The Quadratic formula

Goal: to use the quadratic formula to solve quadratic equations.

For any quadratic equation of the form $ax^2+bx+c=0$ (equation), where a, b, and c are constants with $a \neq 0$, the solutions are ...

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

(ex) Solve

a) $1x^2 = -10x - 22$

$+10x \quad +22 \qquad +10x \quad +22$

$1x^2 + 10x + 22 = 0$

$a = 1,\ b = 10,\ c = 22$

$$x = \frac{-10 \pm \sqrt{10^2-4(1)(22)}}{2(1)}$$

$$x = \frac{-10 \pm \sqrt{100-88}}{2}$$

$$x = \frac{-10 \pm \sqrt{12}}{2}$$

$\sqrt{12} = 2\sqrt{4 \cdot 3}$

$$x = \frac{-10 \pm 2\sqrt{3}}{2}$$

$$= \frac{2(-5 \pm \sqrt{3})}{2 \cdot 1}$$

$$= -5 \pm \sqrt{3}$$ exact

b) $5y^2 + 12y - 1 = 0$

$a = 5,\ b = 12,\ c = -1$

$$y = \frac{-12 \pm \sqrt{12^2-4(5)(-1)}}{2(5)}$$

$$y = \frac{-12 \pm \sqrt{144+20}}{10}$$

$$y = \frac{-12 \pm \sqrt{164}}{10}$$

144

$164 = 4 \cdot 41$

$2 \quad 82$

$2 \quad 41$

$$y = \frac{-6 \pm \sqrt{41}}{5}$$

$$y = \frac{-12 \pm \sqrt{164}}{10}$$

$$y = \frac{-12 \pm 2\sqrt{41}}{10}$$

$$y = \frac{\cancel{2}(-6 \pm \sqrt{41})}{5\cancel{0}}$$

$$y = \frac{-6 \pm \sqrt{41}}{5}$$

c) $2 + \frac{1}{x^2} = \frac{4}{x}$

$$x^2\left(2 + \frac{1}{x^2}\right) = \frac{4}{x} \cdot x^2$$

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

$$-4x \quad -4x$$

$$2x^2 - 4x + 1 = 0$$

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

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

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

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

$$= \frac{\cancel{2}(2 \pm \sqrt{2})}{2\cancel{4}}$$

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

≈ 0.29 or 1.707

d) $3x^2 + 2x + 4 = 0$

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

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

$$x = \frac{-2 \pm \sqrt{-44}}{6}$$

$$4 - 48$$

$$\sqrt{-44}$$

$$i\sqrt{44}$$

$$2i\sqrt{4 \cdot 11}$$

$$x = \frac{-2 \pm 2i\sqrt{11}}{6}$$

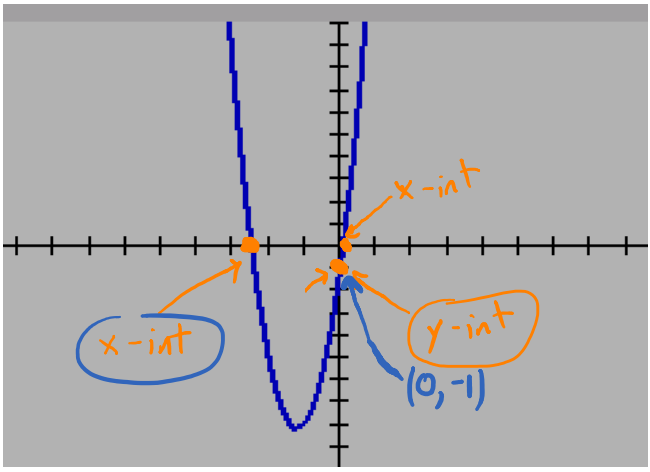
$$= \frac{\cancel{2}(-1 \pm i\sqrt{11})}{3\cancel{6}}$$

$$= \frac{-1 \pm i\sqrt{11}}{3}$$

(ex) Find the x and y-intercepts of

$f(x) = 5x^2 + 12x - 1$

$y = 5x^2 + 12x - 1$



y-int (set $x = 0$)

$y = 5(0)^2 + 12(0) - 1$

$= -1$

$(0, -1)$

x-int (set $y = 0$)

$0 = 5x^2 + 12x - 1$

⋮ Q.F.

see 1st (ex) part (b)

$x = \dfrac{-6 \pm \sqrt{41}}{5}$

$\left(\dfrac{-6-\sqrt{41}}{5}, 0\right) \left(\dfrac{-6+\sqrt{41}}{5}, 0\right)$