

# Algebra 2.3 Quadratic Equations

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Standard form  $ax^2 + bx + c = 0$   $a \neq 0$

zero factor theorem if  $a \cdot b = 0$  then either  $a = 0$  or  $b = 0$

ex: solve  $x^2 - 5x - 6 = 0$

$$(x - 6)(x + 1) = 0$$

$$x = 6, -1$$

ex.  $16x^2 - 9$

$$16x^2 - 9 = 0$$

$$(4x + 3)(4x - 3) = 0$$

$$x = -\frac{3}{4}, \frac{3}{4}$$

Solve:  $2x(4x + 15) = 27$

$$8x^2 + 30x - 27 = 0$$

$$(2x + 9)(4x - 3) = 0$$

$$x = -\frac{9}{2}, \frac{3}{4}$$

solve  $x(x - 5) = 0$

$$x = 0, 5$$

solve  $\frac{2x}{x+3} + \frac{5}{x} = 4 + \frac{18}{x^2+3x}$

$$x \neq 0, -3$$

$$x(x+3) \left( \frac{2x}{x+3} + \frac{5}{x} \right) = \left( 4 + \frac{18}{x^2+3x} \right) x(x+3)$$

$$2x^2 + 5x + 15 = 4x^2 + 12x + 18$$

$$-2x^2 - 7x - 3 = 0$$

$$2x^2 + 7x + 3 = 0$$

$$(2x + 1)(x + 3) = 0$$

$$x = -\frac{1}{2}, -3 \quad \text{circled } x = -\frac{1}{2}$$

## Algebra 2.3 cont.

### Completing the Square

1)  $x^2 + 6x$   $6(\frac{1}{2}) = 3$   $3^2 = 9$

$$(x^2 + 6x + 9) \quad (x+3)^2$$

2)  $x^2 - 10x$   $10(\frac{1}{2}) = 5$   $5^2 = 25$

$$(x^2 - 10x + 25) \quad (x-5)^2$$

3)  $x^2 - 3x$   $3(\frac{1}{2}) = \frac{3}{2}$   $(\frac{3}{2})^2 = \frac{9}{4}$

$$(x^2 - 3x + \frac{9}{4}) \quad (x - \frac{3}{2})^2$$

### Solve by Completing the Square

①  $x^2 + 8x - 11 = 0$

$$x^2 + 8x = 11 \quad 8(\frac{1}{2}) = 4 \quad 4^2 = 16$$

$$x^2 + 8x + 16 = 11 + 16$$

$$(x+4)^2 = 27$$

$$\sqrt{(x+4)^2} = \pm \sqrt{27}$$

$$x+4 = \pm 3\sqrt{3}$$

$$x = 4 \pm 3\sqrt{3}$$

②  $4x^2 - 12x - 11 = 0$  (Note: coefficient of  $x^2$  must be 1!)

$$x^2 - 3x - \frac{11}{4} = 0$$

$$x^2 - 3x = \frac{11}{4} \quad 3(\frac{1}{2}) = \frac{3}{2} \quad (\frac{3}{2})^2 = \frac{9}{4}$$

$$x^2 - 3x + \frac{9}{4} = \frac{11}{4} + \frac{9}{4}$$

$$(x - \frac{3}{2})^2 = 5$$

$$\sqrt{(x - \frac{3}{2})^2} = \pm \sqrt{5}$$

$$x - \frac{3}{2} = \pm \sqrt{5}$$

$$x = \frac{3}{2} \pm \sqrt{5}$$

# Algebra 2.3 cont.

## Quadratic Formula

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

Solve using the Quad Formula

1.)  $6x^2 - 2 = x$

$$x = \frac{-1 \pm \sqrt{1^2 - 4(6)(-2)}}{2(6)} = \frac{1 \pm \sqrt{1+48}}{12} = \frac{1 \pm \sqrt{49}}{12}$$

$$6x^2 - x - 2 = 0$$

$$x = \frac{1 \pm 7}{12} = \frac{8}{12}, -\frac{6}{12} = \frac{2}{3}, -\frac{1}{2}$$

$$a=6 \quad b=-1 \quad c=-2$$

2.)  $\frac{3}{2}y^2 - 4y - 1 = 0$

$$y = \frac{-8 \pm \sqrt{8^2 - 4(3)(-2)}}{2(3)} = \frac{8 \pm \sqrt{64+24}}{6} = \frac{8 \pm \sqrt{88}}{6}$$

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

$$\frac{8 \pm 2\sqrt{22}}{6} = \frac{4 \pm \sqrt{22}}{3}$$

$$a=3 \quad b=-8 \quad c=-2$$

3.)  $\frac{5x}{x^2+9} = -1$

$$x = \frac{-5 \pm \sqrt{5^2 - 4(1)(9)}}{2(1)} = \frac{-5 \pm \sqrt{25-36}}{2} = \frac{-5 \pm \sqrt{-11}}{2}$$

$$(x^2+9) \frac{5x}{x^2+9} = -1(x^2+9)$$

$$5x = -x^2 - 9$$

$$x^2 + 5x + 9 = 0$$

$$a=1 \quad b=5 \quad c=9$$

for sec 2.3 stop here

$100x^2 - 220x - 879 = 0$  (ilrn problem - solve by completing the square)

$$\frac{100x^2}{100} - \frac{220x}{100} - \frac{879}{100} = 0$$

$$x^2 - \frac{11}{5}x = \frac{879}{100} \quad \frac{11}{5}(\frac{1}{2}) = \frac{11}{10} \quad (\frac{11}{10})^2 = \frac{121}{100}$$

$$x^2 - \frac{11}{5}x + \frac{121}{100} = \frac{879}{100} + \frac{121}{100}$$

$$(x - \frac{11}{10})^2 = \frac{1000}{100}$$

$$\sqrt{(x - \frac{11}{10})^2} = \pm \sqrt{10}$$

$$(x - \frac{11}{10}) = \pm \sqrt{10}$$

$$x = \frac{11}{10} \pm \sqrt{10}$$