name: *Solution*

1 (10 points). Here is a data set that illustrates an important point about correlation:

X	25	35	45	55	65
Y	10	30	50	30	10

(a) Make a scatterplot of Y versus X.
(b) Describe the relationship between Y and X. Is it weak? Is it strong? Is it linear?
(c) Find the correlation between Y and X.
(d) What important point about correlation does this exercise illustrate?

(a)
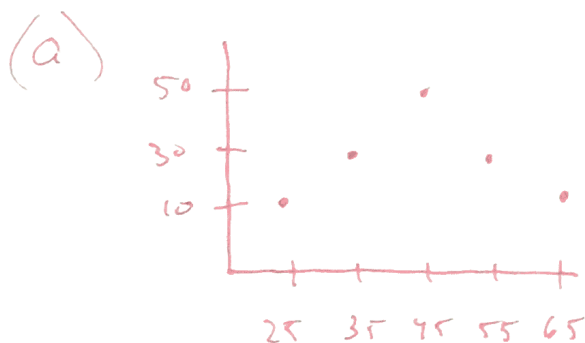
(b) The relationship initially increases until X reaches 45, then decreases. It's piecewise linear & quite strong.

(c)

$$r = \frac{1}{n-1} \sum \left(\frac{x_k - \bar{x}}{s_x}\right)\left(\frac{y_k - \bar{y}}{s_y}\right) = \frac{1}{(n-1)s_x s_y} \sum (x_k - \bar{x})(y_k - \bar{y})$$

$$\bar{x} = \tfrac{1}{5}(25 + \cdots + 65) = 45$$

$$\bar{y} = \tfrac{1}{5}(10 + \cdots + 10) = 26$$

$$\sum (x_k - \bar{x})(y_k - \bar{y}) =$$

$$(25-45)(10-26) + (35-45)(30-26)$$
$$+ (45-45)(50-26) + (55-45)(30-26)$$
$$+ (65-45)(10-26) =$$

$$(-20)(-16) + (-10)(4) + 0 + (10)(4) + (20)(-16)$$

$$= 0. \implies \boxed{r = 0}$$

(d) It doesn't matter how strong the relationship is on parts of X, but only overall.