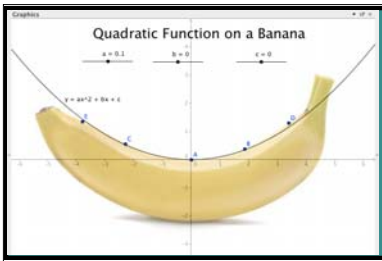
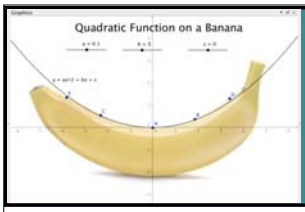


2.3 The Quadratic Formula

There is a way to calculate the roots
(zeros or x-intercepts) of any quadratic.
It is called the Quadratic Formula or Equation.

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



Ex.) Solve $x^2 + 2x - 3 = 0$ using the Quadratic Equation.

a b c

Steps: *Start by identifying the terms a, b and c
*Then, substitute the values into the Quadratic Equation

$ax^2 + bx + c = 0$

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

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

$$x = \frac{-2 \pm \sqrt{16}}{2} = \frac{-2 \pm 4}{2}$$

$x = \frac{(-2+4)}{2} = \boxed{1}$ (1,0)

$x = \frac{(-2-4)}{2} = \boxed{-3}$ (-3,0)

Ex.) a) $x^2 + 4x - 1 = 0$

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

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

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

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

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

$x = -2 \pm \sqrt{5}$ Exact Value

Nearest Hundredth

$x = 0.24$
$x = -4.24$

b) $x^2 - x + 4 = 0$

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

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

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

$x = \frac{1 \pm \sqrt{-15}}{2}$ not possible

$\therefore$ no x-intercepts

therefore

Ex.) Solve the following with the quadratic formula.

a) $x^2 + 4x - 2 = 0$

$a=1$
$b=4$
$c=-2$

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

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

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

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

$x = -2 \pm \sqrt{6}$ Exact

$x = 0.45$
$x = -4.45$ Nearest Hundredth

b) $x^2 - 5x + 4 = 0$

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

$x = \frac{5 \pm \sqrt{9}}{2}$

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

$\frac{8}{2} = 4$

$\frac{2}{2} = 1$

Solving Quadratics NOT in the form $ax^2 + bx + c = 0$

If the Quadratic Equation is not in the form $ax^2 + bx + c = 0$, then it must be converted to this form first before solving! One side must equal zero.

Ex.) Solve each equation:

a) $2x = 3(x-1)(x+1)$

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

$2x = 3x^2 - 3$

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

$a = 3$

$b = -2$

$c = -3$

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

$x = \frac{2 \pm \sqrt{40}}{6}$

$x = \frac{2 \pm 2\sqrt{10}}{6}$

$x = \frac{1 \pm \sqrt{10}}{3} = 1.39 \text{ or } -0.72$

b) $\frac{2}{3}x^2 + 1 = \frac{5}{6}x$

$-\frac{5}{6}x \quad -\frac{5}{6}x$

$\frac{2}{3}x^2 - \frac{5}{6}x + 1 = 0$

$x = \frac{-(-5/6) \pm \sqrt{(-5/6)^2 - 4(2/3)(1)}}{2(2/3)}$

$x = \frac{5/6 \pm \sqrt{-71/36}}{4/3}$

no solutions
no x-int
no roots
no zero's

Pg. 254 # 3, 4, 5, 6, 7.