Solving Equations with Maple

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Objective

In this project we present a general discussion of how to solve various equations using Maple. Space limits what can be said here, but further information is available in Maple's Help pages.

Narrative

As indicated in the first Maple tutorial, the two basic commands Maple provides for solving equations are `solve` and `fsolve`. Here is more information about these commands:

`solve`:

1. "`solve(f(x)=0,x)`" returns the solution(s) to the equation $f(x) = 0$ that Maple can find, symbolically. If no solutions can be found then none will be returned; however, this does not mean that solutions do not exist.

2. There are formulas for computing solutions to polynomial equations of degree 3 and smaller explicitly; Maple knows them and will use them. For polynomial equations of degree greater than 3, Maple will find and report the solutions it can find; if $f(x)$ or one of its factors cannot be factored then it will be returned with `RootOf`.

`fsolve`:

1. "`fsolve(f(x)=0,x)`" returns the first solution to the equation $f(x) = 0$ that Maple can find, as a floating point number (in decimal form). It returns all the solutions to the equation $f(x) = 0$ that Maple can find if $f(x)$ is a polynomial, as floating point numbers (in decimal form).
2. "`fsolve(f(x)=0,x,x=a..b)`" returns the first solution to the equation $f(x) = 0$ that Maple can find in the interval $[a, b]$, as a floating point number (in decimal form). This allows you to focus in on a specific solution. If you want a solution but don't know where to start looking for one then you might want to start by graphing $y = f(x)$ to locate one by eye.
3. "`fsolve(f(x)=0,x=a)`" returns the first solution to the equation $f(x) = 0$ that Maple can find near $x = a$ as a floating point number (in decimal form).
4. In each of the above cases, If no solution can be found then none will be returned; however, this does not mean that solutions do not exist.

Some other commands that are useful in conjunction with `solve` and `fsolve` are:

1. "`simplify(f(x))`" simplifies $f(x)$, making it easier to look for solutions (either manually or automatically).
2. "`numer(f(x))`" and "`denom(f(x))`" isolate the numerator and denominator, respectively, of the fractional expression $f(x)$.
3. "`solns[n]`" identifies the nth element of the list `solns` of solutions.
4. `evalf` converts from expression to floating point form.

Task

1. Type the following command lines into Maple in the order in which they are listed. The effect of each command is described in the right-hand column for your reference.

`> # Your name and today´s date`	
`> # Solving Equations with Maple`	
`> # Task 1`	
`> restart;`	Clear Maple's memory.
`> solve(x^2-x-6=0,x);`	Solve the equation $x^2 - x - 6 = 0$ for x.
`> solve(2*x+1=2*x+2,x);`	Solve the equation $2x + 1 = 2x + 2$ for x.
`> solve(sin(x)=1,x);`	Solve the equation $\sin x = 1$ for x.
`> solve(x^4-x-6=0,x);`	Solve the equation $x^4 - x - 6 = 0$ for x.
`> fsolve(x^2-x-6=0,x);`	Solve the equation $x^2 - x - 6 = 0$ for x.
`> fsolve(2*x+1=2*x+2,x);`	Solve the equation $2x + 1 = 2x + 2$ for x.
`> fsolve(sin(x)=1,x);`	Solve the equation $\sin x = 1$ for x.
`> plot(sin(x),x=-10..10);`	Graph $\sin x$ over the interval $[-10, 10]$.
`> fsolve(sin(x)=1,x,x=6..8);`	Find the solutions of $\sin x = 1$ in the interval $[6, 8]$.
`> fsolve(sin(x)=1,x=6);`	Find a solution of $\sin x = 1$ near $x = 6$.
`> x+1/x^2;`	Let's look at the expression $x + 1/x^2$.
`> simplify(%);`	Simplify this expression.
`> solve(numer(%)=0,x);`	Find where the numerator is 0.
`> solve(denom(%%)=0,x);`	Find where the denominator is 0.
`> solve(1+1/x=x^2,x);`	Solve the equation $1 + 1/x = x^2$ for x.
`> solns := evalf(%);`	Express the solutions in decimal form.
`> first := solns[1];`	Let `first` denote the first solution.

2. Write your own Maple code to find:

a) the solutions to $2x^2 - 5x - 3 = 0$.

b) the solutions to $2x^2 - 5x - 4 = 0$, to 4 significant digits.

c) the solutions to $x^5 + x^2 + x = 0$.

d) a solution to $\tan x = x + 1$.

e) the values of x for which $1 - 4/(x^4 - 3x^2) = 0$ and

f) the values of x for which $1 - 4/(x^4 - 3x^2)$ does not exist.

g) the positive solution to $\cos x = 2x$, to 4 significant digits.

At this time, make a hard-copy of your typed input and Maple's responses: this hard-copy will be your lab report.