

8.9 The Quadratic Formula
and the discriminant.

$$1) x^2 - 19x + 70 = 0$$

$$a=1 \quad b=-19 \quad c=70$$

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

$$x = \frac{-(-19) \pm \sqrt{(-19)^2 - 4(1)(70)}}{2(1)}$$

$$x = \frac{19 \pm \sqrt{361 - 280}}{2}$$

$$x = \frac{19 \pm \sqrt{81}}{2}$$

$$x = \frac{19+9}{2} \quad \frac{19-9}{2}$$

$$x = \frac{28}{2} \quad \frac{10}{2}$$

14	5
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$$2) \quad x^2 + 32x + 175 = 0$$

$$a=1 \quad b=32 \quad c=175$$

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

$$x = \frac{-(32) \pm \sqrt{(32)^2 - 4(1)(175)}}{2(1)}$$

$$x = \frac{-32 \pm \sqrt{1024 - 700}}{2}$$

$$x = \frac{-32 \pm \sqrt{324}}{2}$$

$$x = \frac{-32 \pm 18}{2}$$

$$\frac{-32+18}{2} \quad \frac{-32-18}{2}$$

$$\frac{-14}{2} \quad \frac{-50}{2}$$

$$\textcircled{-7, -25}$$

$$3) 2x^2 + 37x - 19 = 0$$

$$a = 2 \quad b = 37 \quad c = -19$$

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

$$x = \frac{-(37) \pm \sqrt{(37)^2 - 4(-19)(2)}}{2(2)}$$

$$x = \frac{-37 \pm \sqrt{1369 + 152}}{4}$$

$$x = \frac{-37 \pm \sqrt{1521}}{4}$$

$$x = \frac{-37 \pm 39}{4}$$

$$x = \frac{-37 + 39}{4} \quad \frac{-37 - 39}{4}$$

$$x = \frac{-2}{4} \quad \frac{-76}{4}$$

$$\frac{-1}{2} \quad -19$$

$$4) \quad x^2 - 10x = 75$$

$$x^2 - 10x - 75 = 0$$

$$a = 1 \quad b = -10 \quad c = -75$$

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

$$x = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(1)(-75)}}{2(1)}$$

$$x = \frac{10 \pm \sqrt{100 + 300}}{2}$$

$$x = \frac{10 \pm 20}{2}$$

$$x = \frac{10+20}{2} \quad \frac{10-20}{2}$$

$$\frac{30}{2}, \quad \frac{-10}{2}$$

$$\boxed{15, -5}$$

$$5) \quad x^2 + x = 132$$

$$x^2 + x - 132$$

$$a=1 \quad b=1 \quad c=-132$$

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

$$x = \frac{-1 \pm \sqrt{1^2 - 4(1)(-132)}}{2(1)}$$

$$x = \frac{1 \pm \sqrt{1 + 528}}{2}$$

$$x = \frac{1 \pm \sqrt{529}}{2}$$

$$x = \frac{1 \pm 23}{2} \quad \frac{1 - 23}{2}$$

$$\frac{24}{2}$$

$$(12)$$

$$\frac{22}{2}$$

$$(-11)$$

$$b) \quad 6x^2 + 13x = 28$$

$$6x^2 + 13x - 28 = 0$$

$$a=6 \quad b=13 \quad c=-28$$

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

$$x = \frac{-(13) \pm \sqrt{(13)^2 - 4(-28)(6)}}{2(6)}$$

$$x = \frac{-13 \pm \sqrt{169 + 672}}{12}$$

$$x = \frac{-13 \pm \sqrt{841}}{12}$$

$$x = \frac{-13 \pm 29}{12}$$

$$x = \frac{-13 + 29}{12} \quad \frac{-13 - 29}{12}$$

$$x = \frac{+16}{12} \quad \frac{-42}{12}$$

$$\left(\frac{4}{3}, -\frac{7}{2} \right)$$

$$7) 20x^2 + 11x = 3$$

$$20x^2 + 11x - 3$$

$$a=20 \quad b=11 \quad c=-3$$

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

$$x = \frac{-(11) \pm \sqrt{(11)^2 - 4(20)(-3)}}{2(20)}$$

$$x = \frac{-11 \pm \sqrt{121 + 240}}{40}$$

$$x = \frac{-11 \pm \sqrt{361}}{40}$$

$$x = \frac{-11 \pm 19}{40}$$

$$x = \frac{-11 + 19}{40} \quad \cdot \quad \frac{-11 - 19}{40}$$

$$x = \frac{+8}{40} \quad \frac{-30}{40}$$

$$\left(\frac{1}{5}\right)$$

$$\left(\frac{-3}{4}\right)$$

$$f) \quad 4x^2 + 24x = -35$$

$$4x^2 + 24x + 35 = 0$$

$$a = 4 \quad b = 24 \quad c = 35$$

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

$$x = \frac{-(24) \pm \sqrt{(24)^2 - 4(4)(35)}}{2(4)}$$

$$x = \frac{-24 \pm \sqrt{576 - 560}}{8}$$

$$x = \frac{-24 \pm \sqrt{16}}{8}$$

$$x = \frac{-24 \pm 4}{8}$$

$$x = \frac{-24 + 4}{8} \quad \frac{-24 - 4}{8}$$

$$\frac{-20}{8} \quad \frac{-28}{8}$$

$$\left(\frac{-5}{2}\right) \quad \left(\frac{-7}{2}\right)$$

Find the number of solutions of each equation.

9) $4x^2 + 12x + 9 = 0$
 $a = 4$ $b = 12$ $c = 9$

$$b^2 - 4ac$$

$$12^2 - 4(4)(9)$$

$$144 - 144$$

0
one solution

$b^2 - 4ac$ is called the discriminant.

If $b^2 - 4ac$ is negative
~~There is~~
The square root can not be found.

If $b^2 - 4ac$ is $= 0$
There is only one solution.

If $b^2 - 4ac$ is a positive number there are two solutions.

10) $x^2 - 12x + 32 = 0$
 $a = 1$ $b = -12$ $c = 32$

$$b^2 - 4ac$$

$$(-12)^2 - 4(1)(32)$$

$$144 - 128$$

16 two solutions

$$11) \quad x^2 - 10x + 1 = 0$$
$$a=1 \quad b=-10 \quad c=1$$

$$b^2 - 4ac$$

$$(-10)^2 - 4(1)(1)$$

$$100 - 4$$

96 two solutions

$$12) \quad 3x^2 + 6x + 8 = 0$$
$$a=3 \quad b=6 \quad c=8$$

$$b^2 - 4ac$$

$$(6)^2 - 4(3)(8)$$

$$36 - 96$$

$$-60$$

no real solutions

~~$$13) \quad 3x^2 + 6x + 8 = 0$$~~

~~$$a=3 \quad b=6 \quad c=8$$~~

~~$$b^2 - 4ac$$~~

~~$$(6)$$~~

$$13) \quad 3x^2 - 5x = -6$$

$$3x^2 - 5x + 6 = 0$$

$$a=3 \quad b=-5 \quad c=6$$

$$b^2 - 4ac$$

$$(-5)^2 - 4(3)(6)$$

$$25 - 72$$

-47 No real solutions.

$$15) \quad x^2 + 100 = 20x$$

$$x^2 - 20x + 100 = 0$$

$$a=1 \quad b=-20 \quad c=100$$

$$b^2 - 4ac$$

$$(-20)^2 - 4(1)(100)$$

$$400 - 400$$

0 one solution.

$$16) \quad 5x^2 - 7x = 2$$

$$5x^2 - 7x - 2 = 0$$

$$a=5 \quad b=-7 \quad c=-2$$

$$b^2 - 4ac$$

$$(-7)^2 - 4(5)(-2)$$

$$49 + 40$$

89 two solutions.

17) Round answer to the nearest hundredth.

$$h^2 - 2h - 2 = 0$$

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

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

$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-2)}}{2(1)}$$

$$x = \frac{2 \pm \sqrt{4 + 8}}{2}$$

$$x = \frac{2 \pm \sqrt{12}}{2}$$

$$x = \frac{2 \pm 3.4641}{2}$$

$$x = \frac{2 + 3.4641}{2}$$

$$\frac{5.4641}{2}$$

$$2.73205$$

$$\boxed{2.73}$$

$$\frac{2 - 3.4641}{2}$$

$$\frac{-1.4641}{2}$$

$$-0.73205$$

$$\boxed{-0.73}$$

8.9

The Quadratic Formula
and the discriminant.

$$1) \quad x^2 - 6x + 4$$

$$a = 1 \quad b = -6 \quad c = 4$$

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

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

$$x = \frac{6 \pm \sqrt{36 - 16}}{2}$$

$$x = \frac{6 \pm \sqrt{20}}{2}$$

$$x = \frac{6 \pm 4.4721}{2}$$

$$x = \frac{6 + 4.4721}{2}$$

$$\frac{10.4721}{2}$$

$$5.23605$$

$$\underline{5.24}$$

$$\frac{6 - 4.4721}{2}$$

$$\frac{1.5279}{2}$$

$$0.76395$$

$$\underline{0.76}$$

$$2) \quad x^2 - 5x - 24 = 0$$

$$a = 1 \quad b = -5 \quad c = -24$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \text{quadratic formula.}$$

$$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(-24)}}{2(1)}$$

$$x = \frac{5 \pm \sqrt{25 + 96}}{2}$$

$$x = \frac{5 \pm \sqrt{121}}{2}$$

$$x = \frac{5 \pm 11}{2}$$

$$x = \frac{5 + 11}{2} \quad \frac{5 - 11}{2}$$

$$x = \frac{16}{2} \quad \frac{-6}{2}$$

$$x = 8, -3$$

$$3) \quad 2x^2 + 13x + 15 = 0$$

$$a = 2 \quad b = 13 \quad c = 15$$

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

$$x = \frac{-(13) \pm \sqrt{(13)^2 - 4(2)(15)}}{2(2)}$$

$$x = \frac{-13 \pm \sqrt{169 - 120}}{4}$$

$$x = \frac{-13 \pm \sqrt{49}}{4}$$

$$x = \frac{-13 \pm 7}{4}$$

$$x = \frac{-13 + 7}{4} \quad \frac{-13 - 7}{4}$$

$$\frac{-6}{4} \quad \frac{-20}{4}$$

$$-\frac{3}{2} \quad (-1\frac{1}{2}) \quad (-5)$$

$$4) \quad y^2 - 4y - 4 = 0$$

$$a = 1 \quad b = -4 \quad c = -4$$

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

$$X = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-4)}}{2(1)}$$

$$X = \frac{4 \pm \sqrt{16 + 16}}{2}$$

$$X = \frac{4 \pm \sqrt{32}}{2}$$

$$X = \frac{4 \pm 5.656}{2}$$

$$\frac{4 + 5.656}{2}$$

$$\frac{9.656}{2}$$

$$4.828$$

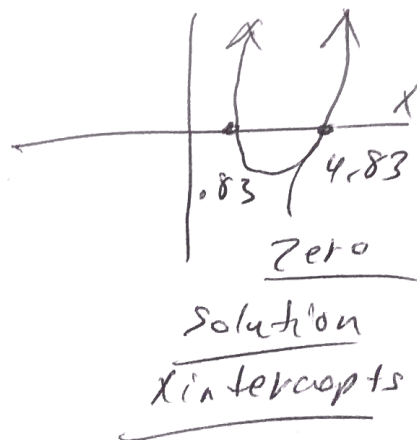
$$4.83$$

$$\frac{4 - 5.656}{2}$$

$$\frac{-1.656}{2}$$

$$-0.828$$

$$-0.83$$



$$5) \quad X^2 + 12x + 16 = 0$$

$$a=1 \quad b=12 \quad c=16$$

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

$$X = \frac{-(12) \pm \sqrt{(12)^2 - 4(1)(16)}}{2(1)}$$

$$X = \frac{-12 \pm \sqrt{144 - 64}}{2}$$

$$X = \frac{-12 \pm \sqrt{80}}{2}$$

$$X = \frac{-12 \pm 8.944}{2}$$

$$X = \frac{-12 + 8.944}{2}$$

$$\frac{-3.056}{2}$$

$$-1.528$$

$$\textcircled{-1.53}$$

$$\frac{-12 - 8.944}{2}$$

$$\frac{-20.944}{2}$$

$$-10.472$$

$$\textcircled{-10.47}$$

$$6) \quad 5x^2 + 3x = 1$$

$$5x^2 - 3x - 1 = 0$$

$$a=5 \quad b=-3 \quad c=-1$$

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

$$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(5)(-1)}}{2(5)}$$

$$x = \frac{3 \pm \sqrt{9 + 20}}{10}$$

$$x = \frac{3 \pm \sqrt{29}}{10}$$

$$x = \frac{3 \pm 5.3851}{10}$$

$$\frac{3 + 5.3851}{10}$$

$$\frac{8.3851}{10}$$

$$0.83851$$

0.84

$$\frac{3 - 5.3851}{10}$$

$$\frac{-2.3851}{10}$$

$$-0.23851$$

-0.24

$$7) x^2 - 10x + 1 = 0$$

$$a=1 \quad b=-10 \quad c=1$$

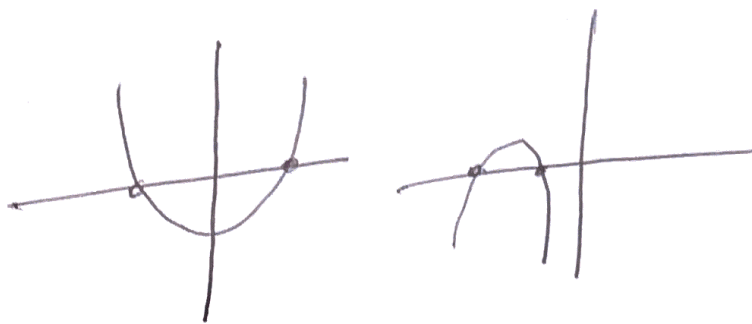
$$b^2 - 4ac$$

$$(-10)^2 - 4(1)(1)$$

$$100 - 4$$

$$(96)$$

If the answer is positive
you have **two solutions**.



$$8) 3x^2 + 6x + 8 = 0$$

$$a=3 \quad b=6 \quad c=8$$

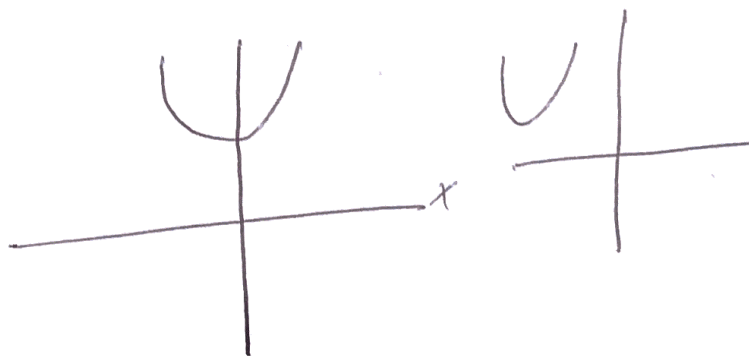
$$b^2 - 4ac$$

$$(6)^2 - 4(3)(8)$$

$$36 - 96$$

$$-60$$

If you have a negative
answer
you have
No Real Solutions



$$9) x^2 - 20x + 100 = 0$$

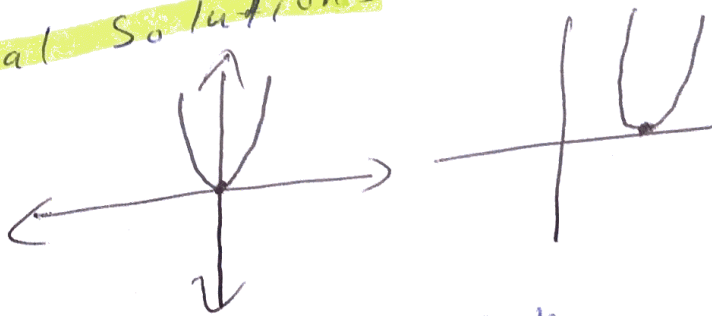
$$a=1 \quad b=-20 \quad c=100$$

$$b^2 - 4ac$$

$$(-20)^2 - 4(1)(100)$$

$$400 - 400$$

If the answer is zero
you have **one solution**



$$10) \quad x^2 - 5x - 24 = 0$$

$$a=1 \quad b=-5 \quad c=-24$$

$$b^2 - 4ac$$

$$(5)^2 - 4(1)(-24)$$

$$25 + 96$$

$$121$$

two solutions

11)

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

$$a=6 \quad b=0 \quad c=6$$

$$b^2 - 4ac$$

$$(0)^2 - 4(6)(6)$$

$$0 - 144 \quad \text{No real solution}$$

$$-144$$

12)

$$5x^2 - 7x - 2 = 0$$

$$a=5 \quad b=-7 \quad c=-2$$

$$b^2 - 4ac$$

$$(-7)^2 - 4(5)(-2)$$

$$49 + 40$$

$$89$$

two solutions.