Geophysics 457

Assignment 2

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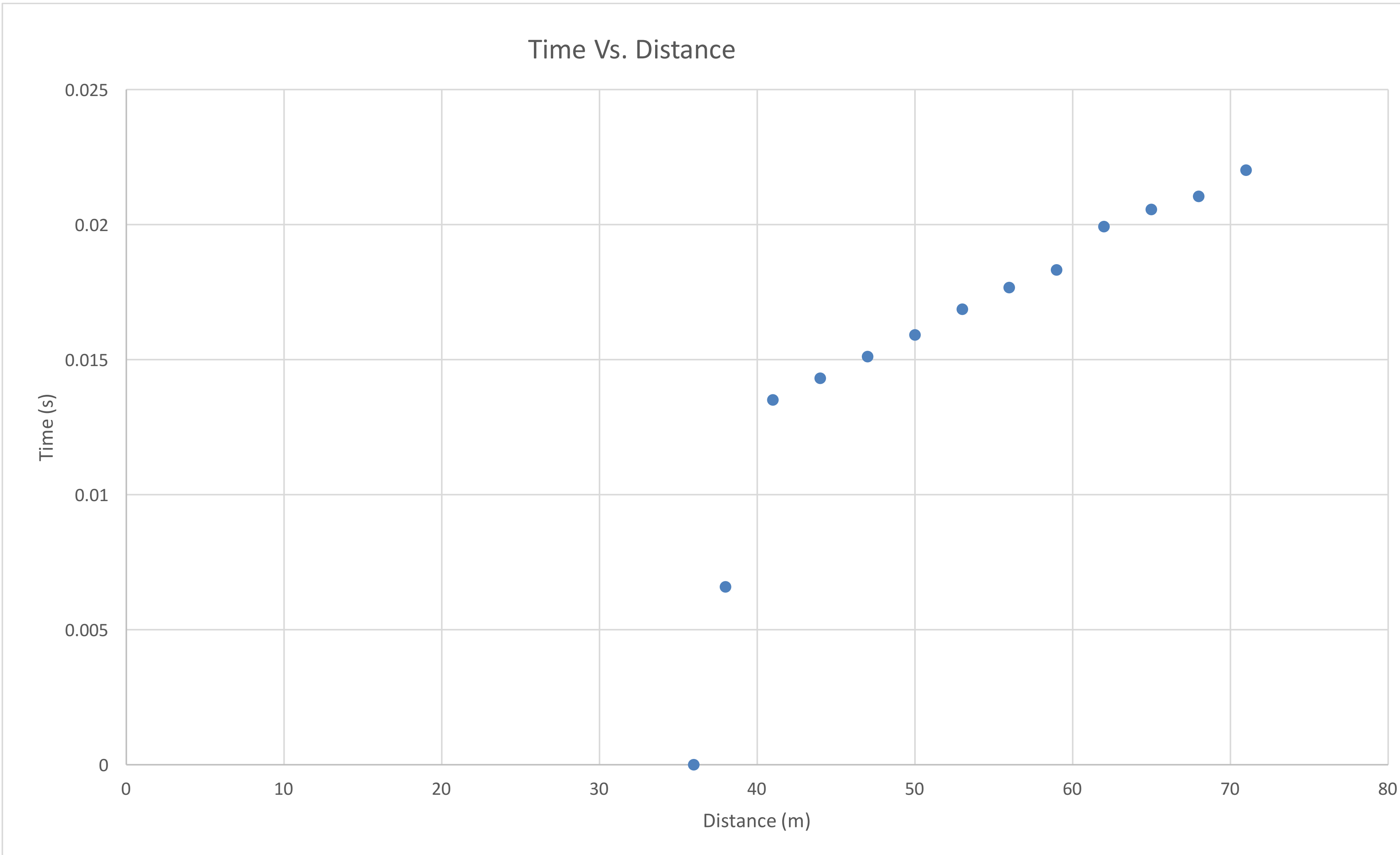
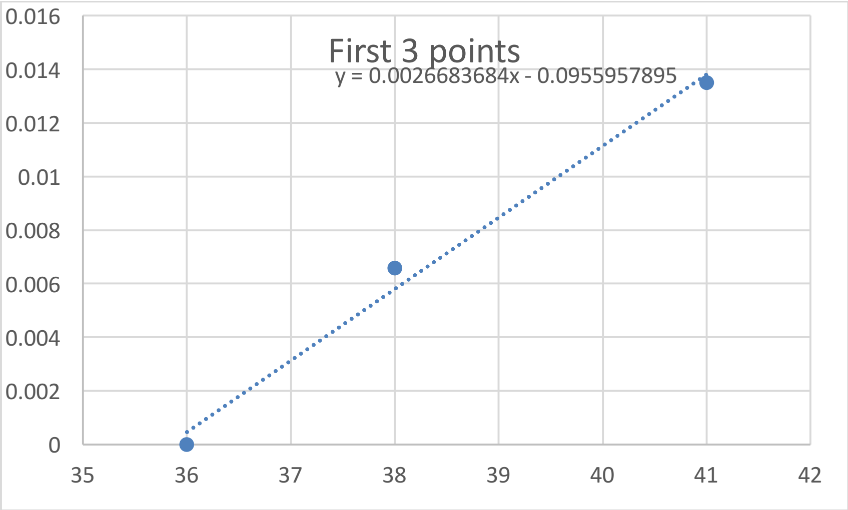
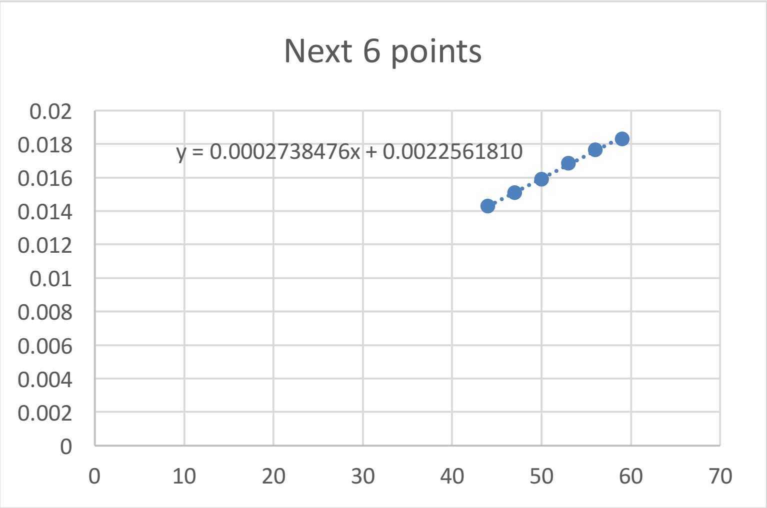
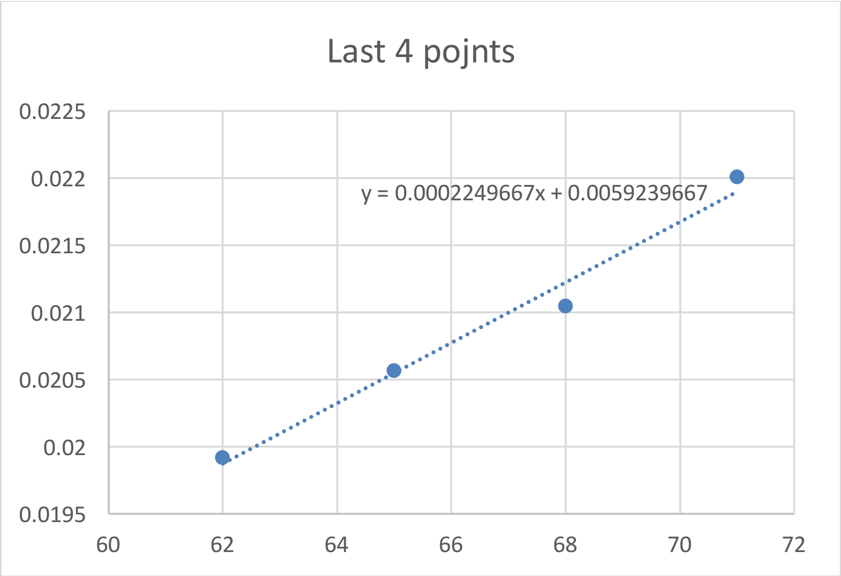
1.


Time Vs. Distance
0.025
0.02
0.015
0.01
0.005
0
Time (s)
0
10
20
30
40
50
60
70
80
Distance (m)


First 3 points
y = 0.0026683684x - 0.0955957895
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
35
36
37
38
39
40
41
42


Next 6 points
y = 0.0002738476x + 0.0022561810
0.02
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
0
10
20
30
40
50
60
70


Last 4 pojnts
y = 0.0002249667x + 0.0059239667
0.0225
0.022
0.0215
0.021
0.0205
0.02
0.0195
60
62
64
66
68
70
72

2. From looking at the first plot, we can see three distinct slopes. These three distinct slopes represent the 3 different mediums since velocity between medium changes, and since it is 3 different mediums there is 3 slopes, hence there is 3 layers.

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3. The velocity of a layer is simply the reciprocal of the slope. Thus for the first layer, it is 1/0.0026683684 = 374.8m/s = v0.

For layer 2 it is 1/0.0002738476 = 3651.7 m/s = v1.

For layer 3 it is 1/0.0002249667 = 4445.1 m/s = v2.

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4. The thickness for layer 1 would be represented by the formula;

$$h_0 = \frac{\tau_1}{2\left(\frac{1}{v_0^2} - \frac{1}{v_1^2}\right)^{\frac{1}{2}}}$$

Where t1 is the y intercept of the line in the second graph on page 2. Thus;

$$\frac{0.0022561810}{2\sqrt{\frac{1}{374.8^2} - \frac{1}{3651.7^2}}}$$

Which gives us 0.425053 m for layer 1 thickness.

Layer 2 thickness would be represented by;

$$h_1 = \frac{\tau_2 - 2h_0(1/v_0^2 - 1/v_2^2)^{1/2}}{2(1/v_1^2 - 1/v_2^2)^{1/2}}$$

And so plugging in values would give us;

$$\frac{0.0059239667 - (2 \times 0.425053)\sqrt{\frac{1}{374.8^2} - \frac{1}{4445.1^2}}}{2\sqrt{\frac{1}{3651.7^2} - \frac{1}{4445.1^2}}}$$

Which results in 11.7324 m

Layer 3 doesn't really have a thickness/infinite because of it being halfspace region.

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5. To find density for layers, we use Gardener's Relation:

$$(V_p \text{ in m/s}) \quad \rho = 0.31 V_p^{1/4}$$

So for layer 1 we have: p = 0.31(374.80m/s)^(1/4) = 1.36 g/cm^3
For layer 2 we have: p = 0.31(3651.7m/s)^(1/4) = 2.41g/cm^3
For layer 3 we have: p = 0.31(4445.1m/s)^(1/4) = 2.53g/cm^3

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5. We can use the following equation to find v, poisons ratio, where Vs is Vp/1.7

$$\nu = \frac{V_p{}^2 - 2V_s{}^2}{2(V_p{}^2 - V_s{}^2)}$$

Thus for layer 1:

$$\frac{374.8^2 - 2\left(\frac{374.8}{1.7}\right)^2}{2\left(374.8^2 - \left(\frac{374.8}{1.7}\right)^2\right)}$$

Which results in 0.2354 = v. Other layers can be found with same equation

6.

Table Compiling All Data

Layer #	Velocity (m/s)	Thickness (m)	Density (g/cm^3)	Poisson Ratio
1	374.8	0.455053	1.364	0.2354
2	3651.7	11.7324	2.41	0.2354
3	4445.1	-	2.53	0.2354