HUDSONVILLE HIGH SCHOOL COURSE FRAMEWORK

COURSE / SUBJECT Statistics A and B

KEY COURSE OBJECTIVES/ENDURING UNDERSTANDINGS	OVERARCHING/ESSENTIAL SKILLS OR QUESTIONS
BE ABLE TO DISPLAY CATEGORICAL AND QUANTITATIVE DATA IN VARIOUS GRAPHS; SUMMARIZE DATA NUMERICALLY; UNDERSTAND STANDARD DEVIATION **UNDERSTAND WHAT NORMAL DISTRIBUTIONS ARE; HOW TO COMPUTE PROBABILITIES USING THEM; KNOW WHAT Z-SCORES ARE** **UNDERSTAND CORRELATION, FINDING LINEAR EQUATIONS FOR APPROPRIATE DATA; INTERPRETING THE SLOPE AND Y-INTERCEPT IN CONTEXT; KNOWING WHAT RESIDUALS AND RESIDUAL PLOTS SHOW** **BE ABLE TO COMPUTE BINOMIAL PROBABILITIES, JOINT AND CONDITIONAL PROBABILITIES; P(A AND B) AS WELL AS P(A OR B); UNDERSTAND "INDEPENDENCE" BETWEEN EVENTS** **UNDERSTAND BASIC ELEMENTS OF SAMPLING METHODS AND EXPERIMENTAL DESIGN. KNOW THE DIFFERENCE BETWEEN OBSERVATIONAL STUDIES AND EXPERIMENTS AND WHY IT MATTERS.** **LEARN INFERENCE METHODS FOR PROPORTION, MEANS, AND CATEGORICAL DATA**	Make sense of problems and persevere in solving them. Reason abstractly and quantitatively. Construct viable arguments and critique the reasoning of others. Model with mathematics. Use appropriate tools strategically. Attend to precision. Look for and make use of structure. Look for and express regularity in repeated reasoning.

UNIT and PACING	LESSON NUMBER	STANDARD	UNIT LEARNING TARGETS	EXAMPLE	KEY CONCEPTS
UNIT 1A: ANALYZING DATA GRAPHICALLY AND NUMERICALLY	1	S-ID.5	Display categorical data in two-way tables and bar charts or pie charts		Be able to take data counts and organize in tables, compute probabilities, and look for associations
Time spent: 3 weeks	2	S-ID.1	Display quantitative data in dotplots, boxplots, histograms, ogives, and stemplots		Be able to make and read various graphs applicable to quantitative data; be aware of pros and cons to these graphs
	3		Be able to use spreadsheet software to create basic graphs (scatterplots, bar/pie charts)		Be able to put data into a spreadsheet to make various graphs, alter axes, give labels.
	4	S-ID.3	Summarize data numerically: mean , median, standard deviation, IQR; know various shape names for graphs/data	If a set of incomes is skewed right, how will the mean compare to the median?	Understand how skew or outliers effect mean and SD, much less so the median and IQR.
	5		Learn how linear transformations to a data set effect its numerical summary measures	If we add 10 points to a set of test scores, which measures change?	Know the effects of multiplying and adding on measures of center and spread.

UNIT and PACING	LESSON NUMBER	STANDARD	UNIT LEARNING TARGETS	EXAMPLE	KEY CONCEPTS
UNIT 2A: THE NORMAL DISTRIBUTION	1	S-ID.4	Understand what makes for a normal distribution; know how to apply the 68-95-99.7 rule; understand the concept of z-scores	Data has a mean of 30 and SD of 4. Convert 37 into a z-score;	Understand what normal distributions are an their importance; convert between data and z-scores
Time spent: 1.5 weeks	2	S-ID.4	Be able to find probabilities using a normal distribution for z-scores and/or actual data values	If normal, what prop. of data would be above 37?	Know how to use the calculator to compute probabilities from a normal distribution
	3		Be able to do inverse normal calculations to find “cutoff” scores for various probabilities	What score would cut off the top 10% in a set of data?	Be able to use the calculator’s inverse normal function appropriately
	4		Be able to construct a Control Chart and identify “out of control” signals	Take a sample of data to make a control chart and see if in or out of control	Know the three signals for out of control; be able to make a control chart for a sample of data; understand role of the normal distribution in the chart and signals

UNIT and PACING	LESSON NUMBER	STANDARD	UNIT LEARNING TARGETS	EXAMPLE	KEY CONCEPTS
UNIT 3A: LINEAR REGRESSION	1	S-ID.6 S-ID..8	Put bivariate data into a scatterplot; be able to get and interpret the correlation coefficient, r. Understand the limitations of the r-value, especially for non-linear data or if outliers/ influential points are present.	What is the correlation between student GPAs and ACT scores? Is it linear?	Be able to use technology (spreadsheets and calculator) to make scatterplots, compute the correlation.
Time spent: 3 weeks	2		Understand several properties of the correlation coefficient: is unitless; always between 1 and -1; unchanged by choice of explanatory and response variable	Will the correlation change if we convert all our data from feet to centimeters? No	Know that the correlation, by being unitless, does not get effected by changing of units or or input/output variables on a scatterplot
	3	S-ID.6a S-ID.6c	If appropriate, fit a linear equation to a scatterplot of data; understand criteria for how line of best fit is determined	Find the line of best for the relationship between GPA and ACT scores of students	Be able to use technology (spreadsheets and calculator) to compute the line of best fit ("least squares line") for data deemed to be linear in form.
	4	S-ID.6b	Understand how to compute and the role of analyzing residuals and residual plots	Based on a residual plot, is a linear model appropriate for a set of data?	Be able to use technology (spreadsheets and calculator) to compute residuals and make residual plots; be able to assess what a residual plot tells us about the data
	5	S-ID.9	Know that correlation is not the same as causation.	Suppose art prices and stock prices are correlated, is one causing changes in the other?	Understand that correlation can be the result of many things; know what confounding or "lurking" variables are and the role they can play in correlation.
	6	S-ID.7	Interpret the slope and y-intercept of a linear model in the context of the variables	If GPA=1.1+. 9(GPA) what does the slope tells us?	Be able to use the context of the variables to discuss the meaning of slopes and intercepts.

UNIT and PACING	LESSON NUMBER	STANDARD	UNIT LEARNING TARGETS	EXAMPLE	KEY CONCEPTS
UNIT 4A: SAMPLING AND EXPERIMENT DESIGN	1		Be knowledgeable about sources of bias in sampling	Explain a possible source of bias in the following phone survey...	Know the problems inherent in sampling that can cause bias; terms include response bias, nonresponse, voluntary response, undercoverage
Time spent: 2 weeks	2	S-IC.3 S-MD.6	Understand the basic ideas behind various sampling designs		Understand SRS, stratified, systematic, and cluster samples as well as pros and cons of each.
	3	S-IC.3	Understand structure of basic experiments; difference between observational studies and experiments; role of randomization		Experiments can determine causation; understand terminology associated with obs. studies and experiments
	4	S-IC.5	Begin examining experiment data to see if treatments appear to make a difference		Draw from graphing and summarizing knowledge to informally assess if treatments appear to be causing a difference.

UNIT and PACING	LESSON NUMBER	STANDARD	UNIT LEARNING TARGETS	EXAMPLE	KEY CONCEPTS
UNIT 5A: PROBABILITY	1	S-ID.5 S-CP.1 S-CP.2 S-CP.4 S-CP.5 S-CP.6	Using two-way tables to compute P(A and B), P(A or B), P(A|B)	Using a table, compute the probability of being a male and have glasses; male or glasses; male given one wears glasses	Understand how wording is crucial to computing two-way table probabilities to find correct numerator and denominator; learn how probabilities give insight into variables' dependence.
Time spent: 1.5 weeks	2	S-CP.7 S-CP.8	Be able to use P(A and B) and P(A or B) rules	Same as above, but with various probabilities given, not from a table.	Know how, and when, to use the appropriate probability formula
End of Part A Statistics	3		Be able to compute binomial probabilities; know when a situation is binomial; find mean and SD of binomial distributions	What is the probability of a 70% shooter making at least 6 out of 8 free throws?	Understand how to use the calculator to solve binomial probabilities; compute mean/ expected value of a distribution

UNIT and PACING	LESSON NUMBER	STANDARD	UNIT LEARNING TARGETS	EXAMPLE	KEY CONCEPTS
UNIT 1B: BEGIN PART B OF STATISTICS SAMPLING DISTRIBUTIONS	1	S-IC.1	Learn that a sampling distribution of a statistic is the long-run pattern behind random sample statistics to lay the foundation behind inference methods		Shape, center, and spreads of statistics over many, many samples are very predictable and often normally distributed
1.5 weeks	2		Distribution of sample proportions: shape, mean, and SD		Understand how to predict what values of a sample proportion might arise if population parameter is known.
			Distribution of sample means: shape, mean, and SD		Understand how to predict what values of a sample mean might arise if population parameter is known.

UNIT and PACING	LESSON NUMBER	STANDARD	UNIT LEARNING TARGETS	EXAMPLE	KEY CONCEPTS
UNIT 2B: INFERENCE FOR PROPORTIONS	1	S-IC.1 S-IC.4	Develop concept of a confidence interval to estimate a population proportion; margins of error; sample size needed for desired margin of error	How large of a sample is needed for a 95% confidence interval to have a margin of error of +/-3%?	Where confidence levels come from; margins of error in samples; effect of sample size and confidence level on margin of error
3 weeks	2	S-IC.1 S-IC.2 S-IC.5	Method of significance tests for a proportion; types of errors	Does a sample provide evidence that the proportion of teens that smoke at HHS is different from the national rate of 23%?	Stating null and alternate hypotheses; computing and understanding p-values; type I and II errors; levels of significance
	3	S-IC.1 S-IC.2 S-IC.4 S-IC.5	Confidence intervals and significance tests for estimating the difference between two proportions	Give a 95% confidence interval to estimate the difference in smoking rates for U.S. males and females.	Same as for one proportion

UNIT and PACING	LESSON NUMBER	STANDARD	UNIT LEARNING TARGETS	EXAMPLE	KEY CONCEPTS
UNIT 3B: INFERENCE FOR MEANS	1	S-IC.1 S-IC.4	Further develop concept of a confidence interval to estimate a population mean; margins of error; sample size needed for desired margin of error	How large of a sample is needed for a 95% confidence interval to have a margin of error of +/-1.5 pounds?	Margins of error in samples; effect of sample size and confidence level on margin of error
3 weeks	2	S-IC.1 S-IC.2	Method of significance tests for a mean	Does a sample provide evidence that the mean hours of studying HHS students do per week is less than 3 hours?	Stating null and alternate hypotheses; computing and understanding p-values; type I and II errors in the context of a problem
	3	S-IC.1 S-IC.2 S-IC.4 S-IC.5	Confidence intervals and significance tests for estimating the difference between two means	Give a 95% confidence interval to estimate the difference in mean hours of studying per week for HHS males and females.	Same as for one mean
	4	S-IC.1 S-IC.2 S-IC.4 S-IC.5	Student-collected data to test their own hypothesis and compute confidence interval		Applying inference methods to data students collect to investigate their own question or theory

UNIT and PACING	LESSON NUMBER	STANDARD	UNIT LEARNING TARGETS	EXAMPLE	KEY CONCEPTS
UNIT 4B: INFERENCE FOR CATEGORICAL DATA: CHI-SQUARED TESTS	1	S-IC.1 S-IC.2 S-IC.5	Understand how to apply inference methods to categorical data: Chi-squared goodness of fit test	Does a sample provide evidence against student absences being uniform throughout the week?	expected values for table entries; computing a chi-squared value as a measure of the fit between what was observed and expected; degrees of freedom
2 weeks	2	S-IC.1 S-IC.2 S-IC.5	Chi-squared test of independence for two categorical variables	Are gender and whether one votes independent variables?	Same as previous lesson
END OF TRIMESTER B	3	S-IC.1 S-IC.2 S-IC.4 S-IC.5	Student-collected data to test their own hypothesis about categorical variables		Applying chi-squared methods to data students collect to investigate their own question or theory