

Computing Project 3 – Root Finding (50 points)

Due date: Thursday 4 October

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

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

See my web page

<http://www.math.uakron.edu/~kreider>

for a downloadable MATLAB function definition (to avoid typographical errors). Use any root finding method you wish. Report your answers to at least 10 digits after the decimal. Describe briefly why you chose the method you used.

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.