Today's Learning Goal(s):

By the end of the class, I will be able to:

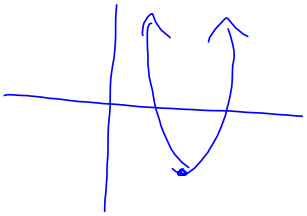
a) Understand and apply the quadratic formula.

Warm-up: Write in standard form

a) $y=(x-3)^2-6$

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

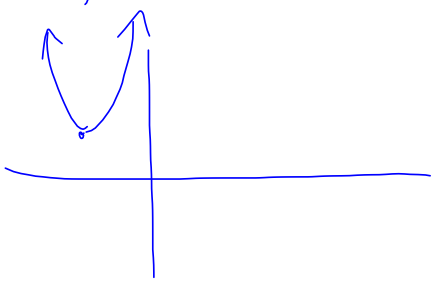
$=x^2-6x+3$



b) $y=(x+2)^2+1$

$=x^2+4x+4+1$

$=x^2+4x+5$



MCF 3MI 4.3 Solving Quadratic Equations Using the Quadratic Formula

Date: Mar. 29/19

The quadratic formula is derived by completing the square and solving for x.
(Refer to pp. 218-219 for 1 method.)

All quadratic equations of the form $ax^2 + bx + c = 0$ can be solved using the quadratic formula.

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

The formula (above) allows you to find the roots (zeros) without factoring, and for unfactorable quadratic expressions.

If $ax^2 + bx + c = 0$, then $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$4x^2+2-7x=0$

Ex.1: Identify the values of a, b, and c for the following:

a) $4x^2 - 7x + 2 = 0$

$a=4 \quad b=-7 \quad c=2$

$a = 4,\ b = -7,\ c = 2$

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

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

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

$2x^2-4x-9=0$

$a = 2,\ b = -4,\ c = -9$

Ex.2: Use the quadratic formula to solve each equation.

Find the roots of each equation. (Round to 2 decimal places, if necessary.)

a) $x^2 - 6x + 3 = 0$

$a=1 \quad b=-6 \quad c=3$

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

$=\dfrac{-(-6)\pm\sqrt{(-6)^2-4(1)(3)}}{2(1)}$

$=\dfrac{6\pm\sqrt{36-12}}{2}$

$=\dfrac{6\pm\sqrt{24}}{2}$

$x=\dfrac{6+\sqrt{24}}{2}$ or $x=\dfrac{6-\sqrt{24}}{2}$

$\doteq 5.449 \qquad \doteq 0.550$

$\doteq 5.45 \qquad \doteq 0.55$

$x \doteq 5.45, x \doteq 0.55$

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

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

$a=1 \quad b=4 \quad c=5$

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

$=\dfrac{-4\pm\sqrt{16-20}}{2}$

$=\dfrac{-4\pm\sqrt{-4}}{2}$

$\therefore$ No Real roots

b/c No $\sqrt{}$ negative

Ans: No Real solution

c) $4x^2 - 9x + 5 = 0$

$a=4 \quad b=-9 \quad c=5$

$x=\dfrac{-(-9)\pm\sqrt{(-9)^2-4(4)(5)}}{2(4)}$

$=\dfrac{9\pm\sqrt{81-80}}{8}$

$=\dfrac{9\pm\sqrt{1}}{8}$

$x=\dfrac{9+1}{8}$ or $x=\dfrac{9-1}{8}$

$=\dfrac{10}{8}$ $=\dfrac{8}{8}$

$=\dfrac{5}{4}$ $=1$

$x = \dfrac{5}{4}$ or $x = 1$

$\therefore$ it factored (Check quickly first)

$(4x-5)(x-1)=0$

Ex.3: See p.220, Example 4.

EXAMPLE 4 Applying the quadratic formula to solve a problem

The profit on a school drama production is modelled by the quadratic equation $P(x) = -60x^2 + 790x - 1000$, where $P(x)$ is the profit in dollars and x is the price of the ticket, also in dollars.

a) Use the quadratic formula to determine the break-even price for the tickets.

b) At what price should the drama department set the tickets to maximize their profit?

Recall: To "break-even" means the profit =0; or P(x)=0.

$0 = -60x^2 + 790x - 1000$

$a=-60 \quad b=790 \quad c=-1000$

$$x = \frac{-790 \pm \sqrt{790^2 - 4(-60)(-1000)}}{2(-60)}$$

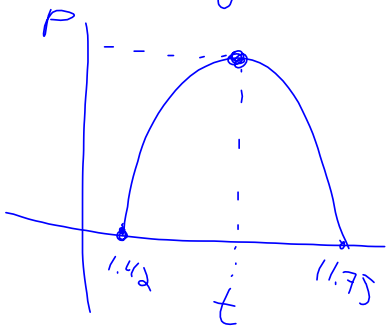
$$= \frac{-790 \pm \sqrt{384\,100}}{-120}$$

$$x = \frac{-790 + \sqrt{384100}}{-120} \quad \text{or} \quad x = \frac{-790 - \sqrt{384\,100}}{-120}$$

$\doteq 1.418$ $\doteq 11.747$

$\doteq 1.42$ $\doteq 11.75$

∴ if they charge \$1.42 or \$11.75 they will break-even



b) To find max. profit, find the vertex.

$$x = \frac{-b}{2a}$$

$$= \frac{-790}{2(-60)}$$

$\doteq 6.583$

$\doteq 6.58$

∴ the ticket price should be \$6.58.

Today's Homework: pp. 222-223 # 1bcd, 3, 6, 8