Exercises from Applied Numerical Methods with MATLAB

7.35

$D = 0.01\sigma V^2 + \frac{0.95}{\sigma}\left(\frac{W}{V}\right)^2$

- a) With $\sigma = 0.6$ and $W = 16000$, determine the minimum drag (D) and the velocity (V) at which it occurs.

```
>> D = @(V) 0.01 .* (0.6) .* V.^2 + 0.95./(0.6) .* (16000./V).^2;
>> [z,fval] = fminbnd(D, 200, 600)

z =

     509.8181

fval =

   3.1190e+03
```

- b) In addition, develop a sensitivity analysis to determine how this optimum varies in response to a range of $W = 12.000 \quad \text{to} \quad 20.000$ with $\sigma = 0.6$.

We have $D = 0.01\sigma V^2 + \frac{0.95}{\sigma}\left(\frac{W}{V}\right)^2$ with $\sigma = 0.6$ and $W \in [12000, 20000]$.

```
>> Vs = zeros(1,8000);
>> Ds = zeros(1,8000);
>> for W = 12000:20000
D = @(V) 0.01 .* (0.6) .* V.^2 + 0.95./(0.6) .* (W./V).^2;
[z,fval] = fminbnd(D, 200, 600);
Vs(W-12000+1) = z;
Ds(W-12000+1) = fval;
end
>> histogram(Vs,100)
% could make a contour plot of Vs and Ds
```

We could do better: see *section 3.5.4* from the book.