5.2 HW

5.19 **a**

SCATTER PLOT

$\hat{y} = -3 + 1.5x$

RESPONSE VARIABLE

8th grade / 4th grade

$(\bar{x}, \bar{y})$
$(17.5, 23.5)$

EXPLANATORY VARIABLE

RESIDUAL PLOT Should Show NO pattern

Residual / 4th Grade

DESCRIBE ASSOCIATION
- FORM
- DIRECTION
- STRENGTH
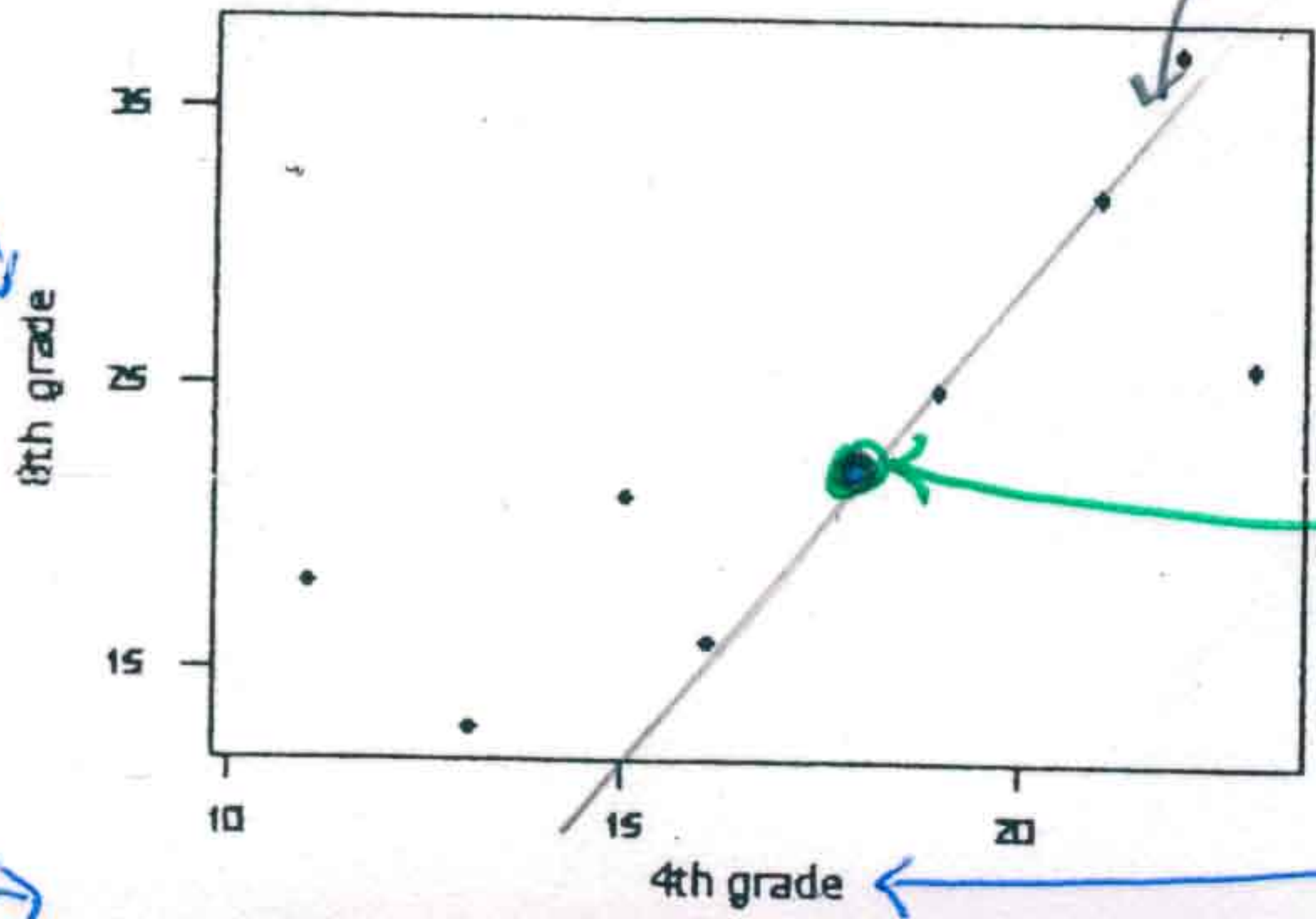
There is a moderately strong positive linear relationship between the percentage of public schools who were at or above the proficient level in math in 4th and 8th grade in the 8 states. ← IN CONTEXT

b x = 4th grade and y = 8th grade;
n = 8, $\bar{x} = 17.5, \bar{y} = 23.5$

$r = .82 \rightarrow (.8 - 1)$
↑   ↑
        strong

The slope, $b = \dfrac{S_{xy}}{S_{xx}} = \dfrac{207}{136} = 1.522$

The intercept, $a = \bar{y} - b\bar{x} = 23.5 - 1.522(17.5) = -3.135$

The equation: $\hat{y} = -3.135 + 1.522x$

c Predicted 8th grade = -3.135 + 1.522(4th grade percent) ⇒ -3.135 + 1.522(14) = 18 (rounded to nearest integer). This is 2% lower than the actual 8th grade value of 20 for Nevada.
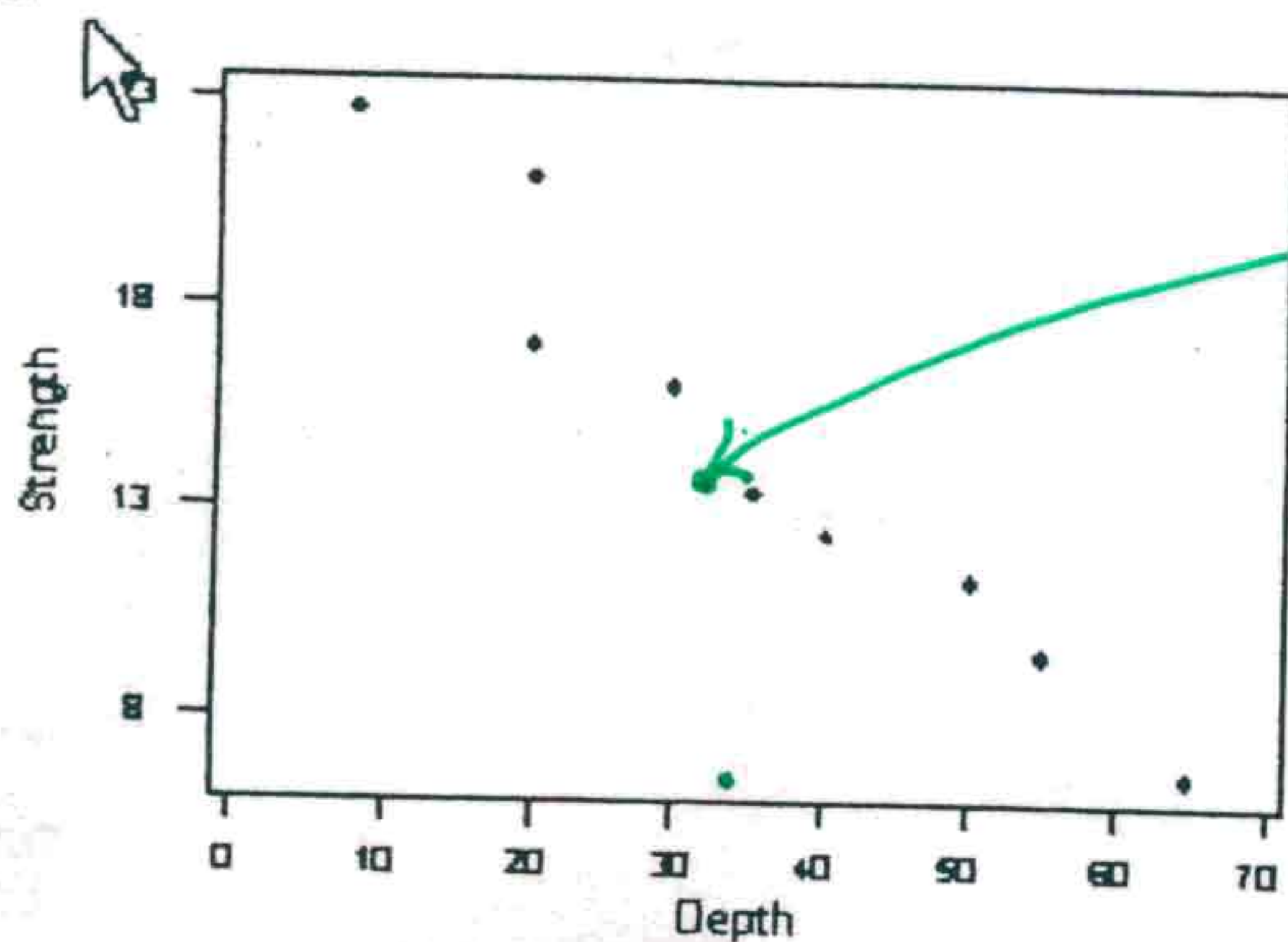
$\hat{y} = 18$ ← PREDICTED EQUATION

$y_i = 20$ ← ACTUAL

$y_{NV} = 20$

SKIP

a

$(\bar{x}, \bar{y})$ $(35.9, 14.5)$

RESIDUAL PLOT
SHOULD SHOW NO
PATTERN.

✳ There appears to be a negative linear association between carbonation depth and the strength of concrete for a sample of core specimens.

b

$$\bar{x} = 35.889, \quad \bar{y} = 14.533$$

The slope, $b = \dfrac{S_{xy}}{S_{xx}} = \dfrac{-754.367}{2746.889} = -0.275$

The intercept, $a = \bar{y} - b\bar{x} = 14.533 - (-0.275)(35.889) = 24.40$

The equation: $\hat{y} = 24.4 - 0.275x$ ⟵ — MUST USE $\hat{y}$

c   When depth is 25, predicted strength $= 24.4 - 0.275(25) = 17.5$

d   The least squares line was calculated using values of "depth" of between 8 mm and 65 mm and therefore is only valid for values in this range. We don't know if the relationship between depth and strength remains the same outside these values and so this equation cannot be used. A depth of 100 mm is clearly outside these values and it would be unreasonable to use this equation to predict strength.

5.22   It certainly seems that the sooner the paramedics get there, the higher your chances of survival. The slope of the least squares line is – 9.30, which means that for every extra minute, on average, the survival rate decreases by 9.30%.

5.23   The slope is the average increase in the y variable for an increase of one unit in the x variable. Because the home prices (y variable) dropped by an average of $4000 (-4000) for every (1) mile (x variable) from the Bay area, the slope is -4000/1 = -4000.

5.26   a   slope = 244.9   intercept = −275.1

b   244.9

c $y = -275.1 + 244.9(2) = -275.1 + 489.8 = 214.7$

d   No. When shell height (x) equals 1, the equation would result in a predicted breaking strength of $-275.1 + 244.9(1) = -30.2$. It is impossible for breaking strength to be a negative value, so the equation results in a predicted value which is not meaningful.