

# **SOLVING EQUATIONS**

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## Necessary or sufficient

Consider the equation

$$x + 1 = x.$$

To solve it we first square both sides and get

$$x^2 + 2x + 1 = x^2.$$

Subtracting  $x^2 + 1$  from both sides gives

$$2x = -1.$$

Finally dividing by 2 results in the incorrect

$$x = -\frac{1}{2}.$$

**Example of what not to do:**

We solve the equation  $2(x + 2) = x$ .

$$2(x + 2) = x$$

$$2x + 4 = x$$

$$x + 4 = 0$$

$$x = -4$$

**Correct way:**

We solve the equation  $2(x + 2) = x$ .

Expanding the parentheses gives

$$2x + 4 = x.$$

Subtracting  $x$  from both sides results in

$$x + 4 = 0.$$

Finally subtracting 4 from both sides implies that the only possibility for the solution is

$$x = -4.$$

Substituting  $-4$  for  $x$  in the original equation verifies that this is in fact a solution. So the only solution is  $x = -4$ .