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

1. Solve each equation by **factoring.**

a) $x^2 + 8x = -15$

$\frac{3}{3} \times \frac{5}{5} \; \frac{15}{8}$

$x^2 + 8x + 15 = 0$

$(x+3)(x+5) = 0$

$x = -3 \quad x = -5$

b) $100x^2 = 121$

$x^2 = \frac{121}{100} \quad x = \sqrt{\frac{121}{100}} \quad x = \frac{-11}{10} \quad x = \frac{11}{10}$

c) $7x^2 - 2x = 0$

$x(7x-2) = 0$

$x = 0 \quad \frac{7x}{7} = \frac{2}{7}$

$x = 0 \quad x = \frac{2}{7}$

d) $3x^2 - 16x - 12 = 0$

$\frac{-18}{-18} \times \frac{2}{2} \; \frac{-36}{-16}$

	x	-6
$3x$	$3x^2$	$-18x$
2	$2x$	-12

$(3x+2)(x-6)$

$3x = -2 \quad x = 6$

$x = \frac{-2}{3}$

$\frac{-5}{-5} \times \frac{-6}{-6} \; \frac{30}{-11}$

e) $5x^2 - 44x + 120 = -30 + 11x$

$\frac{5x^2}{5} - \frac{55x}{5} + \frac{150}{5} = \frac{0}{5}$

$x^2 - 11x + 30 = 0$

$(x-5)(x-6) = 0$

$x = 5 \quad x = 6$

f) $2x(x-3) = 20$

$\frac{2x^2}{2} - \frac{6x}{2} - \frac{20}{2} = \frac{0}{2}$

$x^2 - 3x - 10 = 0$

$\frac{-5}{-5} \times \frac{2}{2} \; \frac{-10}{-3}$

$(x-5)(x+2) = 0$

$x = 5 \quad x = -2$

2. Algebraically determine the EXACT roots of the equation: $4x^2 + 4x - 5 = 0$
Simplify completely.

$\sqrt{96}$
$\sqrt{16 \cdot 6}$
$4\sqrt{6}$

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

$= \frac{-4 \pm \sqrt{16 + 80}}{8}$

$x = \frac{-4 \pm \sqrt{96}}{8}$

$x = \frac{-4 \pm 4\sqrt{6}}{8}$

$x = \frac{-1 \pm \sqrt{6}}{2}$

$x = \frac{-1 + \sqrt{6}}{2} \quad x = \frac{-1 - \sqrt{6}}{2}$

3. Using calculations, how many times does the graph of each equation cross the x – axis?

a) $y = 2x^2 - 4x + 1$

$\sqrt{b^2 - 4ac}$

$\sqrt{(-4)^2 - 4(2)(1)}$

$\sqrt{16 - 8}$

$\sqrt{8}$

there will be 2 roots

b) $y = 9x^2 - 6x + 1$

$\sqrt{b^2 - 4ac}$

$\sqrt{(-6)^2 - 4(9)(1)}$

$\sqrt{36 - 36}$

$\sqrt{0} = 0$

there will be ONE root

c) $y = 5x^2 + 7x + 3$

$\sqrt{b^2 - 4ac}$

$\sqrt{7^2 - 4(5)(3)}$

$\sqrt{49 - 60}$

$\sqrt{-11}$

there will be NO roots

4. Two integers differ by 4. The sum of their squares is 58. Write a quadratic equation to represent this situation and determine the two numbers.

$x - y = 4$

$x - 4 = y$

$x^2 + y^2 = 58$

$x^2 + (x-4)^2 = 58$

$x^2 + (x-4)(x-4) = 58$

$x^2 + x^2 - 8x + 16 = 58$

$\frac{2x^2}{2} - \frac{8x}{2} - \frac{42}{2} = \frac{0}{2}$

$x^2 - 4x - 21 = 0$

$\frac{-7}{-7} \times \frac{3}{3} \; \frac{-21}{-4}$

$(x-7)(x+3) = 0$

$x = 7 \quad x = -3$

7 and 3
-3 and -7

5. Given the standard form of the quadratic function, $y = 2x^2 + 10x + 8$, determine the

a) vertex $x = \frac{-b}{2a} = \frac{-10}{2(2)} = \frac{-10}{4} = -2.5$

$y = 2(-2.5)^2 + 10(-2.5) + 8$
$= 12.5 - 25 + 8$
$= -4.5$

$(-2.5, -4.5)$

b) y-intercept $(0, 8)$

c) x-intercept(s)

$\frac{2x^2}{2} + \frac{10x}{2} + \frac{8}{2} = \frac{0}{2}$

$x^2 + 5x + 4 = 0$

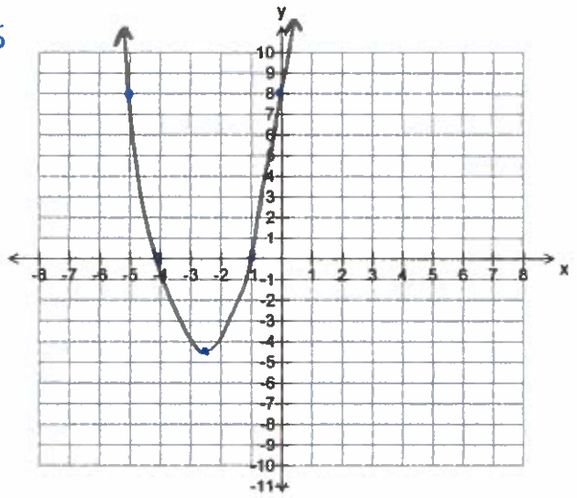
$\frac{4}{4} \times \frac{1}{1}$ $\quad 4 + 1 = 5$

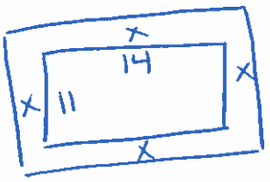
$(x+4)(x+1) = 0$

$x = -4 \quad x = -1$

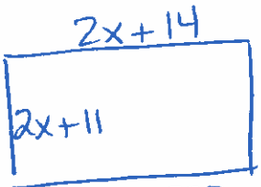
$(-4, 0) \quad (-1, 0)$

d) sketch the graph





6. A photo framer wants to place a mat of uniform width all around a photo. The dimensions of the photo are 11 in. by 14 in. If the total area of the mat and photo is 300 in^2, what is the width of the mat?



$(2x+14)(2x+11) = 300$
$4x^2 + 22x + 28x + 154 = 300$
$4x^2 + 50x - 146 = 0$

$x = \frac{-50 \pm \sqrt{50^2 - 4(4)(-146)}}{2(4)}$

$= \frac{-50 \pm \sqrt{2500 + 2336}}{8}$

$x = \frac{-50 \pm \sqrt{4836}}{8}$

$x = \frac{-50 \pm 69.5}{8}$

$x = \frac{-50 + 69.5}{8}$
$= 2.4$

$x = \frac{-50 - 69.5}{8}$
$= -14.9$
inadmissible

width of mat is 2.4 in

7. The length of one leg of a right triangle is 3 more than the other leg. If the hypotenuse is 15 m, what is the length of the shortest leg?

$a^2 + b^2 = c^2$
$x^2 + (x+3)^2 = 15^2$
$x^2 + (x+3)(x+3) = 225$
$x^2 + x^2 + 6x + 9 = 225$
$\frac{2x^2}{2} + \frac{6x}{2} - \frac{216}{2} = \frac{0}{2}$
$x^2 + 3x - 108 = 0$

$\frac{12}{12} \times \frac{-9}{-9}$ $\quad -108$
$12 + (-9) = 3$

$(x+12)(x-9) = 0$

$x = -12$
inadmissable

$x = 9$

Shortest leg is 9 m

8. A ball is thrown into the air from a bridge that is 15 m above a river. The function of the height, $h(t)$, in meters, of the ball over time, t, in seconds, is $h(t) = -4.9t^2 + 9t + 15$. When is the ball 17 m above the water?

$-4.9t^2 + 9t + 15 = 17$
$-4.9t^2 + 9t - 2 = 0$

$x = \frac{-9 \pm \sqrt{9^2 - 4(-4.9)(-2)}}{2(-4.9)}$

$x = \frac{-9 \pm \sqrt{81 - 39.2}}{-9.8}$

$x = \frac{-9 \pm \sqrt{41.8}}{-9.8} = \frac{-9 \pm 6.5}{9.8}$

$x = \frac{-9 + 6.5}{-9}$
$= 0.28$ s

$x = \frac{-9 - 6.5}{-9}$
$= 1.72$ s

The ball is 17 m above the water at 0.28 s and 1.72 s