Completing the Square - Notes & Worksheet

MATH MONKS

Notes

Process

Start with the polynomial

$ax^2 + bx + c$; $(a = 1)$

① Identify b. Take half of b $\Rightarrow \frac{b}{2}$

② Square $\frac{b}{2} \Rightarrow \left(\frac{b}{2}\right)^2$, which is c

Thus $c = \left(\frac{b}{2}\right)^2$

③ Substitute and factor the polynomial

$$x^2 + bx + \left(\frac{b}{2}\right)^2 = \left(x + \frac{b}{2}\right)^2$$

Example

$x^2 + 5x + c$

① $b = 5 \Rightarrow \frac{b}{2} = \frac{5}{2}$

② $\left(\frac{b}{2}\right)^2 = \left(\frac{5}{2}\right)^2 = \frac{25}{4} = c$

③ $x^2 + 5x + \frac{25}{4} = \left(x + \frac{5}{2}\right)^2$

Find c that will form a perfect square trinomial and then complete the square.

① $x^2 + 8x + c$

c = ____

Square = _____

② $x^2 + 3x + c$

c = ____

Square = _____

③ $x^2 - 4x + c$

c = ____

Square = _____

④ $x^2 + 6x + c$

c = ____

Square = _____

⑤ $x^2 + 10x + c$

c = ____

Square = _____

⑥ $x^2 - 11x + c$

c = ____

Square = _____

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Answers

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② Square $\frac{b}{2} \Rightarrow \left(\frac{b}{2}\right)^2$, which is c

Thus $c = \left(\frac{b}{2}\right)^2$

③ Substitute and factor the polynomial

$x^2 + bx + \left(\frac{b}{2}\right)^2 = \left(x + \frac{b}{2}\right)^2$

Example

$x^2 + 5x + c$

① $b = 5 \Rightarrow \frac{b}{2} = \frac{5}{2}$

② $\left(\frac{b}{2}\right)^2 = \left(\frac{5}{2}\right)^2 = \frac{25}{4} = c$

③ $x^2 + 5x + \frac{25}{4} = \left(x + \frac{5}{2}\right)^2$

Find c that will form a perfect square trinomial and then complete the square.

① $x^2 + 8x + c$

$c =$ 16

Square = $(x + 4)^2$

② $x^2 + 3x + c$

$c = \frac{9}{4}$

Square = $\left(x + \frac{3}{2}\right)^2$

③ $x^2 - 4x + c$

$c =$ 4

Square = $(x - 2)^2$

④ $x^2 + 6x + c$

$c =$ 9

Square = $(x + 3)^2$

⑤ $x^2 + 10x + c$

$c =$ 25

Square = $(x + 5)^2$

⑥ $x^2 - 11x + c$

$c = \frac{121}{4}$

Square = $\left(x - \frac{11}{2}\right)^2$