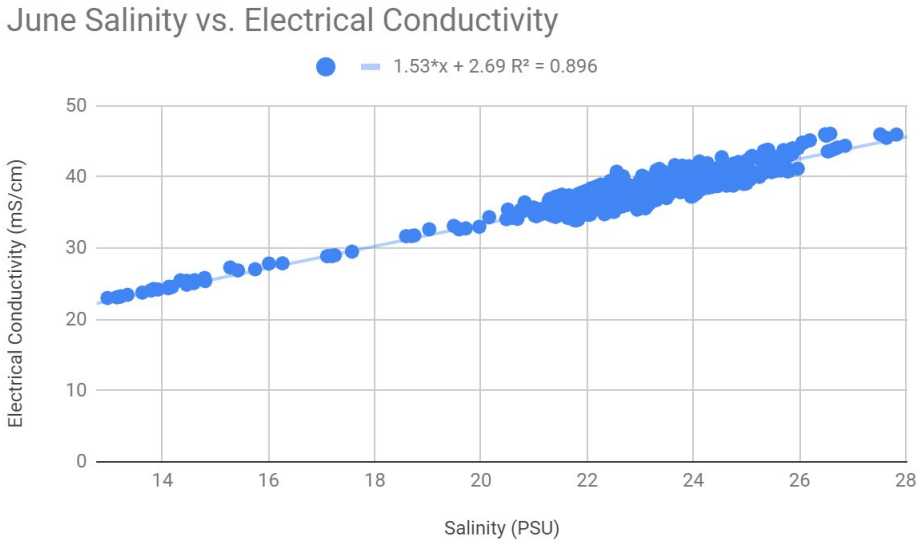
Modeling & Evaluating Linear Trends Worksheet (Answer Key)

KEY TERMS

- **Regression Line**: *a tool for making predictions about future observed values that also provides a useful way of summarizing a linear relationship*
  - $y = a + bx$
- **Slope (*b*):** *the value that tells how much the y-variable changes when the x-variable is increased by one unit*
  - $b = r(s_y \div s_x)$
- **y-Intercept (*a*):** *the predicted value when x is zero*
  - $a = \bar{y} - b\bar{x}$
- **Coefficient of Determination (r^2):** *the square of r (correlation coefficient) that measures how much variation in the response variable is explained by the explanatory variable*
  - The coefficient of determination can also be thought of as how well a regression line fits the scatteredness of the data plotted on a scatterplot.
  - Usually converted to a percentage, so r^2 is always between 0% to 100%.
  - The larger r^2, the smaller the amount of variation/scatter about the regression line.

Gould, R., & Ryan, C. N. (2015). Introductory statistics: Exploring the world through data. Pearson.

The below scatterplot contains a sample of 500 randomly selected salinity vs. electrical conductivity data points from the Mokauea loko iʻa data collected in June 2020. Using technology, a regression line has been applied to the scatterplot to model the linear trend of the data.



The above data is real data collected from research at Mokauea loko iʻa.
Additional Mokauea loko iʻa data can be explored here: http://grogdata.soest.hawaii.edu/

EXERCISE 1: Regression Equation

The regression equation of the regression line is stated at the top of the plot in a generic form. Apply the variables of the graph to the equation & write it in the form stated under "Regression Line" in the above "Key Terms" box.

Electrical conductivity = 2.69 + 1.53(Salinity)

Using the equation you just wrote, what would be the predicted electrical conductivity of the water in Mokauea loko iʻa if the salinity level were to be 25 PSU?

Electrical conductivity = 2.69 + 1.53(25) = 40.94 PSU

EXERCISE 2: Interpreting Slope & y-Intercept

Given the definition of "slope," interpret the slope of your equation above.

For each additional PSU of salinity, the electrical conductivity of the Mokauea loko iʻa tends to increase by 1.53 mS/cm. Each additional PSU of salinity is associated with an increase of 1.53 mS/cm in electrical conductivity.

Given the definition of "y-intercept," interpret the y-intercept of your equation above.

2.69 mS/cm is the predicted value when salinity is 0. In other words, when the Mokauea loko iʻa's salinity is 0 PSU, its electrical conductivity is 2.69 mS/cm.

EXERCISE 3: Coefficient of Determination

As stated at the top of the "June Salinity vs. Electrical Conductivity" plot, r^2 is 0.896. Convert this to a percentage and interpret your result.

$r^2 = 0.896 = 89.6\%$

Salinity explains about 89.6% of the variation in electrical conductivity in the Mokeaua loko i'a.

What would the correlation coefficient be given the value of r^2? Round to the nearest hundredth.

$\sqrt{0.896} = 0.947$