Solving Quadratic Equations by the Quadratic Formula

The quadratic formula will work when trying to solve ANY quadratic equation.

2 musts:

(1) Must have a quadratic equation (squared term)
(2) Must be in standard form ($ax^2 + bx + c = 0$)

Quadratic Formula:
The solution to $ax^2 + bx + c = 0$ with $a \neq 0$, is given by the formula

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

Steps to solve using the quadratic formula:
1.) Collect all terms on one side, leaving zero on the other side.
2.) Identify a, b, and c. Plug these values into the quadratic formula and evaluate.
3.) Check by substituting the solution(s) back into the original equation.

Examples: Solve using the quadratic formula.
a) $2x^2 + 2x = 1$

Solution:

Step 1: gather all terms on one side

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

Step 2: identify a, b, and c

$a = 2$ $\quad$ $b = 2$ $\quad$ $c = -1$

Plugging into the quadratic equation we have:

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

A few things to be aware of and watch for:
(1) Be sure you are dividing the whole right-hand side by the $2a$, not just the radical.
(2) Be sure to put parentheses around the $(b)^2$ term in your calculator because if it is a negative value, it will not square the negative without the parentheses.

Evaluating we have:

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

$$x = \frac{-2 \pm \sqrt{12}}{4}$$ simplify the radical

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

$x = \frac{2(-1 \pm \sqrt{3})}{4}$ factor out a 2 from the numerator so it can be divided by the 4

$x = \frac{-1 \pm \sqrt{3}}{2}$

Final Solution: $\boldsymbol{x = \frac{-1 \pm \sqrt{3}}{2}}$

Step 3: Plug in each solution to the original to check your work! Use your calculator to help.

b) $3x^2 - 2x + 4 = 0$

Solution:

Step 1: The quadratic is already in standard form, so no work here!

Step 2: identify a, b, and c

$a = 3$ $\quad b = -2$ $\quad c = 4$

Plugging into the quadratic equation we have:

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

A few things to be aware of and watch for:
(1) Be sure you are dividing the whole right-hand side by the $2a$, not just the radical.
(2) Be sure to put parentheses around the $(b)^2$ term in your calculator because if it is a negative value, it will not square the negative without the parentheses.

Evaluating we have:
$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(3)(4)}}{2(3)}$

$x = \frac{2 \pm \sqrt{4 - 48}}{6}$

$x = \frac{2 \pm \sqrt{-44}}{6}$ simplify the radical

$x = \frac{2 \pm 2i\sqrt{11}}{6}$

$x = \frac{2(1 \pm i\sqrt{11})}{6}$ in the numerator, you can factor out a common factor of 2, then divide it with the 6 in the denominator.

$x = \frac{1 \pm i\sqrt{11}}{3}$

Final Solution: $\boldsymbol{x = \frac{1 \pm i\sqrt{11}}{3}}$

Step 3: Plug in each solution to the original to check your work! Use your calculator to

help.