Ap statistics experimental design worksheet pdf

Name _____ Date _____

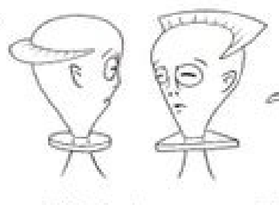
English Learners 20.5

Experimental Probability

Read the cartoon. Answer the question at the end of the cartoon.

"I wonder . . . what is the probability of this number cube landing on 3 when it is tossed?"

"Do you want to find the theoretical probability or the experimental probability?"



"What's the difference?"

"The theoretical probability is $\frac{1}{6}$ because 1 of the 6 sides is numbered 3."

"To find the experimental probability, you must do an experiment."

"How do I do that?"

"Toss the cube a certain number of times."

"The number of times you toss the cube is the number of **trials.**"

"The number of times the cube lands on 3 is the number of **favorable outcomes.**"

experimental probability =

$$\frac{\text{favorable outcomes}}{\text{trials}}$$

"Compare the number of favorable outcomes with the number of trials."

Later that day . . .

"I tossed the cube 120 times, and the cube landed on 3 only 30 times. What is my experimental probability?"

Write the experimental probability in its simplest form.

_____ = _____

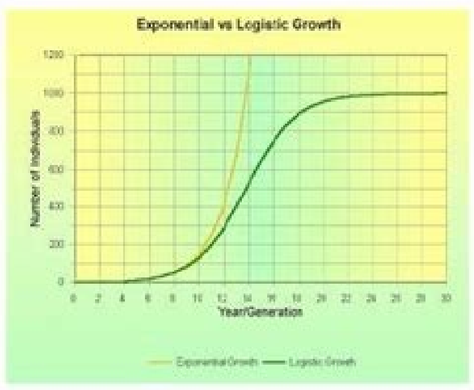
Use with text pages 540–543.

Name: Corinne, Elvis, Carlos Date: _____

Population Ecology Graph Worksheet

Directions: Look at the graphs below and answer the following questions.

Graphs 1 - Exponential Growth and Carrying Capacity



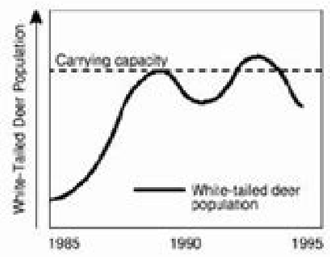
1. Which of the two curves exhibits exponential growth? The yellow "J" shaped curve.

2. Which of the two curves exhibits a carrying capacity? The green "s" shaped curve.

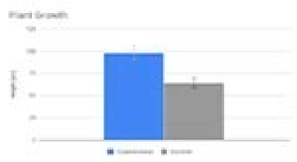
3. What is the carrying capacity of this graph? 1000 individuals

4. In what generation does this population reach its carrying capacity? It reaches carrying capacity at 24 to 26 year/generation.

Graph 2



1. For what type of organism is the carrying capacity shown? The carrying capacity shown is for the White-tailed deer.

Hypothesis and Predictions	Experimental Design	Interpreting Data
Hypothesis (Alternative) **Explanatory** - testable, falsifiable statement that explains observed phenomenon **Generalizing** - statement that describes an observed pattern in nature *Example: Plants require nutrients for growth.* **Null Hypothesis (H_0)** – Hypothesis that there is no significant effect, difference, or trend. The opposite of the alternative hypothesis. *Plants do not require nutrients for growth.* *Rejecting the null hypothesis means that the alternative hypothesis is correct.* **Prediction** - measurable event that will happen as a result of an experiment if the hypothesis is valid (if...then) *If plants are given fertilizer, which contains the nutrient, nitrogen, then they will grow taller and faster than plants grown without fertilizer.* 	**Independent Variable** – The actual thing that you are testing and changing across your experimental groups, also called the "manipulated variable." *Fertilizer (nitrogen) is the independent variable.* **Dependent Variable** – The response to your independent variable, this is sometimes called the "responding variable." *Growth of plants (height) is the dependent variable.* **Control Group** – The group that does not receive an experimental change or treatment. This is to determine if the independent variable actually causes a difference compare. Not all experiments have a control group. *The control group consists of plants not given fertilizer.*	1. Describe trends or relationships 2. Summarize data. 3. Make sure that what you state is actually what the data shows. 4. Statistical analysis may be needed (standard deviation, T test, chi square) to disprove the null hypothesis. 
Graphs and Tables		**Conclusions**
Graphs should have: • Descriptive title • Labels on X and Y axis, include units • Consistent scales (5,10,15,20) • Large enough scales to clearly see trends Data tables should have: • Labeled columns/rows • Units shown **Labs can be messy, most scientists keep a lab notebook for sketches, notes, and data collection. Final lab reports and publications have a formal version of these notes and data.*		This is where you make **inferences** about what the data means, or tie the experiment to broad scientific principles. Refer back to your original hypothesis and state whether you **accept** or **reject** the hypothesis based on your data. 👉 Avoid using the word "prove" in your analysis. Your conclusion can also include suggestions for future research or experiments, and reflections about the design or your experiment and how it could be improved.

http://study.com/academy/practice/quiz-worksheet-theoretical-probability.html Study.com

Quiz & Worksheet - Theoretical Probability

1. There are 95 white pieces of paper in a hat along with 5 blue pieces of paper. What is the theoretical probability that a blind-folded person draws a blue piece of paper on the first attempt?

- 5 out of 100, which is 5/100 or 1/20 (5%)
- 5 out of 95, which is 5/95 or 1/19 (5.3%)
- 1 out of 100, which is 1/100 (1%)
- 5 out of 5, which is 5/5 (100%)

2. Jake has been flipping a coin for 3 hours straight and he is about to flip it for the 500th time. What is the theoretical probability that Jake gets heads on this last flip?

- 1 out of 2 (50%) because no matter how many times a coin is flipped, each flip has just two possible outcomes, *heads* or *tails*.
- 2 out of 500 (0.4%) because there are two possible outcomes, *heads* or *tails* in 500 flips.
- 2 out of 1 (200%) because there are two possible outcomes, *heads* or *tails* and one flip.
- 3 out of 500 (0.6%) because it has taken 3 hours to flip 500 times.

3. A bag has been filled with 35 red marbles, 25 green marbles, 25 blue marbles and 15 orange marbles. What is the theoretical probability that someone can reach in and randomly pick an orange marble?

- 15 out of 100, which is 15/100 (15%)
- 15 out of 25, which is 15/25 (60%)
- 1 out of 100, which is 1/100 (1%)
- 15 out of 85, which is 15/85 (18%)

Ap statistics 4.2c worksheet experimental design answers. Ap statistics experimental design worksheet answers.

Contents: What is Simple Linear Regression? How to Find a Linear Regression Equation: Finding related items: Leverage: Leverage in Linear Regression. Back to top What is Simple Linear Regression? Watch the video for a brief introduction to linear regression: Intro to Linear RegressionWatch this video on YouTube. Can’t see the video? Click here. If you’re just beginning to learn about regression analysis, a simple linear is the first type of regression you’ll come across in a stats class. Linear regression is the most widely used statistical technique; it is a way to model a relationship between two sets of variables. The result is a linear regression equation that can be used to make predictions about data. Most software packages and calculators can calculate linear regression. For example: You can also Find a linear regression by hand. Before you try your calculations, you should always make a scatter plot to see if your data roughly fits a line. Why? Because regression will always give you an equation, and it may not make any sense if your data follows an exponential model. If you know the relationship is non-linear, but don’t know exactly what that relationship is, one solution is to use linear basis function models— which are popular in machine learning. Etymology “Linear” means line. The word Regression came from a 19th-Century Scientist, Sir Francis Galton, who coined the term “regression toward mediocrity” (in modern language, that’s regression to the mean. He used the term to describe the phenomenon of how nature tends to dampen excess physical traits from generation to generation (like extreme height). Why use Linear Relationships? Linear relationships, i.e. lines, are easier to work with and most phenomenon are naturally linearly related. If variables aren’t linearly related, then some math can transform that relationship into a linear one, so that it’s easier for the researcher (i.e. you) to understand. What is Simple Linear Regression? You’re probably familiar with plotting line graphs with one X axis and one Y axis. The X variable is sometimes called the independent variable and the Y variable is called the dependent variable. Simple linear regression plots one independent variable X against one dependent variable Y. Technically, in regression analysis, the independent variable is usually called the predictor variable and the dependent variable is called the criterion variable. However, many people just call them the independent and dependent variables. More advanced regression techniques (like multiple regression) use multiple independent variables. Regression analysis can result in linear or nonlinear graphs. A linear regression is where the relationships between your variables can be described with a straight line. Non-linear regressions produce curved lines.(**) Simple linear regression for the amount of rainfall per year. Regression analysis is almost always performed by a computer program, as the equations are extremely time-consuming to perform by hand. **As this is an introductory article, I kept it simple. But there’s actually an important technical difference between linear and nonlinear, that will become more important if you continue studying regression. For details, see the article on nonlinear regression. Back to top How to Find a Linear Regression Equation: Overview Regression analysis is used to find equations that fit data. Once we have the regression equation, we can use the model to make predictions. One type of regression analysis is linear analysis. When a correlation coefficient shows that data is likely to be able to predict future outcomes and a scatter plot of the data appears to form a straight line, you can use simple linear regression to find a predictive function. If you recall from elementary algebra, the equation for a line is y = mx + b. This article shows you how to take data, calculate linear regression, and find the equation y’ = a + bx. Note: If you’re taking AP statistics, you may see the equation written as b0 + b1x, which is the same thing (you’re just using the variables b0 + b1 instead of a + b. Watch the video or read the steps below to find a linear regression equation by hand. Find a linear regression equation (by hand)Watch this video on YouTube. Can’t see the video? Click here. The Linear Regression Equation Linear regression is a way to model the relationship between two variables. You might also recognize the equation as the slope formula. The equation has the form Y= a + bX, where Y is the dependent variable (that’s the variable that goes on the Y axis), X is the independent variable (i.e. it is plotted on the X axis), b is the slope of the line and a is the y-intercept. The first step in finding a linear regression equation is to determine if there is a relationship between the two variables. This is often a judgment call for the researcher. You’ll also need a list of your data in x-y format (i.e. two columns of data—independent and dependent variables). Warnings: Just because two variables are related, it does not mean that one causes the other. For example, although there is a relationship between high GRE scores and better performance in grad school, it doesn’t mean that high GRE scores cause good grad school performance. If you attempt to try and find a linear regression equation for a set of data (especially through an automated program like Excel or a TI-83), you will find one, but it does not necessarily mean the equation is a good fit for your data. One technique is to make a scatter plot first, to see if the data roughly fits a line before you try to find a linear regression equation. How to Find a Linear Regression Equation: Steps Step 1: Make a chart of your data, filling in the columns in the same way as you would fill in the chart if you were finding the Pearson’s Correlation Coefficient. Subject Age x Glucose Level y xy x2 y2 1 43 99 4257 1849 9801 2 21 65 1365 441 4225 3 25 79 1975 625 6241 4 42 75 3150 1764 5625 5 57 87 4959 3249 7569 6 59 81 4779 3481 6561 Σ 247 486 20485 11409 40022 From the above table, Σx = 247, Σy = 486, Σxy = 20485, Σx2 = 11409, Σy2 = 40022. n is the sample size (6, in our case). Step 2: Use the following equations to find a and b. a = 65.1416 b = .385225 Click here if you want easy, step-by-step instructions for solving this formula. Find a: ((486 × 11,409) – ((247 × 20,485)) / 6 (11,409) – 2472) 484979 / 7445 =65.14 Find b: (6(20,485) – (247 × 486)) / (6 (11409) – 2472) (122,910 – 120,042) / 68,454 – 2472 2,868 / 7,445 = .385225 Step 3: Insert the values into the equation. y’ = a + bx y’ = 65.14 + .385225x That’s how to find a linear regression equation by hand! Like the explanation? Check out the Practically Cheating Statistics Handbook, which has hundreds more step-by-step solutions, just like this one! * Note that this example has a low correlation coefficient, and therefore wouldn’t be too good at predicting anything. Back to top Find a Linear Regression Equation in Excel Watch the video or read the steps below: How to find Regression in Excel 2013Watch this video on YouTube. Linear Regression Equation Microsoft Excel: Steps Step 1: Install the Data Analysis Toolpak, if it isn’t already installed. For instructions on how to load the Data Analysis Toolpak, click here. Step 2: Type your data into two columns in Excel. For example, type your “x” data into column A and your “y” data into column b. Do not leave any blank cells between your entries. Step 3: Click the “Data Analysis” tab on the Excel toolbar. Step 4: Click “regression” in the pop up window and then click “OK.” The Data Analysis pop up window has many options, including linear regression. Step 5: Select your input Y range. You can do this two ways: either select the data in the worksheet or type the location of your data into the “Input Y Range box.” For example, if your Y data is in A2 through A10 then type “A2:A10” into the Input Y Range box. Step 6: Select your input X range by selecting the data in the worksheet or typing the location of your data into the “Input X Range box.” Step 7: Select the location where you want your output range to go by selecting a blank area in the worksheet or typing the location of where you want your data to go in the “Output Range” box. Step 8: Click “OK”. Excel will calculate the linear regression and populate your worksheet with the results. Tip: The linear regression equation information is given in the last output set (the coefficients column). The first entry in the “Intercept” row is “a” (the y-intercept) and the first entry in the “X” column is “b” (the slope). Back to top TI83 Linear Regression Watch the video for the steps: Watch this video on YouTube. Can’t see the video? Click here. Two linear regression lines. TI 83 Linear Regression: Overview Linear regression is tedious and prone to errors when done by hand, but you can perform linear regression in the time it takes you to input a few variables into a list. Linear regression will only give you a reasonable result if your data looks like a line on a scatter plot, so before you find the equation for a linear regression line you may want to view the data on a scatter plot first. See this article for how to make a scatter plot on the TI 83. TI 83 Linear Regression: Steps Sample problem: Find a linear regression equation (of the form y = ax + b) for x-values of 1, 2, 3, 4, 5 and y-values of 3, 9, 27, 64, and 102. Step 1: Press STAT, then press ENTER to enter the lists screen. If you already have data in L1 or L2, clear the data: move the cursor onto L1, press CLEAR and then ENTER. Repeat for L2. Step 2: Enter your x-variables, one at a time. Follow each number by pressing the ENTER key. For our list, you would enter: 1 ENTER 2 ENTER 3 ENTER 4 ENTER 5 ENTER Step 3: Use the arrow keys to scroll across to the next column, L2. Step 4: Enter your y-variables, one at a time. Follow each number by pressing the enter key. For our list, you would enter: 3 ENTER 9 ENTER 27 ENTER 64 ENTER 102 ENTER Step 5: Press the STAT button, then use the scroll key to highlight “CALC.” Step 6: Press 4 to choose “LinReg(ax+b)”. Press ENTER and then ENTER again. The TI 83 will return the variables needed for the equation. Just insert the given variables (a, b) into the equation for linear regression (y=ax+b). For the above data, this is y = 25.3x – 34.9. That’s how to perform TI 83 Linear Regression! Back to top How to Find a Linear Regression Slope: Overview Remember from algebra, that the slope is the “m” in the formula y = mx + b. In the linear regression formula, the slope is the a in the equation y’ = b + ax. They are basically the same thing. So if you’re asked to find linear regression slope, all you need to do is find b in the same way that you would find m. Calculating linear regression by hand is tricky, to say the least. There’s a lot of summation (that’s the Σ symbol, which means to add up). The basic steps are below, or you can watch the video at the beginning of this article. The video goes into a lot more detail about how to do summation. Finding the equation will also give you the slope. If you don’t want to find the slope by hand (or if you want to check your work), you can also use Excel. How to Find Linear Regression Slope: Steps Step 1: Find the following data from the information given: Σx, Σy, Σxy, Σx2, Σy2. If you don’t remember how to get those variables from data, see this article on how to find a Pearson’s correlation coefficient. Follow the steps there to create a table and find Σx, Σy, Σxy, Σx2, and Σy2. Step 2: Insert the data into the b formula (there is no need to find a). If formulas scare you, you can find more comprehensive instructions on how to work the formula here: How to Find a Linear Regression Equation: Overview. How to Find Regression Slope in Excel 2013 How to find Regression in Excel 2013Watch this video on YouTube. Subscribe to our Youtube channel for lots more stats tips and tricks. Back to top How to Find the Regression Coefficient A regression coefficient is the same thing as the slope of the line of the regression equation. The equation for the regression coefficient that you’ll find on the AP Statistics test is: B1 = b1 = Σ [(xi – x)(yi – y)] / Σ [(xi – x)2]. “y” in this equation is the mean of y and “x” is the mean of x. You could find the regression coefficient by hand (as outlined in the section at the top of this page). However, you won’t have to calculate the regression coefficient by hand in the AP test — you’ll use your TI-83 calculator. Why? Calculating linear regression by hand is very time consuming (allow yourself about 30 minutes to do the calculations and check them) and because of the huge number of calculations you have to make you’re very likely to make mathematical errors. When you find a linear regression equation on the TI83, you get the regression coefficient as part of the answer. Sample problem: Find the regression coefficient for the following set of data: x: 1, 2, 3, 4, 5. y: 3, 9, 27, 64, 102. Step 1: Press STAT, then press ENTER to enter LISTS. You may need to clear data if you already have numbers in L1 or L2. To clear the data: move the cursor onto L1, press CLEAR and then ENTER. Repeat for L2 if you need to. Step 2: Enter your x-data into a list. Press the ENTER key after each entry. 1 ENTER 2 ENTER 3 ENTER 4 ENTER 5 ENTER Step 3: Scroll across to the next column, L2 using the arrow keys at the top right of the keypad. Step 4: Enter the y-data: 3 ENTER 9 ENTER 27 ENTER 64 ENTER 102 ENTER Step 5: Press the STAT button, then scroll to highlight “CALC.” Press ENTER Step 6: Press 4 to choose “LinReg(ax+b)”. Press ENTER. The TI 83 will return the variables needed for the linear regression equation. The value you’re looking for >the regression coefficient > is b, which is 25.3 for this set of data. That’s it! Back to top Linear Regression Test Value Two linear regression lines. Linear regression test values are used in simple linear regression exactly the same way as test values (like the z-score or T statistic) are used in hypothesis testing. Instead of working with the z-table you’ll be working with a t-distribution table. The linear regression test value is compared to the test statistic to help you support or reject a null hypothesis. Linear Regression Test Value: Steps Sample question: Given a set of data with sample size 8 and r = 0.454, find the linear regression test value. Note: r is the correlation coefficient. Step 1: Find r, the correlation coefficient, unless it has already been given to you in the question. In this case, r is given (r = .0454). Not sure how to find r? See: Correlation Coefficient for steps on how to find r. Step 2: Use the following formula to compute the test value (n is the sample size): How to solve the formula: Replace the variables with your numbers: T = .454√((8 – 2)/(1-[.454]2)) Subtract 2 from n: 8 – 2 = 6 Square r: .454 × .454 = .206116 Subtract step (3) from 1: 1 – .206116 = .793884 Divide step (2) by step (4): 6 / .793884 = 7.557779 Take the square root of step (5): √7.557779 = 2.74914154 Multiply r by step (6): .454 × 2.74914154 = 1.24811026 The Linear Regression Test value, T = 1.24811026 That’s it! Finding the test statistic The linear regression test value isn’t much use unless you have something to compare it to. Compare your value to the test statistic. The test statistic is also a t-score (t) defined by the following equation: t = slope of the sample regression line / standard error of the slope. See: How to find a linear regression slope / How to find the standard error of the slope (TI-83). You can find a worked example of calculating the linear regression test value (with an alpha level) here: Correlation Coefficients. Back to top Leverage in Linear Regression Data points that have leverage have the potential to move a linear regression line. They tend to be outliers. An outlier is a point that is either an extremely high or extremely low value. Influential Points If the parameter estimates (sample standard deviation, variance etc.) change significantly when an outlier is removed, that data point is called an influential observation. The more a data point differs from the mean of the other x-values, the more leverage it has. The more leverage a point is, the higher the probability that point will be influential (i.e. it could change the parameter estimates). Leverage in Linear Regression: How it Affects Graphs In linear regression, the influential point (outlier) will try to pull the linear regression line toward itself. The graph below shows what happens to a linear regression line when outlier A is included: Two linear regression lines. The influential point A is included in the upper line but not in the lower line. Outliers with extreme X values (values that aren’t within the range of the other data points) have more leverage in linear regression than points with less extreme x values. In other words, extreme x-value outliers will move the line more than less extreme values. The following graph shows a data point outside of the range of the other values. The values range from 0 to about 70,000. This one point has an x-value of about 80,000 which is outside the range. It affects the regression line a lot more than the point in the first image above, which was inside the range of the other values. A high-leverage outlier. The point has moved the graph more because it is outside the range of the other values. In general, outliers that have values close to the mean of x will have less leverage that outliers towards the edges of the range. Outliers with values of x outside of the range will have more leverage. Values that are extreme on the y-axis (compared to the other values) will have more influence than values closer to the other y-values. Like the videos? Subscribe to our Youtube Channel. Connection to Affine Transformation Linear regression is infinitely connected to affine transformation. The formula y’ = b + ax isn’t really linear…it’s an affine function, which is defined as a linear function plus a transformation. So it should really be called affine regression, not linear! References Edwards, A. L. An Introduction to Linear Regression and Correlation. San Francisco, CA: W. H. Freeman, 1976. Edwards, A. L. Multiple Regression and the Analysis of Variance and Covariance. San Francisco, CA: W. H. Freeman, 1979. -- Need help with a homework or test question? 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