

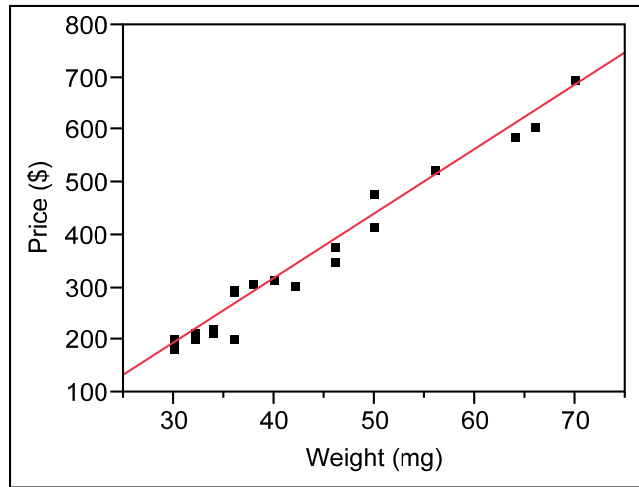
Valentines Day is just a week away and some may be lucky enough to get a diamond as a gift. Suppose you receive a diamond as a gift. You know the size of the diamond (50 milligrams) but you don't know the price (\$). A random sample of 25 diamonds (weighing from 25 to 100 mg) is obtained and you find the corresponding prices.

- a) Answer the questions Who are we collecting data on? and What data are being collected? for this problem.

Who? – Diamonds.

**What? – Size of diamonds, mg.
Price of diamonds, \$.**

- b) Below is a plot of price versus weight.



Describe the relationship in terms of direction, form, strength, and indicate any unusual points.

The direction is positive, the form is linear, the strength is moderately strong and there are no unusual points.

Below is partial JMP output for the least squares regression line.

Linear Fit

$$\text{Predicted Price (\$)} = -172.04 + 12.273 * \text{Weight (mg)}$$

Summary of Fit

RSquare	0.975972
RSquare Adj	0.974928
Root Mean Square Error	23.77098
Mean of Response	330.64
Observations (or Sum Wgts)	25

- c) Give an interpretation of the slope within the context of the problem.

For each additional 1 mg of weight, a diamond costs \$12.27 more, on average. The average price of 1 additional mg of diamond is \$12.27.

d) Why doesn't the y-intercept have an interpretation within the context of the problem?

A diamond that has no weight does not exist and so the price of a non-existent diamond makes no sense.

e) Use the least squares regression line to predict the price of a diamond weighing 50 mg.

$$\text{Predicted Price (\$)} = -172.04 + 12.273*(50) = -172.04 + 613.65 = \$441.61$$

f) One of the 25 diamonds in the sample weighs 50 mg and has a price of \$489. What is the residual for this diamond?

$$\text{Residual} = \text{observed} - \text{predicted} = 489 - 441.61 = \$47.39$$

g) Graph the least squares regression line on the plot in b). In order to get full credit it must be obvious to me that you are using the equation to draw the line.

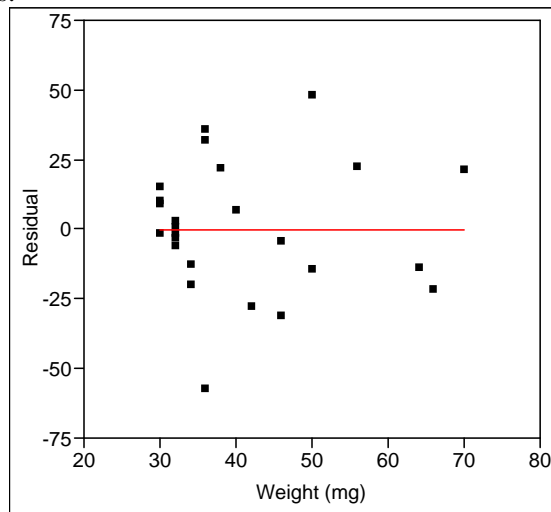
$$\text{Weight} = 50 \text{ mg, Predicted Price} = \$441.61$$

$$\text{Weight} = 70 \text{ mg, Predicted Price} = \$687.07$$

h) How much of the variability in the price of diamonds can be explained by the linear relationship with weight?

97.6% of the variability in the price of diamonds can be explained by the linear relationship with weight.

i) Below is a plot of residuals. Describe what you see in the plot and what this tells you about the least squares regression line for predicting the prices of diamonds from their weights.



There is a random scatter of residuals above and below the zero line. This indicates that the linear model is an adequate model for describing the relationship between the size and price of diamonds.