# The Quadratic Formula

QF06-V1 · storyboard · QF06 Quadratic formula. Read each picture with its sentences.

**Picture 1**

Solve $ax^2 + bx + c = 0$.

$$x^2 + \frac{b}{a}x = -\frac{c}{a}$$ divide every term by $a$

$$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2}$$ add $\left(\frac{b}{2a}\right)^2$ to both sides

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$ the whole top is over 2a

1. Solve a x squared plus b x plus c equals 0.
2. Divide every term by a, and move the c over a across.
3. Half of b over a is b over 2 a.
4. Square it and add it to both sides: x plus b over 2 a, all squared, equals b squared minus 4 a c, over 4 a squared.
5. Undo the square and move the b over 2 a across: x equals negative b, plus or minus the root of b squared minus 4 a c, all over 2 a.
6. That is the quadratic formula.

**Picture 2**

$$r^2 + 4r - 96 = 0$$ standard form first: $c = -96$

$$r = \frac{-4 \pm \sqrt{4^2 - 4(1)(-96)}}{2(1)}$$

each number in brackets

$$r = \frac{-4 \pm \sqrt{400}}{2} = \frac{-4 \pm 20}{2}$$ 16 + 384 = 400

$$\boxed{r = 8 \text{ or } r = -12}$$

7. Now use it.
8. Solve r squared plus 4 r equals 96.
9. Standard form first: r squared plus 4 r minus 96 equals 0.
10. So a is 1, b is 4, and c is negative 96.
11. Put each number into the formula, in brackets.
12. Under the root, negative 4 times negative 96 is plus 384: two minus signs make a plus.
13. 16 plus 384 is 400, and root 400 is 20.
14. So r is 8 or negative 12.

**Picture 3**

**Trap** $r^2 + 4r = 96$

✗ $c = 96$

✓ $c = -96$

15. Watch for the trap.
16. c isn't 96: put the equation in standard form first, and c is negative 96.

**Picture 4**

**Trap** $x^2 - 5x + 6 = 0$

✗ $-5^2 - 24 = -49$

✓ $(-5)^2 - 24 = 1$

17. And with a negative b, use brackets: negative 5, in brackets, squared is 25, so the part under the root is 1.