MA 15200 Lesson 15 Section 1.5 (part 2)

I The Discriminant

The part of the quadratic formula under the radical sign (b^2-4ac) is called the **discriminant.** (Some textbooks call it the determinant.) Note: The discriminant is without the radical sign.

1. If $b^2-4ac=0$, then the formula would be $x=\frac{-b\pm\sqrt{0}}{2a}=-\frac{b}{2a}$. There will only be **one rational solution.**
2. If b^2-4ac equals a positive perfect square number, then the formula would be $x=\frac{-b\pm\sqrt{k^2}}{2a}=\frac{-b\pm k}{2a}$, where *k* is a positive rational number. There will be **two rational solutions.**
3. If b^2-4ac equals a positive non-perfect square number, then the formula would be $x=\frac{-b\pm\sqrt{n}}{2a}$, where *n* is a non-perfect square number. There will be **two conjugate irrational solutions** because the solutions include a radical.
4. If b^2-4ac equals a negative number, then the formula will be $x=\frac{-b\pm\sqrt{-n}}{2a}=\frac{-b}{2a}\pm\frac{\sqrt{n}}{2a}i$, where *n* is a positive number. There will be **two conjugate complex solutions.**

Ex 1: Use the discriminant to determine the number and types of solutions.

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

b) $10x^2+29x=21$

II Determining Which Method to Use

Always clear fractions and usually write a quadratic equation in general form with a positive leading coefficient.

There is a table on page 148 of the textbook that summarizes the most logical method to use when solving a quadratic equation. (However, they did not include completing the square method.) Here is my summary.

1. If the polynomial of $ax^2+bx+c=0$ can easily be factored, use factoring and the zero-product principle to solve.

2. If the equation is of the form $u^2 = d$, use the square root property to solve.
3. If the equation is of the form $x^2 + bx + c = 0$, you could use completing the square to solve.
4. The quadratic formula could always to used to solve, especially if it does not look easy to factor or the leading coefficient is not a 1.

Ex 2: Solve each equation by an appropriate method.

a) $x - 2 = \frac{15}{x}$

b) $30x^2 - 10 = 13x$

c) $(2x + 7)^2 = 36$

d) $3x^2 - 27 = 0$

e) $x^2 - 4x = -17$

f) $x(2x+5) = 2$

g) $\frac{1}{x} + \frac{1}{x+3} = \frac{1}{4}$

III Applied Problems

Ex 3: Three times a negative number subtracted from the square of the number equals 9. Find the number.

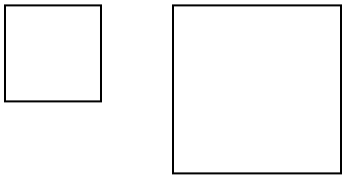
Ex 4: The formula $P = 0.006A^2 - 0.02A + 120$ models a man's normal systolic blood pressure given his age in years. Find the age, to the nearest tenth of a year, for a man whose normal systolic blood pressure is 123.

The Pythagorean Theorem relates the 3 sides of a right triangle. If the two legs, or shorter sides, are represented by *a* and *b* and the hypotenuse, or longest side, is represented by *c*, then $a^2 + b^2 = c^2$.

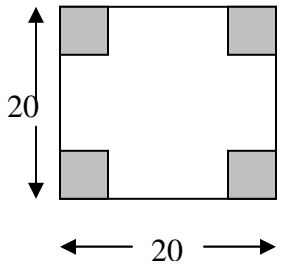
Ex 5: A right triangle has one leg 45 cm long and the longest side, the hypotenuse is 60 cm long. Approximate the length of the remaining leg to the nearest tenth of a cm.

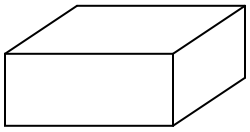
Ex 6: A rectangle has a length 4 inches more than its width. If the area of the rectangle is 117 square inches, find its width and length.

Ex 7: The side of a square is 4 centimeters shorter than the side of a second square. If the sum of their areas is 106 square centimeters, find the length of one side of the larger square.



Ex 8: A piece of thick cardstock, 20 inches per side, is to have four equal squares cut from its corners as shown. If the edges are then to be folded up to make an open topped box with a bottom area of 256 square inches, find the depth of the box.





Ex 9: A picture showing through a picture frame is 9 inches by 12 inches. The frame around the picture is of uniform width. (See picture below.) If the area of the picture plus the frame is 208 square inches, find the width of the frame.