Numerical Methods – Spring ‘18

PA #5

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Programming Assignment #5

Problem 1:

Relevant equation & table of values:

$$\text{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$$

x	0	0.5	1.0	1.5	2.0
erf(x)	0	0.5205	0.8427	0.9661	0.9953

Write MALAB function that inputs a number x and returns a row vector containing four numbers, in order: The estimate of erf(x) using a quadratic Lagrange interpolating polynomial, the true relative error for the Lagrange polynomial estimate, the cubic spline with not-a-knot end condition estimate, and the true relative error for the spine estimate.

My Solution:

See leurodriguez1.m

Problem 2:

The drag coefficient for spheres varies as a function of the *Reynolds* number, R. The Reynolds number is a ratio of the inertial forces to the viscous forces:

$$R = \frac{\rho v D}{\mu}$$

where ρ is the density of the fluid through which the sphere passes (air, oil, etc), v is the velocity, D is the diameter, and μ is the dynamic viscosity. Using standard units, R is dimensionless (no units). While an equation can sometimes be found, the relationship between R and the drag coefficient, c_d, is frequently given in tabular form:

$R \cdot 10^{-4}$	2	5.8	16.8	27.2	29.9	33.9
c_d	0.52	0.52	0.52	0.5	0.49	0.44

$R \cdot 10^{-4}$	36.3	40	46	60	100	200	400
c_d	0.18	0.074	0.067	0.08	0.12	0.16	0.19

The model for the drag force on an object is given by

$$F = \frac{1}{2}\rho v^2 A c_d$$

where A is the frontal area of the object (for us, this is a hemisphere). Write a script that graphs drag force as a function of velocity for $4 \leq v \leq 40$. Use the following values: $\rho = 1.3, \mu = 1.78 \cdot 10^{-5}$, and $D = 22cm$.

My Solution:

See leurodriguez2.m