**Quadratic Formula:**

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad y = ax^2 + bx + c$$

1. Solve each equation using the quadratic formula.

a. $x^2 - 4x = -1$

$x^2 - 4x + 1 = 0$

$$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(1)}}{2(1)}$$

$$= \frac{4 \pm \sqrt{16 - 4}}{2}$$

$$= \frac{4 \pm \sqrt{12}}{2}$$

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

$$= \boxed{2 \pm \sqrt{3}}$$

b. $f(x) = 3x^2 + 5x + 4$

$$x = \frac{-5 \pm \sqrt{5^2 - 4(3)(4)}}{2(3)}$$

$$= \frac{-5 \pm \sqrt{25 - 48}}{6}$$

$$= \frac{-5 \pm \sqrt{-23}}{6}$$

$$= \boxed{\frac{-5 \pm i\sqrt{23}}{6}}$$

**Discriminant:** $b^2 - 4ac$

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

Solutions of Quadratic Equations when $a$, $b$, and $c$ are integers

| example | Discriminant | Number of Solutions | Type of Solutions |
|---|---|---|---|
| $b^2 - 4ac = 16$ | Positive, perfect square | 2 | Rational |
| $b^2 - 4ac = 2$ | Positive, but not a perfect square | 2 | Irrational |
| $b^2 - 4ac = 0$ | Zero | 1 | Rational |
| $b^2 - 4ac = -4$ | Negative | 2 | Complex |

irrational = # can't be written as ratio

ex) $\pi$, $\sqrt{2}$

6. Evaluate the discriminant for each equation. Then use it to determine the number of distinct solutions, and tell whether they are rational, irrational, or nonreal complex numbers. (Do not solve the equation).

a. $x^2 + 4x + 4 = 0$

$b^2 - 4ac$

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

$16 - 16$

$0$

1 Real Root

b. $8x^2 = -14x - 3$

$8x^2 + 14x + 3 = 0$

$14^2 - 4(8)(3)$

$196 - 96$

$100$

perfect square

2 Rational Roots

c. $2x^2 + 4x + 1 = 0$

$b^2 - 4ac$

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

$16 - 8$

$8$

2 Irrational Roots