

Hurricane

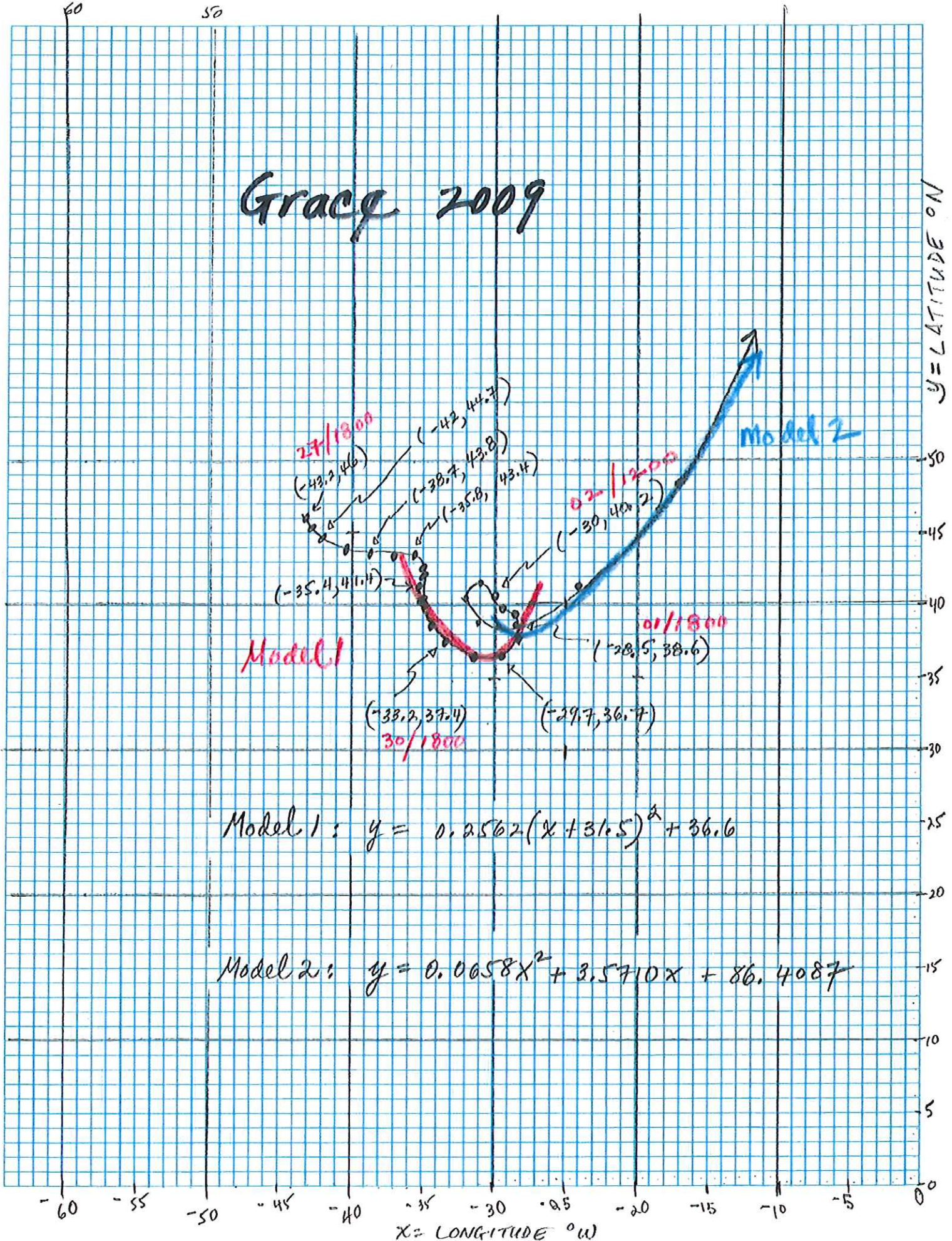
Grace

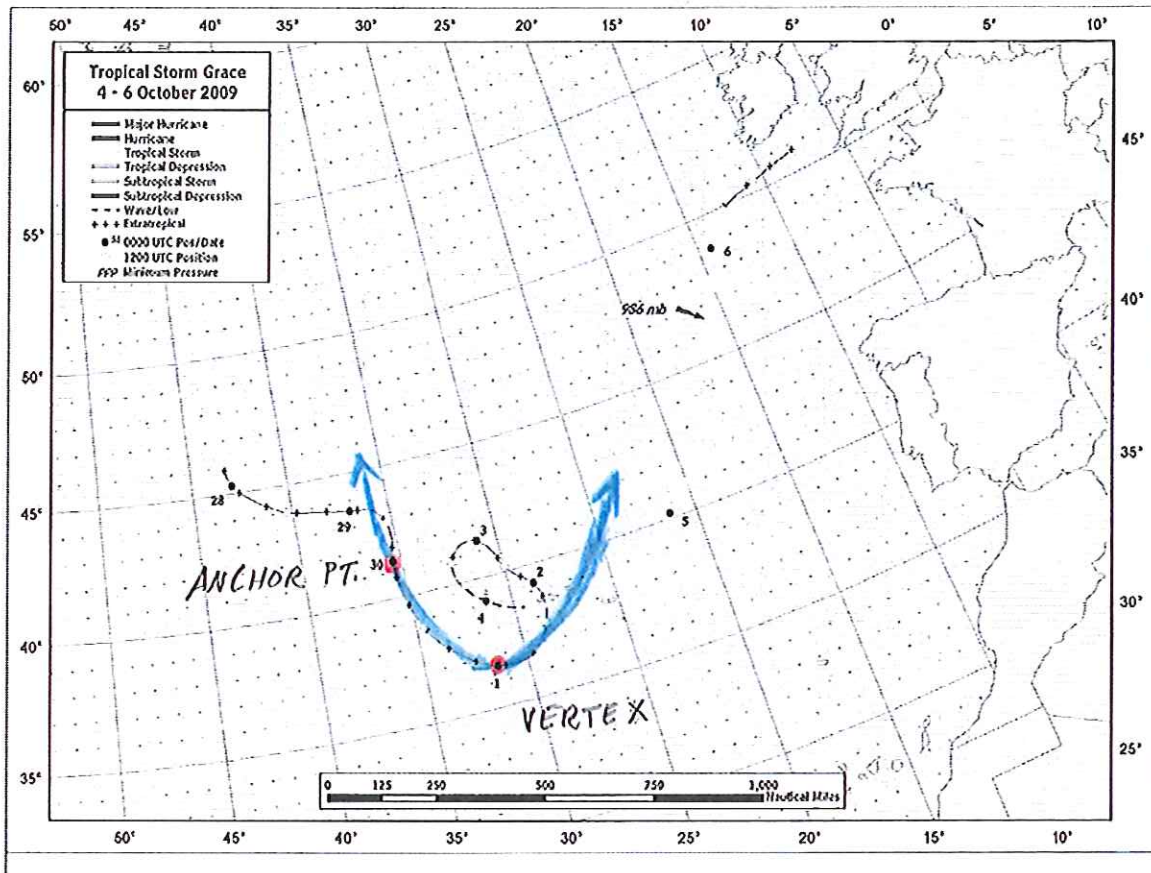
2009

Mathematical

Models

Grace 2009





MODEL #1: Vertex Form

$$\text{VERTEX} = (h, k) = (-31.5, 36.6)$$

$$\text{ANCHOR POINT} = (-35.3, 40.3)$$

$$y = a(x - h)^2 + k$$

$$(40.3) = a(-35.3 - -31.5)^2 + 36.6$$

$$40.3 = 14.44a + 36.6$$

$$a = 0.2562$$

(#1)

$$y = 0.2562(x + 31.5)^2 + 36.6$$

VERTEX FORM

Model #1 Calculations

$$y = a(x-h)^2 + k$$

$$h = -31.5$$

$$k = 36.6$$

$$x = -35.3$$

$$y = 40.3$$

$$(40.3) = a(-35.3 - (-31.5))^2 + 36.6$$

$$40.3 = a(-3.8)^2 + 36.6$$

$$40.3 = 14.44a + 36.6$$

$$\underline{-36.6}$$

$$\underline{-36.6}$$

$$\begin{array}{r} 3.7 \\ \hline 14.44 \end{array} = \begin{array}{r} 14.44a \\ \hline 14.44 \end{array}$$

$$a = \frac{3.7}{14.44} = 0.2562$$

$$\therefore y = 0.2562(x + 31.5)^2 + 36.6$$

Graphic Verification of Model #1: Vertex Form

$$y = 0.0658x^2 + 3.5710x + 86.4101$$

My data points are being plotted by Plot1, and my equation is stored in Y1.

```

Plot1 Plot2 Plot3
Off Off
Type: [ ] [ ] [ ]
      [ ] [ ] [ ]
Xlist:L1
Ylist:L2
Mark: [ ] +
    
```

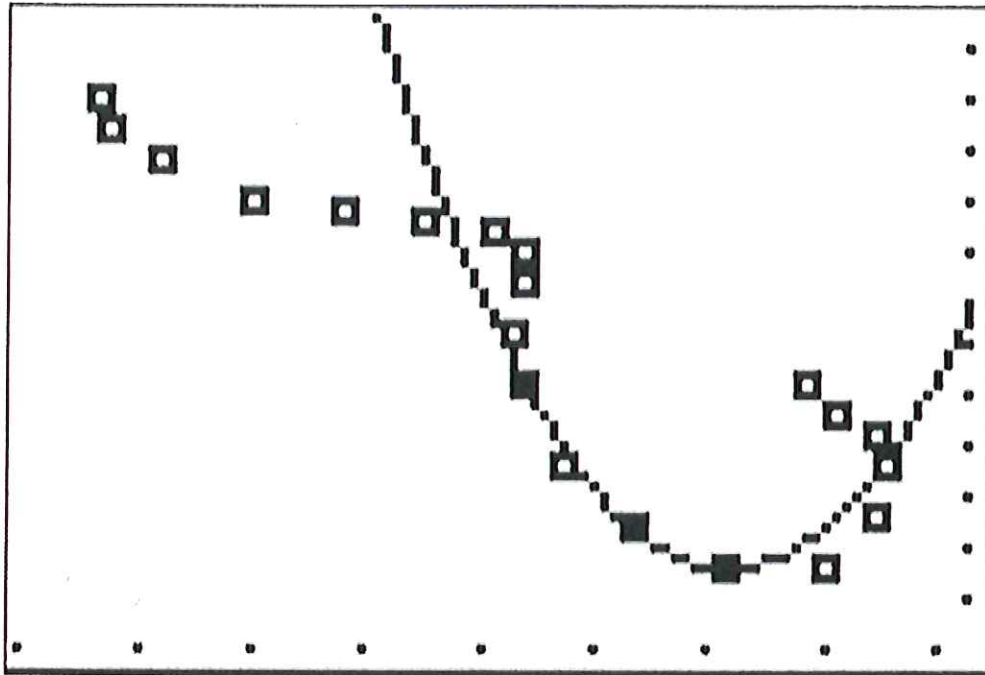
L1	L2	
-43.2	46	
-42.9	45.3	
-42	44.7	
-40.3	44	
-38.7	43.8	
-37.1	43.6	
-35.8	43.4	

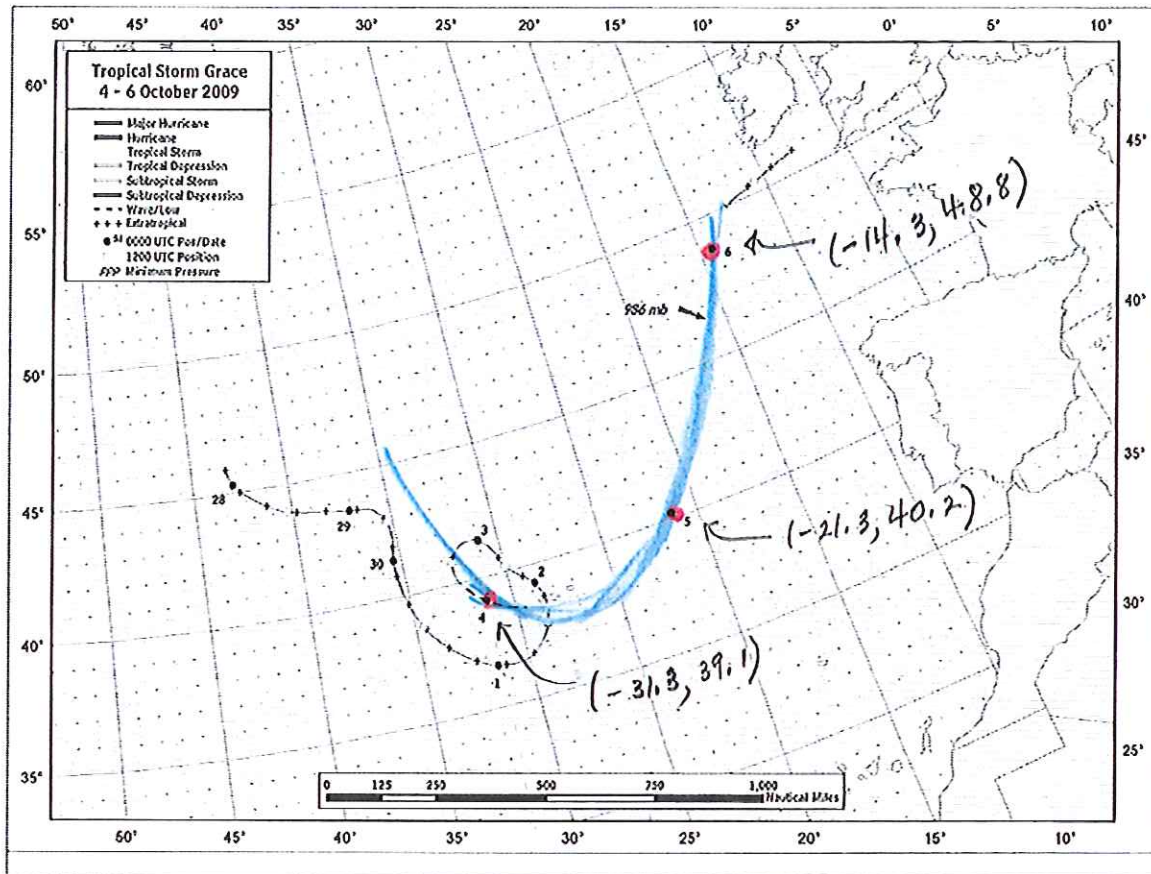
Name=

```

Plot1 Plot2 Plot3
Y1: .2562(X+31.5)
     ^2+36.6
Y2:=
Y3:=
Y4:=
Y5:=
Y6:=
    
```

Result:





MODEL #2: General Form : $y = ax^2 + bx + c$

Point #1: (Day 4) = $(-31.3, 39.1)$

Point #2: (Day 5) = $(-21.3, 40.2)$

Point #3: (Day 6) = $(-14.3, 48.8)$

$$\begin{array}{l} \text{Equation \#1} \quad \underline{979.69a - 31.3b + c = 39.1} \\ \text{Equation \#2} \quad \underline{453.69a - 21.3b + c = 40.2} \\ \text{Equation \#3} \quad \underline{204.49a - 14.3b + c = 48.8} \end{array}$$

yields:

(#2) $y = 0.0658x^2 + 3.5710x + 86.4087$

GENERAL FORM

Model #2 Calculations

Equation #1:

$$a(-31.3)^2 + b(-31.3) + c = 39.1$$

$$\rightarrow 979.69a - 31.3b + c = 39.1$$

Equation #2:

$$a(-21.3)^2 + b(-21.3) + c = 40.2$$

$$\rightarrow 453.69a - 21.3b + c = 40.2$$

Equation #3:

$$a(-14.3)^2 + b(-14.3) + c = 48.8$$

$$\rightarrow 204.49a - 14.3b + c = 48.8$$

SETUP 3 EQUATIONS FROM:
 (-31.3, 39.1)
 (-21.3, 40.2)
 (-14.3, 48.8)

$$(Eq \#1) * 1 \rightarrow 979.69a - 31.3b + c = 39.1$$

$$(Eq \#2) * -1 \rightarrow -453.69a + 21.3b - c = -40.2$$

$$\text{Equation 4} \rightarrow 526a - 10.0b = -1.1 \quad (4)$$

Eliminate c

$$(Eq \#1) * 1 \rightarrow 979.69a - 31.3b + c = 39.1$$

$$(Eq \#3) * -1 \rightarrow -204.49a + 14.3b - c = -48.8$$

$$\text{Equation 5} \rightarrow 775.2a - 17.0b = -9.7 \quad (5)$$

$$(Eq 4) * -17 \Rightarrow -8942a + 170b = 18.7$$

$$(Eq 5) * +10 \Rightarrow +7752a - 170b = -97$$

$$\hline -1190a = -78.3$$

(cont.)

$$a = 0.0658$$

Model 2 Calculations (cont.)

$$a = 0.0658 \xrightarrow{\text{STO}} A$$

Using Equation 4: $526a - 10.0b = -1.1$

$$526(0.0658) - 10.0b = -1.1$$

$$34.6099 - 10b = -1.1$$

$$-10b = -35.7099$$

$$b = 3.57099$$

$$b \approx 3.5710$$

$\xrightarrow{\text{STO}}$ Alpha B

Using equation #1:

$$979.69a - 31.3b + c = 39.1$$

$$979.69(0.0658) - 31.3(3.5710) + c = 39.1$$

$$64.4620 - 313.0 + c = 39.1$$

$$c = 86.4087$$

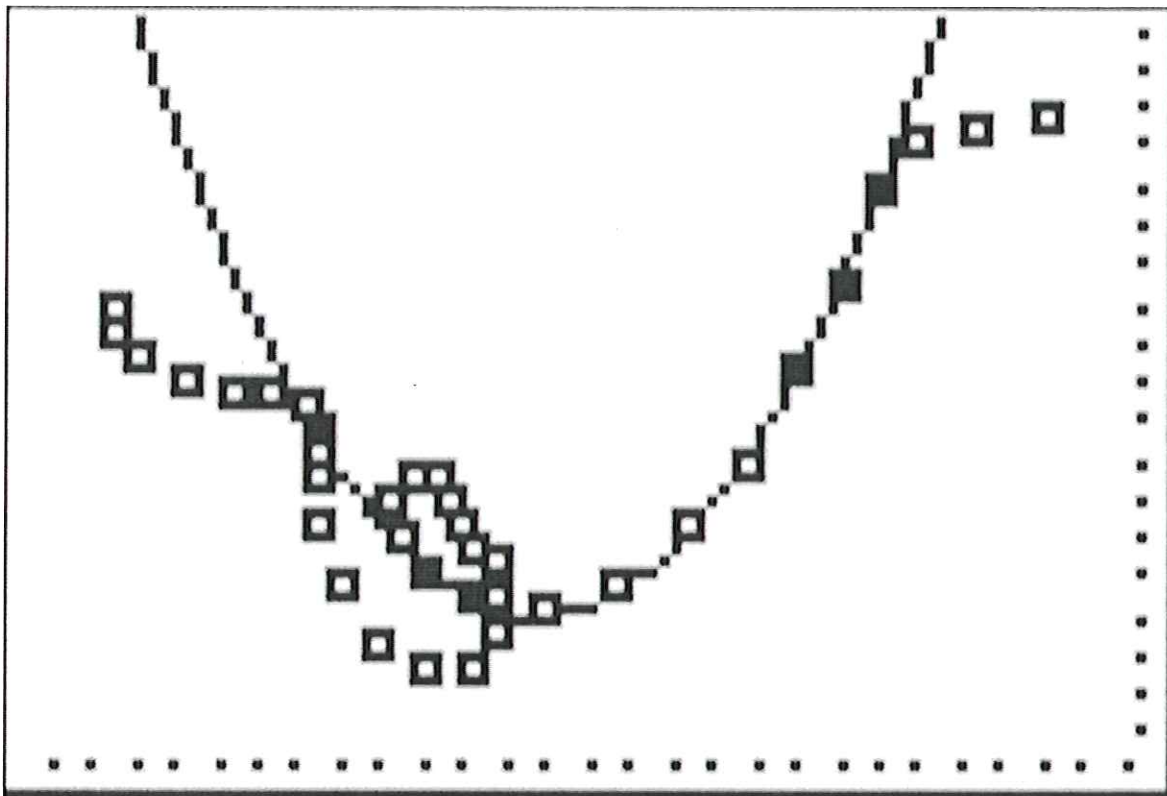
Model 2: General Form

$$y = 0.0658x^2 + 3.5710x + 86.4087$$

Graphic Verification of Model #2: General Form

$$y = 0.0658x^2 + 3.5710x + 86.4101$$

<p>Plot2 Plot3 <input type="checkbox"/> Off Type: <input type="checkbox"/> Xlist: L3 Ylist: L1 Mark: + .</p>	<p>Plot2 Plot3 Y1: $0.0658X^2 + 3.5710X + 86.4101$ Y2= Y3= Y4= Y5= Y6=</p>	<p>WINDOW Xmin=-46.75 Xmax=-4.15 Xscl=1.5707963... Ymin=34.186 Ymax=53.214 Yscl=1 Xres=1</p>
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$x = \text{Longitude } ^\circ W$

$y = \text{Latitude } ^\circ N$

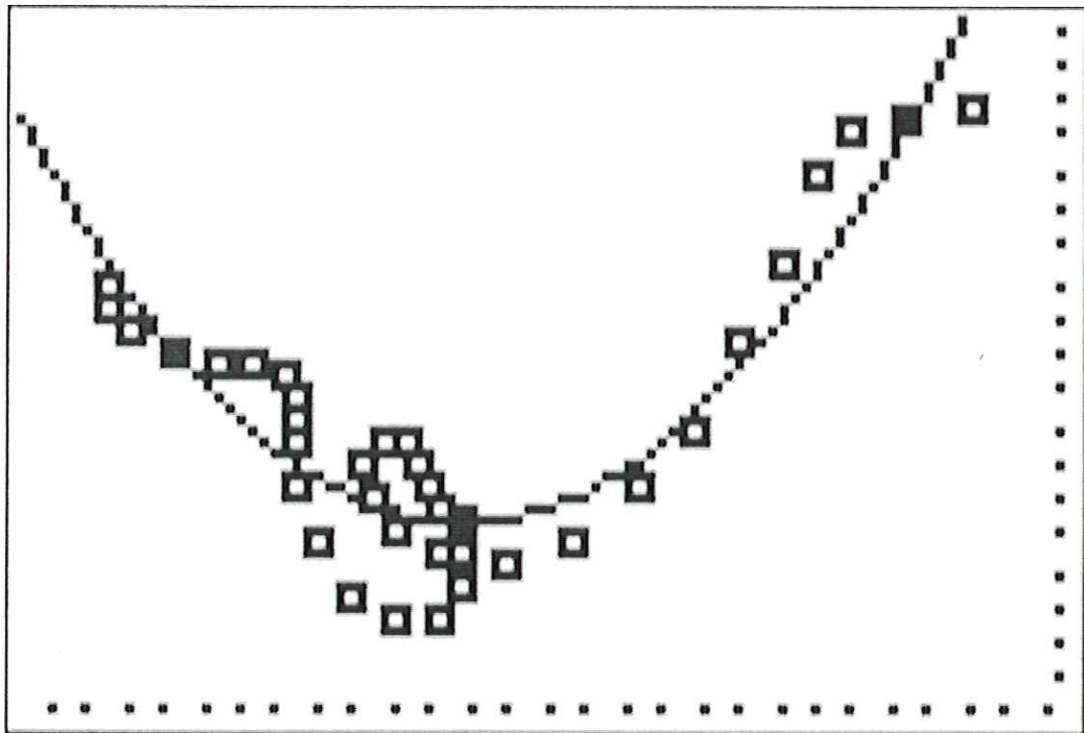
Results of Quadratic Regression

$$y = 0.0335x^2 + 1.9162x + 66.7243$$

```
QuadReg
y=ax^2+bx+c
a=.0335198495
b=1.916150394
c=66.72426457
R^2=.8330578589
```

```
WINDOW
Xmin=-46.75
Xmax=-4.15
Xscl=1.5707963...
Ymin=34.186
Ymax=53.214
Yscl=1
Xres=1
```

```
Plot2 Plot3
Y1=
Y2=.0335198495
191X^2+1.9161503
939968X+66.72426
4572391
Y3=
Y4=
```



$x = \text{Long}^\circ W$

$y = \text{Latitude}^\circ N$