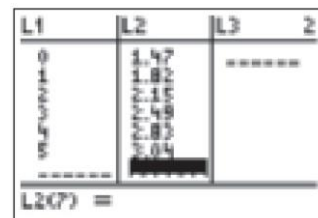# 4-6 Notes: Regression and Median-Fit Lines

Equations of Best-Fit Lines Many graphing calculators utilize an algorithm called **linear regression** to find a precise line of fit called the **best-fit line**. The calculator computes the data, writes an equation, and gives you the **correlation coefficient**, a measure of how closely the equation models the data.

Example: GAS PRICES The table shows the price of a gallon of regular gasoline at a station in Los Angeles, California on January 1 of various years.

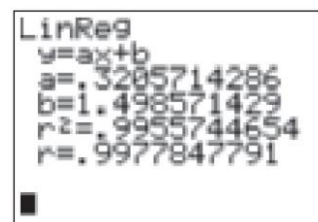| Year	2005	2006	2007	2008	2009	2010
Average Price	$1.47	$1.82	$2.15	$2.49	$2.83	$3.04

Source: U.S. Department of Energy

a. Use a graphing calculator to write an equation for the best-fit line for that data. Enter the data by pressing [STAT] and selecting the Edit option. Let the year 2005 be represented by 0. Enter the years since 2005 into List 1 (L1). Enter the average price into List 2 (L2).

Then, perform the linear regression by pressing [STAT] and selecting the CALC option. Scroll down to LinReg (ax+b) and press [ENTER]. The best-fit equation for the regression is shown to be $y = 0.321x + 1.499$.

b. Name the correlation coefficient. The correlation coefficient is the value shown for r on the calculator screen. The correlation coefficient is about 0.998.

Exercises
Write an equation of the regression line for the data in each table below. Then find the correlation coefficient.

1. OLYMPICS Below is a table showing the number of gold medals won by the United States at the Winter Olympics during various years.

Year	1992	1994	1998	2002	2006	2010
Gold Medals	5	6	6	10	9	9

Source: International Olympic Committee

Let x represent years since 1992; y = 0.25x + 5.41; r = 0.843

2. INTEREST RATES Below is a table showing the U.S. Federal Reserve's prime interest rate on January 1 of various years.

Year	2006	2007	2008	2009	2010
Prime Rate (percent)	7.25	8.25	7.25	3.25	3.25

Source: Federal Reserve Board

Let x represent years since 2006; y = -1.3x + 8.45; r = -0.853

Regression and Median-Fit Lines

Equations of Median-Fit Lines A graphing calculator can also find another type of best-fit line called the **median-fit line**, which is found using the medians of the coordinates of the data points.

Example: ELECTIONS The table shows the total number of people in millions who voted in the U.S. Presidential election in the given years.

Year	1980	1984	1988	1992	1996	2004	2008
Voters	86.5	92.7	91.6	104.4	96.3	122.3	131.3

Source: George Mason University

a. Find an equation for the median-fit line. Enter the data by pressing $\boxed{\text{STAT}}$ and selecting the Edit option. Let the year 1980 be represented by 0. Enter the years since 1980 into List 1 (L1). Enter the number of voters into List 2 (L2).

Then, press $\boxed{\text{STAT}}$ and select the CALC option. Scroll down to Med-Med option and press $\boxed{\text{ENTER}}$. The value of a is the slope, and the value of b is the y-intercept.

The equation for the median-fit line is $y = 1.55x + 83.57$.

b. Estimate the number of people who voted in the 2000 U.S. Presidential election. Graph the best-fit line. Then use the $\boxed{\text{TRACE}}$ feature and the arrow keys until you find a point where $x = 20$.

When $x = 20$, $y \approx 115$. Therefore, about 115 million people voted in the 2000 U.S. Presidential election.

Exercises
Write an equation of the regression line for the data in each table below. Then find the correlation coefficient.

1. **POPULATION GROWTH** Below is a table showing the estimated population of Arizona in millions on July 1st of various years.

Year	2001	2002	2003	2004	2005	2006
Population	5.30	5.44	5.58	5.74	5.94	6.17

Source: U.S. Census Bureau

a. Find an equation for the median-fit line. **y = 0.171x + 5.267**

b. Predict the population of Arizona in 2009. **About 6.63 Million**

2. **ENROLLMENT** Below is a table showing the number of students enrolled at Happy Days Preschool in the given years.

Year	2002	2004	2006	2008	2010
Students	130	168	184	201	234

a. Find an equation for the median-fit line. **y = 11.42x + 137.83**

b. Estimate how many students were enrolled in 2007. **About 195 students**