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Solving quadratic equations by completing the square

Solve $4X^2 + 8X + 4 = 36$

Quadratic equations can be solved in many ways you can use the factoring method, the quadratic formula or solve by completing the square. We are going to solve this example by completing the square.

Step 1

Make the equation to equal to zero and let the first number of the equation or the first coefficient of the equation to be **1**.

$$4X^2 + 8X + 4 - 36 = 0 \quad \text{that is} \quad 4X^2 + 8X - 32 = 0$$

Step 2

Simplify the equation and make the first coefficient to be **1** by dividing every coefficient by **4** since they are all divisible by **4**

That produces $X^2 + 2X - 8 = 0$

Step 3

Rearrange the equation $X^2 + 2X = 8$

Step 4

Divide the second number in the equation **2** by **2** and square the answer

$$X^2 + 2X = 8$$

$$\left[\frac{2}{2} \right]^2$$

That becomes $1^2 = 1$

Step 5

Now add the answer **1** to the left side and to the right side of the equation

That becomes

$$X^2 + 2X + 1 = 8 + 1$$

Step 6

Now Simplify the equation

That becomes

$$X^2 + 2X + 1 = 9$$

Step 7

Now complete the square. To complete the square, we take **X** and the next sign which is a **+** in this question and the squared number which is **1** square it and bring the number on the right side of the equation.

That becomes

$$(X + 1)^2 = 9$$

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Step 8

Now remove the square. To do that, we will get the **square root of $(X+1)^2$** and also **the square root of 9**

That becomes $\sqrt{(X+1)^2} = \sqrt{9}$

That becomes $X+1 = +3$ $X = 3 - 1 = 2$ or $X = -3 - 1 = -4$

So X is 2 or -4