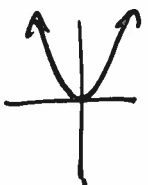
Name: Key

Math 20-1
Quadratic Functions and Equations
Assignment 6: The Quadratic Formula & The Discriminant

1. Find the exact roots of the equation $6x^2 + 5x + 1 = 0$ by using:

a. Graphing



$x = \frac{-1}{3}, \frac{-1}{2}$

b. The quadratic formula $a=6 \quad b=5 \quad c=1$

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

$$x = \frac{-5 \pm \sqrt{25-4(6)(1)}}{2(6)}$$

$$x = \frac{-5 \pm \sqrt{1}}{12} = \frac{-5 \pm 1}{12}.$$

2. Find the roots of the following quadratic equations using the quadratic formula. Your answers should be both exact and rounded to the nearest tenth.

a. $2x^2 - 3x - 4 = 0$

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

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

$$x = \frac{3 \pm \sqrt{41}}{4}, \quad x = -0.9, 2.4$$

b. $10t^2 = 7t + 1$ $\quad 10t^2 - 7t - 1$

$$x = \frac{7 \pm \sqrt{(-7)^2 - 4(10)(-1)}}{2(10)}$$

$$x = \frac{7 \pm \sqrt{89}}{20}, \quad x = -0.1, 0.8$$

$$= \frac{7+\sqrt{89}}{20}, \frac{7-\sqrt{89}}{20}$$

c. $x^2 - 10x - 15 = 0$

$$x = \frac{10 \pm \sqrt{(-10)^2 - 4(1)(-15)}}{2(1)}$$

$$x = \frac{10 \pm \sqrt{160}}{2}$$

$$= \frac{10 \pm 4\sqrt{10}}{2}$$

$$= 5 \pm 2\sqrt{10}$$

$$= 11.3, -1.3$$

d. $3x^2 - 12x + 11 = 0$

$$x = \frac{12 \pm \sqrt{(-12)^2 - 4(3)(11)}}{2(3)}$$

$$x = \frac{12 \pm \sqrt{12}}{6}$$

$$x = \frac{12 \pm 2\sqrt{3}}{6} = \frac{6 \pm \sqrt{3}}{3}$$

$$= 2.6, 1.4$$

3. Find the zeros of the following quadratic functions. Give answers as exact values in simplest form and to the nearest hundredth.

a. $f(x) = x^2 + 20x + 15$

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

$= \frac{-20 \pm \sqrt{(20)^2-4(1)(15)}}{2(1)}$

$= \frac{-20 \pm \sqrt{340}}{2} = \frac{-20 \pm 2\sqrt{85}}{2}$

$x = -10 \pm \sqrt{85}$

$= -19.22, -0.78$

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

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

$x = \frac{-12 \pm \sqrt{244}}{10} = \frac{-12 \pm 2\sqrt{61}}{10}$

$x = \frac{-6 \pm \sqrt{61}}{5}$

$= -2.76, 0.36$

4. Form a quadratic equation and solve. **Give answers as exact values in simplest form.**

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

$6x^2 + 4x - 3x - 2 = 2x^2 + x + 6x + 3$ ($7x$)

$4x^2 - 6x - 5 = 0$ (x, -3) $2x^2 - 7x - 3$

$x = \frac{6 \pm \sqrt{(6)^2-4(4)(-5)}}{2(4)} = \frac{6 \pm \sqrt{116}}{8}$

$x = -0.6, 2.1$

b. $3(x-1)(x+2) - (x^2+3) = 0$

$3(x^2 + 2x - x - 2) - x^2 - 3 = 0$

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

$2x^2 + 3x - 9 = 0$

$x = \frac{-3 \pm \sqrt{9-4(2)(-9)}}{2(2)} = \frac{-3 \pm \sqrt{81}}{4}$

$x = -3, 3/2.$

5. Find a quadratic equation in simplest form which is equivalent to the given equation, but has integral coefficients. Find the roots of the given equation to the nearest tenth.

a. $(1.4x^2 - 2.8x = 1.8)10$ Hint: X 10

$14x^2 - 28x - 18 = 0$

$x = \frac{28 \pm \sqrt{28^2-4(14)(-18)}}{2(14)}$

$x = \frac{28 \pm \sqrt{1792}}{28}$

$= -0.5, 2.5$

b. $\left(\frac{x^2}{2} - \frac{x}{1} - \frac{5}{4}\right)4 = 0$

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

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

$= \frac{4 \pm \sqrt{56}}{4} = \frac{4 \pm 2\sqrt{14}}{4} = \frac{2 \pm \sqrt{14}}{2}$

$= -0.9, 2.9$

6. Find the value of the discriminant in each of the following equations.

a. $x^2 + x + 9 = 0$

$b^2 - 4ac$

$1^2 - 4(1)(9)$

$1 - 36$

$= -35$

b. $3x^2 - 18x + 27 = 0$

$b^2 - 4ac$

$(-18)^2 - 4(3)(27)$

$= 0$

7. Determine the nature of the roots of the following equations without solving or graphing.

a. $2x^2 + 4x + 8 = 0$

$b^2 - 4ac$

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

-48

non real

b. $9x^2 - 24x + 16 = 0$

$(-24)^2 - 4(9)(16)$

$= 0$

real + equal

c. $-2x^2 - x + 3 = 0$

$(-1)^2 - 4(-2)(3)$

$= 25$

real + unequal

d. $-2(x + 3)^2 + 40 = 0$

$-2(x+3)(x+3) + 40 = 0$

$-2(x^2 + 6x + 9) + 40 = 0$

$-2x^2 - 12x \underbrace{-18 + 40}_{22} = 0$

$12^2 - 4(-2)(22)$

$= 96$ real + unequal

e. $x^2 + 10 + 3x = 0$

$3^2 - 4(1)(10)$

$= -31$

nonreal

f. $4x^2 + 4x + 1 = 0$

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

$= 0$

real + equal

8. For what values of *n* does each equation have real roots? ≥ 0

a. $nx^2 - 2x + 1 = 0$

$b^2 - 4ac \geq 0$

$(-2)^2 - 4n(1) \geq 0$

$4 - 4n \geq 0$

$-4n \geq -4$

$n \leq 1, \in R$

b. $2x^2 + 20x + n = 0$

$b^2 - 4ac \geq 0$

$20^2 - 4(2)n \geq 0$

$400 - 8n \geq 0$

$-8n \geq -400$

$n \leq 50, \in R.$

For what values of *a* does the equation $ax^2 + (2a - 3)x + a = 0$ have non-real roots?

$b^2 - 4ac < 0$

$(2a-3)^2 - 4aa < 0$

$4a^2 - 12a + 9 - 4a^2 < 0$

$-12a + 9 < 0$

$-12a < -9$

$a > \frac{9}{12}$

$a > 3/4, \in R.$