Getting started with the TI-89 (solving equations)

A very useful capability of the TI-89 is solving equations. To find the real roots of an equation, first hit **F2 Algebra** and select **1: solve(** Complete the entry line in the following form:

solve(equation, variable)

Examples:

1. To solve the equation $2x^2 + 3x - 4 = 0$, use:

   solve(2x^2 + 3x - 4 = 0, x) enter

   [Note that the comma is a necessary part of the command and is available on the TI-89 keypad. Also enter the right parenthesis. Two roots will be displayed, equivalent to the solutions found "by hand" using the Quadratic Formula.]

2. **solve(2x^2 + 3x + 4 = 0, x) enter**

   returns **False**; that is, there are no real roots. If the command is changed to

   csolve(2x^2 + 3x +4 = 0, x) enter

   (that is, solve for complex roots), the imaginary roots from the Quadratic Formula are displayed.

3. **solve(2x^3 + 3x + 4 = 0, x) enter**

   returns the one real root -.879615.

4. **csolve(2x^3 + 3x + 4 = 0, x) enter**

   returns -.879615 and two additional conjugate imaginary roots.

5. To find the real root of the equation $\sin(x) = x^2$ between 0 and π:

   solve(sin(x) = x^2 , x) | x > 0 and x < π enter (.876726)

   The "**and**" in the command need not be typed in letter by letter; it's one of the options in **Catalog**. Scroll through the options until the cursor is on and. Then hit **enter**.

6. Systems of equations can also be solved by modifying the standard **solve** command slightly. For example, to find the points of intersection of the circle centered at the origin with radius 5 and the line $x + y = 1$:

   solve(x^2 + y^2 = 25 and x + y + 1, x, y) enter

Exercises:

1. Use the solve option on the TI-89 to find the real roots of the following equations:

   a. $x^3 + x - 1 = 0$ [Answer: .682328]

   b. $x^3 + x^2 - 1 = 0$ [Answer: .754878]

   c. $2x^3 - 3x^2 - 2x + 1 = 0$ [Answer: 1.88923, .355416, -.744644]

   d. $\sqrt{x^2 + x - 2} + \sqrt{2x^2 - x - 3} = \sqrt{3x^2 - 5}$ [Answer: 3/2, 1, -1, -2]

2. Suppose that a ladder is leaning against a building and makes acute angle θ with the ground. Suppose that when another ladder, exactly 3 times as long, leans against the building from the same point on the ground, it makes acute angle 3θ with the ground. Find θ.

   [Answer. Use some trig to show that $\cos(3\theta) = 1/3 \cos\theta$. $\theta = 24.0948°$]

3. Find x between 0 and $\pi/2$ such that $\tan x = 1 - x^2$.

   [Answer: .583248]

4. Find the points of intersection of the ellipse $4x^2 + 5y^2 = 6$ and the hyperbola $7x^2 - 8y^2 = 9$.

   [Answer: $x = \sqrt{6231}/67$ and $y = \sqrt{402}/67$ or $x = \sqrt{6231}/67$ and $y = -\sqrt{402}/67$ or $x = -\sqrt{6231}/67$ and $y = \sqrt{402}/67$ or $x = -\sqrt{6231}/67$ and $y = -\sqrt{402}/67$].