c &= 11 \\ b^2 - 4ac &= 36 - 4(1)(11) \\ &= 36 - 44 \\ &= -8 \end{aligned}$$

2 non-real solutions

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

$$\begin{aligned} a &= 1 \\ b &= 6 \\ c &= 9 \\ b^2 - 4ac &= 36 - 4(1)(9) \\ &= 36 - 36 \\ &= 0 \end{aligned}$$

1 real rational solution

Use the discriminant to identify the type and number of solutions. If the solutions will be rational, find the solutions of the quadratic function.

$$22x = 12x^2 + 6$$

Step 1: Standard form

$$12x^2 - 22x + 6 = 0$$

$$\begin{aligned} a &= 12 \\ b &= -22 \\ c &= 6 \\ b^2 - 4ac &= (-22)^2 - 4(12)(6) \end{aligned}$$

$$\begin{aligned} &= 484 - 288 \\ &= 196 > 0 \end{aligned}$$

2 real rational solutions

$$12x^2 + 9x - 2 = -17$$

$$12x^2 + 9x + 15 = 0$$

$$\begin{aligned} a &= 12 \\ b &= 9 \\ c &= 15 \\ b^2 - 4ac &= 81 - 4(12)(15) \end{aligned}$$

$$= 81 - 720$$

$$= -639 < 0$$

2 non-real solutions