Teacher Notes

Activity 2

The Women's 5000 Meter World Record Progression: The Median-Median Line

Objective

- Students will develop an understanding of the median-median line and use it to model real world data

Applicable TI-InterActive! Functions

- Solve — solve(*equation, variable*)
- Define — *function_name* := *function*
- List Editor
- Graph
- Browser
- Median — median (list_name)

Problem

Students will collect the women's 5000 meter progression of world record data from the Internet and find median-median line and the linear regression for the data and investigate the appropriateness of each model.

Pre-Activity

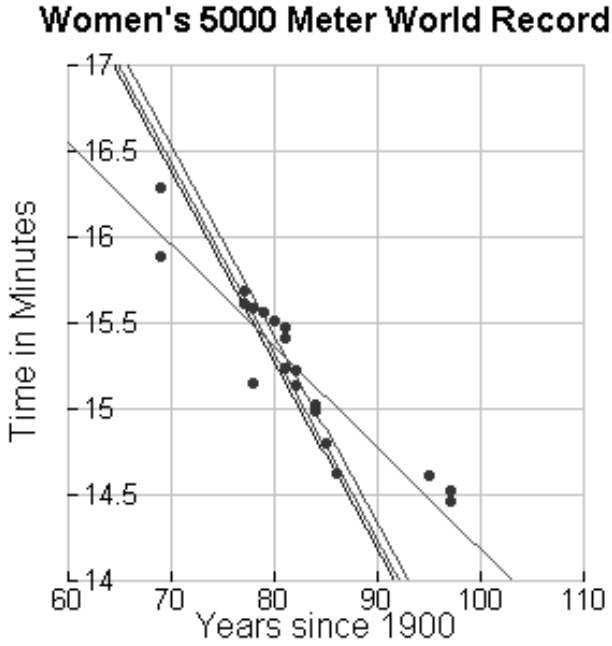
Students should find the slope, the *y*-intercept, and the equation of the line that passes through two given points, ($x1$, $y1$) and ($x2$, $y2$).

1. Students should open a new TI InterActive! document. In math boxes, have students define x1: = 3, y1: = 2, x2: = -1, and y2: = 4.
2. Students should define m: = $\frac{y2 - y1}{x2 - x1}$.
3. Students should solve for the *y*-intercept by entering **solve (y1 = m *x1+b,b).**
4. Students should then define f(x): = mx + b.
5. Students should store $\{x1, x2\} \rightarrow$ L1 and $\{y1, y2\} \rightarrow$ L2.
6. Students should graph $f(x)$ and the scatterplot **L1**, **L2** to verify that their line passes through the two given points.

Exploration

Steps 1 through 11 are details for the students to set up the problem and extract the data from the Internet. The following solutions are based on data from Runners World posted on September 1, 1999. When students have completed step 12, their graph should appear as shown.

1. through 12.



Analysis

1. On May 30, 1978 Loa Olafsson of Denmark broke the women's 5000 Meter World Record by running it in 15 minutes 8.8 seconds. This race was a mixed race with both women and men.

2. ($x1$, $y1$) = (77, 15.6167) (for years 1969 - 1979)

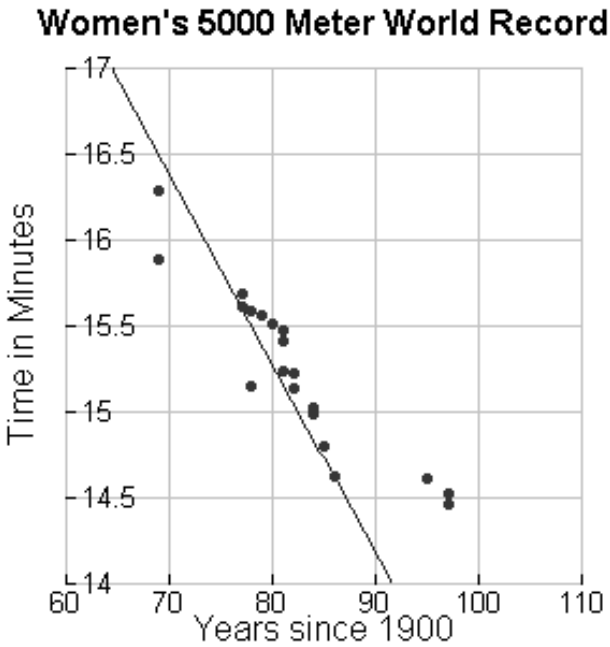
   ($x2$, $y2$) = (81, 15.3259) (for years 1980 - 1982)

   ($x3$, $y3$) = (86, 14.6222) (for years 1984 - 1997)

3. m: = -0.1105

4. b1: = 24.1252

5. f1(x): = -0.1105x + 24.1252

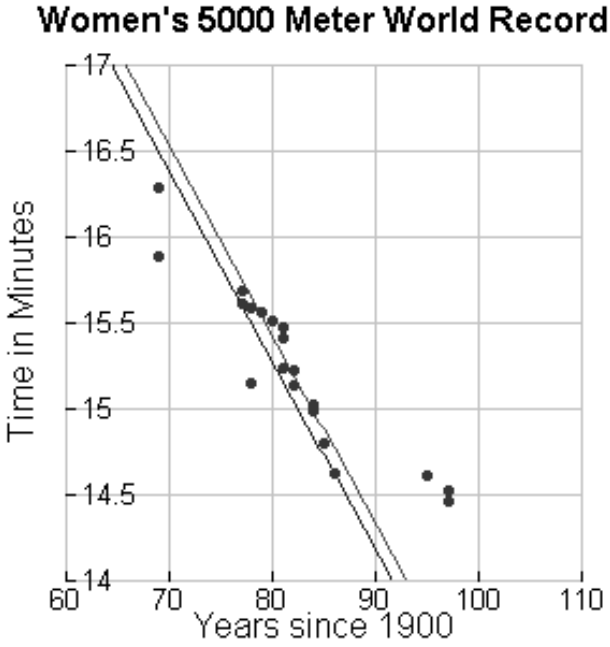


6. f1(x)'s slope looks good for the data from 1977 through 1886, but the y-intercept is too small.

7. m: = -0.1105

   b2: = 24.2764

   f2(x): = -0.1105x + 24.2764

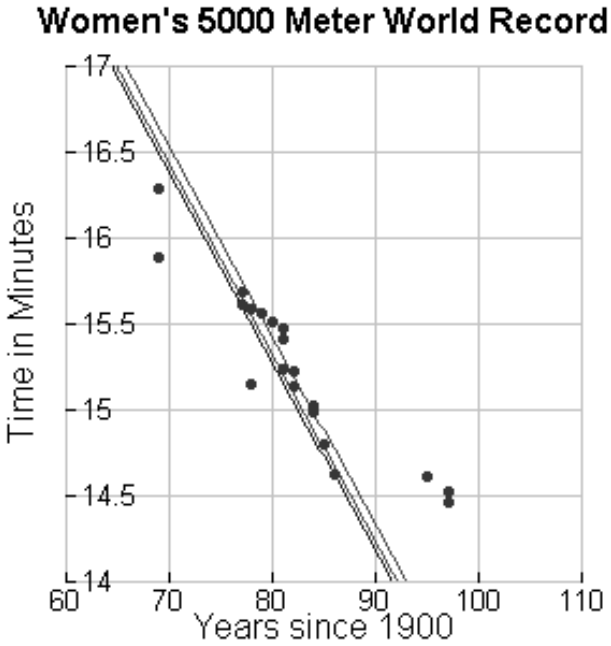


8. f2(x)'s slope is the same as f1(x)'s which fits the middle of the data. f2(x)'s y-intercept is better.

9. m: = -0.1105

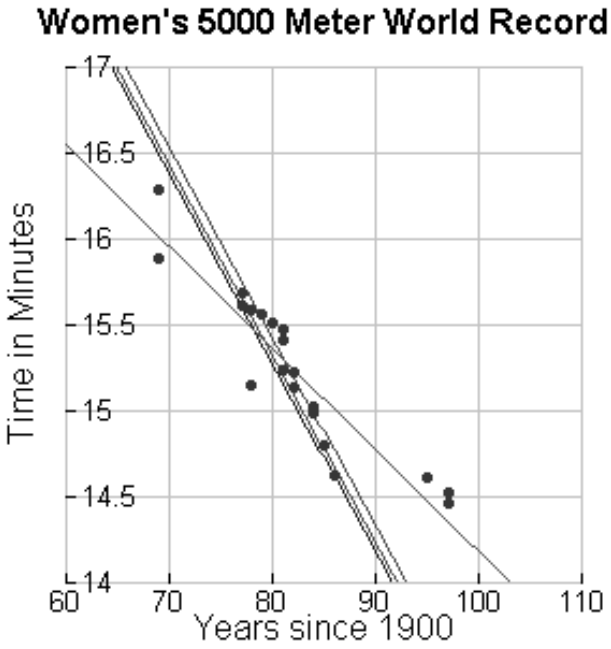
   b3: = 24.1756

   f(x): = -0.1105x + 24.1756



10. *f*(*x*), the median-median line, fits the bulk of the data.

11. g(x)*:* = -0.059325x + 20.1115



12. The linear regression does not pass through any points in the data sets, and takes the outlier data into consideration.

13. Answers may vary. The median-median line would interpolate data better and the linear regression would be perhaps be a better model to extrapolate data.