# Math 217:Exam 2 Review

## Module 3

**Scatterplot***:*

- Graphs the relationship between two quantitative variables.
- In a scatterplot each dot represents *an individual*.
- The **explanatory variable (or predictor variable)**is plotted on the horizontal x-axis.
- The **response variable** is plotted on the vertical y-axis.

**Describing the correlation between two variables:**

- **Direction:**
  - **Positive**: an increase in the explanatory variable tends to be associated with an increase in the response variable.
  - **Negative:** an increase in the explanatory variable tends to be associated with a decrease in the response variable.
- **Form:**
  - **Linear:** the dots tend to follow a linear pattern. Using a line is the best way to summarize (or model) the data.
  - **Nonlinear:** the dots do not follow a linear pattern. There may be no pattern, or using a curve is the best way to summarize (or model) the data.
- **Strength:**
  - Generally, the less scatter about the model line, the stronger the correlation.
  - When the form of a relationship is linear, we use the **correlation coefficient, *r*,** to measure the strength (and direction) of the linear relationship.
    - The correlation ranges between -1 an 1.
    - An r-value of0 indicates no linear relationship
    - An r-value near -1 indicates a strong negative linear relationship
    - An r-value near +1 indicates a strong positive linear relationship

**Correlation does not imply Causation:**

- Do *not* interpret a correlation between explanatory and response variables as a cause-and-effect relationship.
- Beware of **lurking variables (confounding variables***)* that may be explaining the relationship.

**Least-Squares Regression Line (LSR):** $\hat{y}$ =**(***Initial value) + (slope)*$\times x$

- The line that best summarizes a linear relationship.
- The *x* value is the explanatory variable (the independent variable.) The *y* value is the response variable (the dependent variable.)
- The least-squares line is the best fit for the data because it gives the best predictions with the least amount of error.
- The most common measurement of overall error is the **sum of the squares of the errors, SSE**. The least-squares line is the line with the smallest SSE. This is also called the **sum of the squared residuals.**
- We use the least-squares regression line to predict the value of the response variable from a value of the explanatory variable.
- Avoid making predictions outside the range of the data. (This is called **extrapolation**.)
- Use technology to find the equation of theleast-squares regression line. (As well as r , the corelation coefficent)
- The **slope** of the least-squares regression line is the average change in the predicted values when the explanatory variable increases by 1 unit.
- Slope = $\frac{rise}{run} = \frac{change\ \ in\ y}{change\ \ in\ x} = \frac{y_2 - y_1}{x_2 - x_1}$
- When we use a regression line to make predictions, there is error in the prediction. We calculate this error as **observed value – predicted value**. This prediction error is also called a **residual.**

**The correlation of determination: $r^2$**

- Numerical measure that judges how well the regression line models the data:
- $r^2$is the proportion of the variation of the response variable that is *explained* by the explanatory variable.
- $1-r^2$is the proportion of the variation of the response variable that is NOT explained by the explanatory variable.
- A high $r^2$indicates that the LSR does a good job accounting for the variability in the response variable.

## Module 4

**Exponential models:**

- The general form is $y = a \cdot b^x$ Exponentials are nonlinear – curved.
- They predict that y increases or decreases by a constant percentage for each one-unit increase in x.
- **a is the initial value**. It is the y-value when x = 0. It is also the y-intercept.
- **b is the growth or decay factor.**b is always positive.
    - If b is greater than 1, b is a growth factor. From the growth factor we can determine the **percent increase in y** for each additional 1 unit increase in x.
    - If b is greater than 0 and less than 1, b is a decay factor. From the decay factor we can determine the **percent decrease in y** for each additional 1 unit increase in x.
    - The percent of growth/decay can be calculated by $(b - 1) * 100\%$
- Applications of growth and decay
- Continuous compounding - base e

**Tips for preparing for an exam:**

- Gather and organize all of the important materials:
    - In-class activities
    - Take-It-Homes
    - My Statway
    - Quizzes
    - Any additional notes
- Create a study packet for yourself by rewriting all of the important notes. Give examples where helpful. Actually write things down (as opposed to just keeping things in your brain or even typing). Writing helps memory. Don't worry if your study packet gets long.
- Use your study packet to create your "cheat sheet". Take time to do this to ensure you are familiar with what's on it. You may want to colors to organize the content.
- Practice writing up solutions to all types of problems. Pay careful attention to the clarity and precision, making sure you are using correct vocabulary and notation.
- If there are any particular questions or concepts you are uncertain about, check in with a groupmate or your instructor (email or office hours).
- If possible, meet with your group outside of class to study for the exam. Working in groups not only helps you review more concepts and provide motivation, but discussing concepts with others will trigger auditory approach to learning, as well as help your memory.