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Hurricane-Force Math

SOLUTIONS

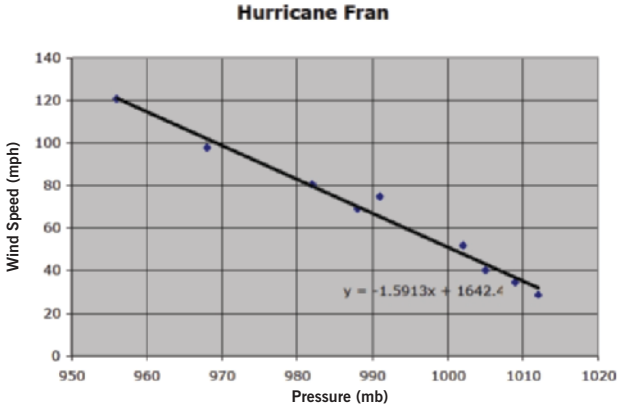
1. Hurricane Fran

Date/Time (UTC)	Pressure (mb)	Wind Speed (kt)	Wind Speed (mph)
23/1200	1012	25	28.75
24/1800	1009	30	34.5
27/1200	1005	35	40.25
28/0000	1002	45	51.75
30/0600	991	65	74.75
31/0000	988	60	69
01/1200	982	70	80.5
03/1800	968	85	97.75
04/1200	956	105	120.75

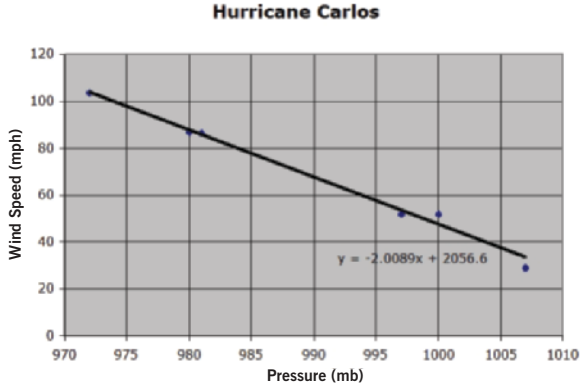
Hurricane Carlos

Date/Time (UTC)	Pressure (mb)	Wind Speed (kt)	Wind Speed (in mph)
10/0600	1007	25	28.75
11/1800	1000	45	51.75
12/0000	980	75	86.25
13/1200	997	45	51.75
14/1200	981	75	86.25
15/0600	972	90	103.5
16/0000	1000	45	51.75

2. The Excel® program was used to generate these solutions. A TI-83, TI-84, or TI–Nspire™ graphing calculator could also be used. Depending on learning goals, students may generate the scatter plots, lines, and linear equations by hand. One drawback to Excel is that it graphs a line segment rather than a line. This difference can be used to generate discussion among students about the difference between lines and line segments and the need for lines when using mathematical models for predictions.



As the pressure of Fran increased, the wind speed decreased at a rate of about 1.59 mph per mb of pressure. In other words, as the pressure increased, the wind speed dropped by about 1.59 times the pressure.



As the pressure of Carlos increased, the wind speed decreased at a rate of about 2 mph per mb of pressure. In other words, as the pressure increased, the wind speed dropped by about twice the pressure.

3. Using the Hurricane Carlos line of best fit,

$$y = -2x + 2057,$$

to calculate each wind speed at the given pressures results in the following table:

Pressure (in mb)	Wind Speed (in mph)
900	257
1020	17
1070	–83

For pressures of 900 mb and 1020 mb, expected wind speeds would be 257 mph and 17 mph, respectively, which are reasonable. However, for a pressure of 1070 mb, the model predicts a negative wind speed, which is impossible, so this is not a reasonable result.

EXTENSION: The Saffir-Simpson Hurricane Wind Scale uses the top wind speed to determine the category of a hurricane (see the table below created from information found on the National Hurricane Center's website: http://www.nhc.noaa.gov/sshws.shtml). Therefore, Fran is classified as a Category 3 hurricane because the top wind speed was 120.75 mph; Carlos is classified as a Category 2 hurricane because its top wind speed was 103.5 mph.

Category	Wind Speed (in mph)	Damage
1	74–95	Very dangerous winds will produce some damage.
2	95–110	Extremely dangerous winds will cause extensive damage.
3	111–130	Devastating damage will occur.
4	131–155	Catastrophic damage will occur.
5	> 155	Catastrophic damage will occur.