Notes – Interpreting Linear Models

1) **Linear Model** – data that can be modeled by a ________ line called a _______ of _______ fit.

*Remember*: linear functions can be represented in different ways – in a _______ _________, or as an _________.

2) **X-intercept** – the point at which the graph crosses the _____ ________.

Ex. 1: Last year, when Dayshawn bought a new computer, he collected pairs of data in a scatter plot to help him understand how the value of a computer changes over time. He used the scatter plot on the left to create the linear model on the right.

![Graph of Computer's Value vs Age]

a) What is the y-intercept, and what does it represent in the context of this problem?

b) What is the x-intercept, and what does it represent in the context of this problem?

c) What is the slope, and what does it represent in the context of this problem?

**Finding the Slope of a Scatter Plot:**
1) Choose 2 _______ from the _______ line.
2) Use your _______ formula:

Ex. 2: Ms. Jones collected data from a sample of 14 students to determine the association between the numbers of hours they studied for a test and their test scores. She created this scatter plot to show the data. The line shows the general trend of the data.

![Graph of Test Scores and Study Times]

a) Write an equation for the linear model.

b) Explain what the slope and y-intercept represent in this situation.

Ex. 3: The equation below demonstrates the total cost of going to Great Adventures Amusement park, where \( r \), represents the number of rides, and \( t \), represents the total cost.

\[
T = 1.50r + 20.00
\]

a) Find and Interpret the Slope.

b) Find and Interpret the Y-intercept.
Ex. 4: Joe's Mechanics Shop charges a flat fee plus an additional rate per hour for labor to work on a car. The shop uses the equation of a linear function to determine, \( y \), the total cost in dollars for \( x \) hours of labor. The table below shows a partial representation of this function.

<table>
<thead>
<tr>
<th>Number of hours (( x ))</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cost in Dollars (( y ))</td>
<td>41</td>
<td>49</td>
<td>57</td>
<td>65</td>
</tr>
</tbody>
</table>

a) What is the rate of change shown by the table and what does it represent in the context of this problem?

b) What is the \( y \)-intercept of this table? What does this represent?

Ex. 5: Custom Company makes custom T-shirts. The cost per T-shirt varies, depending on the design chosen and the number of T-shirts ordered. The scatter plot below shows a sample of T-shirt orders.

[Scatter plot showing T-Shirts Ordered and Prices]

a) Write an equation for the linear model.

b) Interpret the slope.

c) Interpret the \( y \)-intercept.

Ex. 6: A coach recorded the times athletes spend weight training and the numbers of sit-ups they could perform in one minute, in a scatter plot to the right. The linear model is \( y = 4x + 12 \).

Which is the best interpretation of the slope of this model?

a) Each additional hour in the weight room improves one's performance by 4 sit-ups per minute.
b) Every 4 hours in the weight room improves one's performance by 1 sit-up per minute.
c) An athlete who does not lift weights can perform only 4 sit-ups per minute.
d) The number of hours spend in the weight room does not affect sit-up performance.

Ex. 7: Write an equation for the linear model represented by the graph below, and show your work. If any data points are not well represented by the model, identify them and explain why not.

[Graph showing Sleep and Presentation Grades]
Notes – Interpreting Linear Models

1) Linear Model – data that can be modeled by a straight line called a line of best fit.

**Remember:** linear functions can be represented in different ways – in a table graph, or as an equation.

2) X-intercept – the point at which the graph crosses the x-axis.

Ex. 1: Last year, when Dayshawn bought a new computer, he collected pairs of data in a scatter plot to help him understand how the value of a computer changes over time. He used the scatter-plot on the left to create the linear model on the right.

![Graph 1](image)

a) What is the y-intercept, and what does it represent in the context of this problem?

$800, the initial value of a computer.

b) What is the x-intercept, and what does it represent in the context of this problem?

5 years, at and after 5 years, a computer will not have much if any value.

c) What is the slope, and what does it represent in the context of this problem?

$m = \frac{0 - 800}{5} = \frac{-800}{5} = -160$

There is a decrease of $160 per year in value of a computer.

Ex. 2: Mrs. Jones collected data from a sample of 14 students to determine the association between the numbers of hours they studied for a test and their test scores. She created this scatter plot to show the data. The line shows the general trend of the data.

![Graph 2](image)

a) Write an equation for the linear model.

$y = 10x + 40$

b) Explain what the slope and y-intercept represent in this situation.

Slope: $m = 10$, every 4 hour of study increases a test score by 10 points.

Y-intercept: $40$, if a student studied 0 hrs., his/her score would likely be about 40.

Ex. 3: The equation below demonstrates the total cost of going to Great Adventures Amusement park, where $r$ represents the number of rides, and $t$, represents the total cost.

$T = 1.50r + 20.00$

a) Find and Interpret the Slope.

$1.50$, for each additional ride, the total cost increases by $1.50.

b) Find and Interpret the Y-intercept.

$20.00$, the initial fee to get into the park.
Ex. 4: Joe’s Mechanics Shop charges a flat fee plus an additional rate per hour for labor to work on a car. The shop uses the equation of a linear function to determine, \( y \), the total cost in dollars for \( x \) hours of labor. The table below shows a partial representation of this function.

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a) What is the rate of change shown by the table and what does it represent in the context of this problem?
\[
m = \frac{\Delta y}{\Delta x} = \frac{8}{1} = 8
\]
The shop changes $8 for each additional hour of labor.

b) What is the y-intercept of this table? What does this represent?
$33, the initial fee before any work is done on the car.

Ex. 5: Custom Company makes custom T-shirts. The cost per T-shirt varies, depending on the design chosen and the number of T-shirts ordered. The scatter plot below shows a sample of T-shirt orders.

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{15 - 3}{240 - 0} = \frac{12}{240} = \frac{1}{20}
\]

a) Write an equation for the linear model.
\[
y = -0.05x + 15
\]

b) Interpret the slope.
\[
m = -0.05 \text{, the cost per shirt decreases by } 0.05 \text{ per additional shirt ordered.}
\]

c) Interpret the y-intercept.
\[
y = -0.05x + 15 \text{, the price per T-shirt will be } 15, \text{ even if no shirts are ordered.}
\]

Ex. 6: A coach recorded the times athletes spend weight training and the numbers of sit-ups they could perform in one minute, in a scatter plot to the right. The linear model is \( y = 4x + 12 \).

Which is the best interpretation of the slope of this model?

- a) Each additional hour in the weight room improves one’s performance by 4 sit-ups per minute.
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- d) The number of hours spend in the weight room does not affect sit-up performance.

Ex. 7: Write an equation for the linear model represented by the graph below, and show your work. If any data points are not well represented by the model, identify them and explain why not. \( y = mx + b \)

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{90 - 70}{10 - 0} = 2 \text{, the y-intercept is } 60.
\]

b) With no hours of sleep you’re most likely to get a least a 60.

b) Interpret the y-intercept. 60 pts.

C) Interpret the slope (5 pts.) with each additional hour of sleep, you’re likely to increase your grade by 5.