

5.4 Completing the Square

Perfect Square Trinomial

$$x^2 + 12x + 36$$

$$(x+6)(x+6)$$

$$(x+6)^2$$

$$b^2 = 36$$

$$bx + bx = 12x$$

$$2(bx) = 12x$$

$$x^2 + 10x + 25$$

$$\frac{10}{2} = 5$$

$$5^2 = 25$$

$$(x+5)(x+5)$$

$$(x+5)^2$$

$$3 \quad (x+3)^2$$

$$x^2 + 6x + 9$$

$$x^2 + 5x + \frac{25}{4}$$

$$\frac{5}{2}$$

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

① Linear coefficient
Divide by 2

② Square

$$\left(x + \frac{5}{2}\right)\left(x + \frac{5}{2}\right) \quad \left(x + \frac{5}{2}\right)^2$$

$$x^2 + 18x + 81$$

$$(x+9)(x+9)$$

$$\sqrt{81} = 9$$

$$9 \times 2 = 18$$

$$(x+9)^2$$

$$x^2 - 14x + 49$$

$$\frac{-14}{2} \quad (x - 7)(x - 7)$$

$$= -7$$
$$(-7)^2$$
$$49$$

$$(x - 7)^2$$

Solve

$$x^2 - 8x - 3 = 0$$

$$x^2 - 8x + 16 = 3 + 16$$

Complete
the Square

$$x^2 - 8x + 16 = 3 + 16$$

$$\frac{-8}{2}$$

$$x^2 - 8x + 16 = 19$$

Divide by
2

$$-4$$

$$\text{Square } (-4)^2$$

$$16$$

factor

$$(x-4)(x-4) = 19$$

$$\sqrt{(x-4)^2} = \sqrt{19}$$

$$x-4 = \pm \sqrt{19}$$

$$+4 \quad +4$$

$$x = 4 \pm \sqrt{19}$$

$$x^2 + 6x + 8 = 0$$

$$x^2 + 6x + 9 = -8 + 9$$

$$\frac{6}{2} = 3$$

$$3^2 = 9$$

$$x^2 + 6x + 9 = 1$$

factor

$$(x+3)(x+3) = 1$$

$$(x+3)^2 = 1$$

$$\sqrt{(x+3)^2} = \sqrt{1}$$

$$x+3 = \pm 1$$

$$x = -4 \quad x = -2$$

$$x^2 + 6x + 8 = 0$$

factored

$$(x+4)(x+2) = 0$$

$$x+4=0 \quad x+2=0$$

$$x = -4 \quad x = -2$$

$$x^2 + 16x = 2$$

$$x^2 + 16x + 64 = 2 + 64$$

$$\frac{16}{2} = 8$$

$$8^2 = 64$$

$$x^2 + 16x + 64 = 66$$

factor

$$(x+8)(x+8) = 66$$

$$(x+8)^2 = 66$$

$$\sqrt{(x+8)^2} = \sqrt{66}$$

$$x+8 = \pm \sqrt{66}$$

$$x = -8 \pm \sqrt{66}$$

$$21. \quad x^2 + 7x - 26 = 0$$

$$x^2 + 7x + \frac{49}{4} = 26 + \frac{49}{4}$$

$$\frac{7}{2} \quad \left(\frac{7}{2}\right)^2 = \frac{49}{4}$$

$$x^2 + 7x + \frac{49}{4} = \frac{104}{4} + \frac{49}{4}$$

$$x^2 + 7x + \frac{49}{4} = \frac{153}{4}$$

$$\left(x + \frac{7}{2}\right) \left(x + \frac{7}{2}\right) = \frac{153}{4}$$

$$\sqrt{\left(x + \frac{7}{2}\right)^2} = \sqrt{\frac{153}{4}}$$

$$x + \frac{7}{2} = \pm \frac{\sqrt{153}}{2}$$

$$-\frac{7}{2} \quad -\frac{7}{2}$$

$$x = -\frac{7}{2} \pm \frac{\sqrt{153}}{2}$$

OR

$$x = \frac{-7 \pm \sqrt{153}}{2}$$

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