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MATH 4441

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Homework 7

1.a

```
ti = [ 1.0; 1.5; 2.0; 2.5; 3.0 ]  
yi = [ 1.1; 1.2; 1.3; 1.3; 1.4 ]
```

```
A = [ 1, ti(1);  
      1, ti(2);  
      1, ti(3);  
      1, ti(4);  
      1, ti(5) ]
```

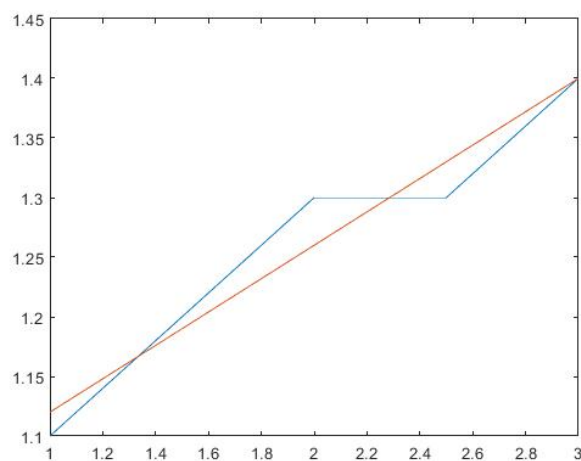
.

1.b

$$y = 0.14(ti) + 0.98$$

1.c

The Blue plot is from the provided data, the orange line is the iftted line.



1.d

For whatever reason, MATLAB kept returning an error when I tried to use the norm command. I

tried building a vector of difference values that it could take the norm of, but that also threw an error. Ultimately, I had to calculate by hand the l_2 -norm, which is 0.003.

Shown is the code I tried to use to calculate the norm:

```
% compute norm of the residual
n = size(ti,1)
%norm = norm(yi - psiTi(ti(i))),2)
for i = 1:n
    yi(i)
    psiTi(i)
    normV(i) = abs(yi(i) - psiTi(i))
end
norm(normV,2)
```

.

2.a

$$\begin{aligned}
 H &= I - \frac{2uu^T}{u^T u} \\
 \Rightarrow H * u &= \left(I - \frac{2uu^T}{u^T u}\right) * u \\
 \Rightarrow Hu &= Iu - \frac{2uu^T u}{u^T u} \\
 \Rightarrow Hu &= Iu - \frac{2u}{1} \\
 \Rightarrow Hu &= u - 2u \\
 \Rightarrow Hu &= -u
 \end{aligned}$$

2.b

Given that $v^T u = 0$

$$\begin{aligned}
 H &= I - \frac{2uu^T}{u^T u} \\
 \Rightarrow H * v &= \left(I - \frac{2uu^T}{u^T u}\right)v \\
 \Rightarrow H * v &= Iv - \frac{2uu^T v}{u^T u} \\
 v^T u = 0 \text{ is given. So, through symmetry, } v^T u &= u^T v = 0, \Rightarrow H * v = Iv - \frac{2u0}{u^T u} \\
 \Rightarrow Hv &= Iv - 0 \\
 \Rightarrow Hv &= v
 \end{aligned}$$

3.a

This algorithm should take about (r^3) flops, as that is the number of operations used in factorization by Householder, but we only need to operate r times

3.b

See code

3.c

See code