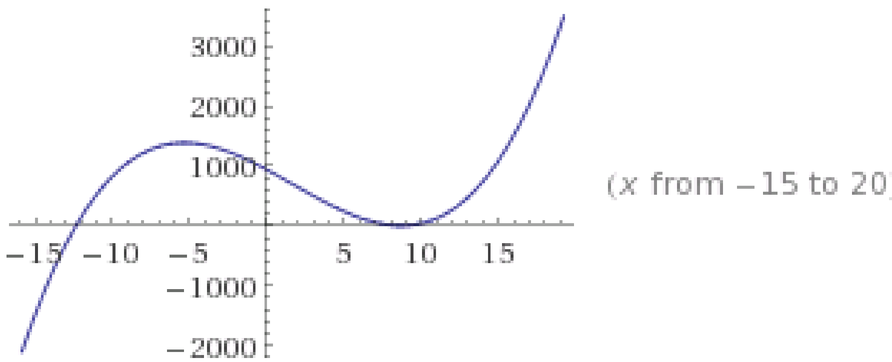
Ryan Brosnahan
Computing Assignment 3

Part 1. (24 points) Find the 3 real roots of

$$f(x) = x^3 - 5.0673710987654321x^2 - 139.172346415742593x + 935.846628210713604$$



The positive roots are very close together which makes Regula-Falsi, Secant, and Bisection methods difficult because they require a guess interval. The equation is not in proper form to do Fixed Point easily. Finding the derivative is easy enough, so Newton's it is!

```
>> NewtonsRoot(f, fp, -15, 10e-9, 50)

ans =

  -1.234567890100894e+01

>> NewtonsRoot(f, fp,8 , 10e-9, 50)

ans =

   8.706454465547902e+00

>> NewtonsRoot(f, fp,10 , 10e-9, 50)

ans =

   8.706595534278467e+00
```

Part 2. (26 points)

This problem is adapted from Numerical Methods with MATLAB, Recktenwald, Prentice-Hall, 2000.

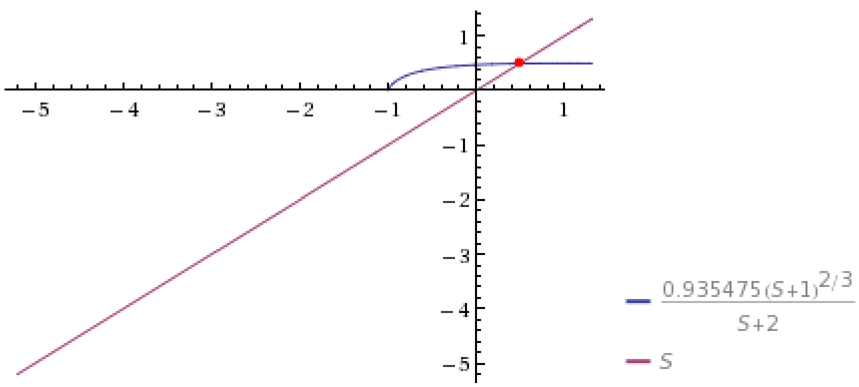
Heat sinks are often attached to electronic devices to increase the cooling efficiency and thereby lower the temperature of the device. One common configuration of heat sinks is the array of pin fins shown below. Given the dimensions of the array, the optimal spacing S of the fins is given by

$$\frac{S}{D} \cdot \frac{2 + S/D}{(1 + S/D)^{2/3}} = \frac{2.75}{Ra^{1/4}} \left(\frac{H}{D}\right)^{1/3},$$

where D is the diameter of the fins and Ra is the Rayleigh number, a dimensionless indicator of the strength of the natural convection responsible for cooling the fins. See "Geometric optimization of cooling techniques", S. J. Kim and J. S. Woo, editors, *Air Cooling Technology for Electronic Equipment*, CRC Press, 1996, pp 1-45.

Use the method of your choice to find the optimal value of S given $D = 1$ mm, $H = 7$ mm, and $Ra = 1000$. Report your answer with at least 8 significant digits.

It is very easy to put the equation in the form s = g(s) so fixed point is a nice choice.



g =

```
@(S)((2.75/(R^(1/4)))*((H/D)^(1/3)))*(((1+S/D)^(2/3))/(2+S/D))*D
```

```
>> fixedPointRoot(g, 5, 1e-9, 50)
```

ans =

4.901086499061800e-01