BEGINNING COLLEGE AND PRE-COLLEGE MATH COURSES: CONTENT SUMMARY

Math 60: Intro to Algebra
Overall design: Beginning algebra for students with no previous algebra experience

Common Topics
- Algebra: basic operations with integers, exponents, algebraic expressions. Linear equations
- Analytical tools: graphing, dimensional analysis, scientific notation, ratio and proportion
- Basic statistics: mean, median, mode, bar graphs
- Applied problems

Math 65: Elementary Algebra
Overall design: Continued development of manipulative algebra skills from MTH 60
Common Topics
- Simplifying algebraic expressions
- Arithmetic of polynomials
- Graphs and solutions of linear and quadratic equations
- Word problems that involve linear and non-linear relationships

Math 95: Intermediate Algebra
Overall design: Fundamental concepts of algebra for students familiar with elementary algebra, basic geometry and statistics. The course is equivalent to second year high school algebra.

Common Topics
- Expressions: inequalities, absolute values, complex numbers, expressions that include radicals
- The idea of functions and function notation
- The behavior of some functions in particular: linear, quadratic
- Arithmetic of polynomials
- Factoring to solve quadratic equations
- Graphing to visualize fxns and solve equations
- Systems of equations

Math 111: College Algebra

Overall design: Fast-paced rigorous treatment of the algebra needed by students preparing for trigonometry, statistics, or calculus.

Common Topics
- Functions: polynomial, rational, exponential, log, linear, non-linear, inverse
- Representation of functions symbolically, numerically, graphically, verbally
- Elementary mathematical modeling

Math 243: Intro to Probability and Statistics
Overall design: Introduction to the methods of probability and descriptive statistics, designed to acquaint students with some basic theory and applications.

Common Topics
- Probability: counting and probability, common probability distributions
- Descriptive Statistics: sampling, confidence intervals, regression and correlation
- Graphical display of data

Mth 105: Math in Society
Overall design: A solid foundation in quantitative reasoning, symbolic reasoning, and problem solving techniques for students interested in Arts and Letters/Humanities

Major Topics   (as proposed Fall 2014)
- Logical Reasoning and Problem Solving
    - Describing and critiquing arguments
    - Applying strategies of problem solving

- Probability and Statistics
    - Measures of central tendencies and spread
    - Calculating and interpreting basic probabilities
    - Interpreting graphical displays/histograms

- Financial Literacy
    - Taxation as percent (*e.g.* sales, income)
    - Interest: simple and compound
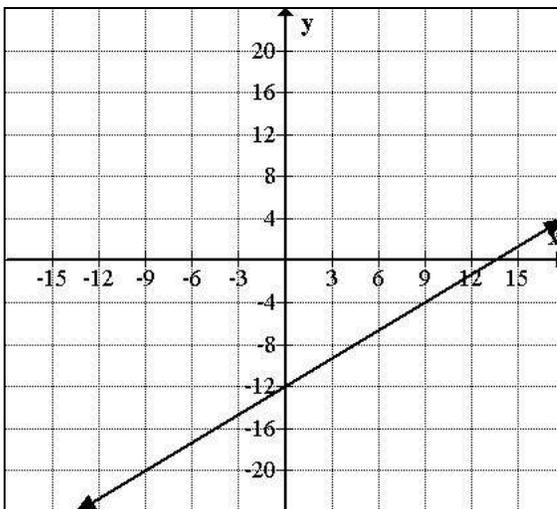

ALGEBRA:
BASIC OPERATIONS WITH INTEGERS, EXPONENTS, ALGEBRAIC EXPRESSIONS AND LINEAR EQUATIONS

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1. Solve $S = 4lw + 2wh$ for h

2. Find the equation of the line that passes through the point $(3, 4)$ and is parallel to the line

$$y = \frac{2}{3}x + 5$$

3. Find and state the equation of the line in the graph below.

4. Solve the equations and state if there is no solution or infinite solutions.

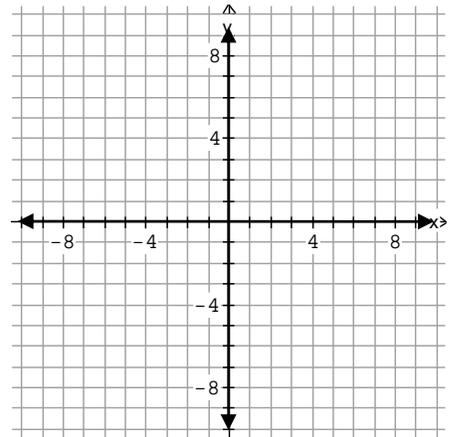**a)** $3(x + 1) = 7(x - 2) - 3$ **b)** $\dfrac{5}{2}x - 3 = -x$ **c)** $2x - 4 = 3(x - 1) - x$

5. Find the line equation, in _slope intercept_ form, that has the same y-intercept as the line: y = 3x + 4 and is parallel to the line: x + 3y = 5.

ANALYTICAL TOOLS:
      GRAPHING, DIMENSIONAL ANALYSIS, SCIENTIFIC NOTATION, RATIO AND PROPORTION

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6. Graph $5x - 3y = -9$ on the grid to the right by first putting the equation into **slope-intercept form**.

7. Berri can run 20 laps on the track in 50 minutes. If one lap is 400 meters long, how fast can Berri run in miles per hour? Use unit analysis to solve. You do not need to divide the fraction.

<div align="center">1000 meters = 1 km   1.61 km = 1 mile</div>

APPLIED PROBLEMS

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8. This year's salary, $42, 074, is a 9% increase over last year's salary. What was last year's salary? You must show an equation, and then solve that equation for the unknown. Remember to define your variable(s). State the answer in a full sentence.

9. You invested $20,000 in two accounts paying 7% and 9% annual interest. If the total interest earned for the year was $1550, how much was invested at each rate?

SIMPLIFYING ALGEBRAIC EXPRESSIONS

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1. Write each of the following using only positive exponents:

a) $(5x^{-7})(6x^2)$

b) $\dfrac{(3y^8x^0)^{-2}}{y^{10}}$

2. Completely simplify each radical expression. Make sure that all denominators are rationalized and that all fractions are reduced. Leave the answer in simplified form.

a) $\sqrt[3]{-8}$

b) $\sqrt{-16}$

c) $-\sqrt{52}$

d) $\sqrt{10x}\sqrt{2x^4}$

e) $\dfrac{3}{\sqrt{5}}$

f) $\dfrac{2}{\sqrt{8}}$

ARITHMETIC OF POLYNOMIALS

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3. Factor the following:

    a) $x^2 - 5x + 4$

    b) $18xy^2 - 8x$

    c) $2x^2 - 7x + 3$

    d) $z^4 - 16$

GRAPHS AND SOLUTIONS OF LINEAR AND QUADRATIC EQUATIONS

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4. A line with a slope of 0 is:

    a. a horizontal line.

    b. a vertical line.

    c. a line that rises to the right.

    d. falls to the right.

5. Solve the following system using each of the following methods: substitution, elimination, and graphing. Then check your solution.

$$\begin{cases} 2x + y = -6 \\ x - 2y = -8 \end{cases}$$

6. Find the equation of the line in slope-intercept form that is **_parallel to_** $4x - 2y = 8$ and contains the point: (6, 1).

7. Solve the following quadratic equations using which ever method you wish. Reduce irrational answers as much as possible.

a) $x^2 + 4 = -5x$

b) $2x^2 - 26 = 0$

c) $(x + 4)^2 = 25$

d) $x^2 + 3x + 1 = 0$

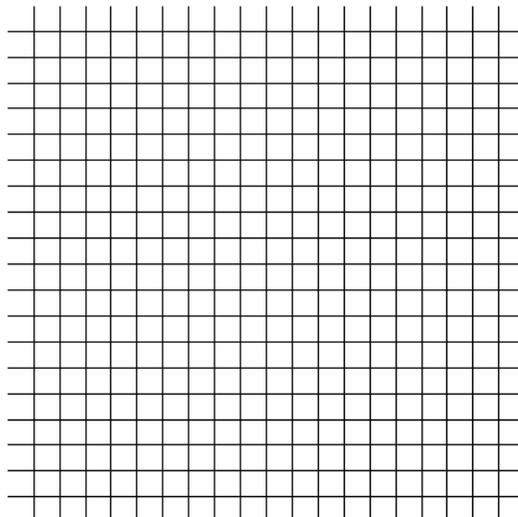**8.** Consider the parabola with equation $y = x^2 - 4$

a) Determine if the parabola opens upward or downward.

b) Find the parabola's x-intercepts

c) Find the parabola's y-intercept

d) Find the parabola's vertex

e) Graph the parabola. Make sure you *label* your axes and your scale.

WORD PROBLEMS THAT INVOLVE LINEAR AND NON-LINEAR RELATIONSHIPS

9. Set up a system of linear equations for the application problem and solve by the method of your choice.

A custodian wants to mix a 6% ammonia solution and an 18% ammonia solution to get 750 ml of a 10% ammonia solution. How many ml of each type of solution should the custodian use?

10. Three Clifford Bars and 6 Zoned Bars contain a total of 1980 calories. Four Clifford Bars and one Zoned Bar contain a total of 1170 calories. How many calories are there in each type of bar? Make sure you define your variables and state your conclusion in a full sentence.

Math 95 Final Exam Questions

EXPRESSIONS:
   INEQUALITIES, ABSOLUTE VALUES, COMPLEX NUMBERS, EXPRESSIONS THAT INCLUDE RADICALS

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1. Solve for *x* and write your answer in subset notation

a) $-2x+1\leq 3$ **b)** $|2x-9|=7$ **c)** $|5-3x|>3$

2. Simplify:

a) $2\sqrt{12}+7\sqrt{3}$ **b)** $\sqrt[3]{\dfrac{3}{x}}\sqrt[3]{\dfrac{9}{x^2}}$ **c)** $(1-i)(2+3i)$

FUNCTIONS AND THE BEHAVIOR OF SOME IN PARTICULAR: LINEAR, QUADRATIC

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3.   Determine whether each relation is a function. Give the domain and range for each relation.

a) $\{(2,7),(3,5)(4,6)\}$

b) $\{(2,7),(3,7)(4,7)\}$

c) $\{(12,13),(14,15)(12,19)\}$

4. Put the following quadratics into vertex form by completing the square. Then state the

vertex: **a)** $f(x)=x^2+4x-7$ **b)** $f(x)=3x^2+12x+8$

5. The amount spent by governments and businesses worldwide on goods and services to thwart terrorists is increasing. The formula
$$T(x) = 0.6x^2 + 5.4x + 28$$
models the amount spent to fight terrorism, T, in billions of dollars, *x* years after 2003.
(source: Homeland Security Research)

a) How much was spent to fight terrorism in 2007?

b) By which year is the amount spent to fight terrorism expected to reach $160 billion? Back up your claim with mathematic

c) Find T(2), then interpret the meaning of it in the *context* of the problem

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ARITHMETIC OF POLYNOMIALS

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6. Divide and **simplify**.

$$\frac{x^2 + x}{2x + 6} \div \frac{x}{x + 3}$$

7. Perform the following indicated operations and *simplify the results* if possible:

a) $\dfrac{\sqrt{50x^6 y}}{\sqrt{2x^2 y^{-1}}}$

b) $\dfrac{(3x^{-4} y)^2 (4x^5 y^{-2})}{(2x^{-2} y)^2}$

c) $2\sqrt{20} - 3\sqrt{125} + 5\sqrt{45}$

d) Rationalize the denominator: $\sqrt[3]{\dfrac{2}{xy^2}}$

e) $\dfrac{x + 2}{4x + 16} - \dfrac{2}{x^2 + 4x}$

f) $\dfrac{3y^2 - 12}{y^2 + 4y + 4} \div \dfrac{y^3 - 2y^2}{y^2 + 2y}$

g) $(\sqrt{2x} - 3)^2$

h) $(4 - 3i)^2$

GRAPHING TO VISUALIZE FUNCTIONS AND SOLVE EQUATIONS

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8. Sketch the parabola by finding the vertex, x-intercepts, and the y-intercept.
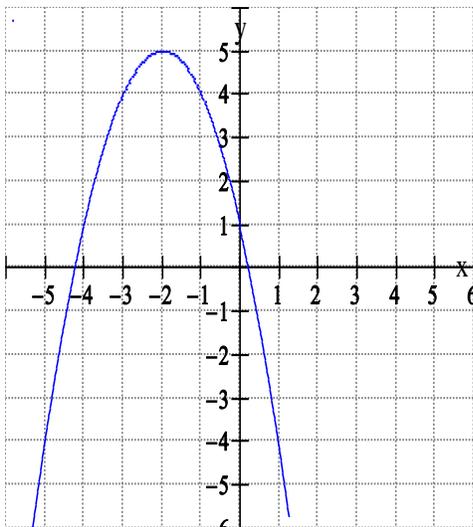   f(x) = − (x + 1)² + 4

   a) vertex:_____

   b) x-intercepts:

        c) y-intercept:_____

        d) Use the points from a—c to sketch the parabola in the space above. Mark your axes, scale and coordinates of points.

9. From the graph of $f(x)$ determine:

a) $f(-3)$ ....

b) $f(1)$ ....

c) Any x value for which $f(x) = 4$ ....

d) x-intercepts ....

e) y-intercept ....

f) The coordinates of the vertex ....

g) The equation of the axis of symmetry ....

h) Interval over which the function is increasing..............

i) The vertex form of the equation of the parabola assuming $a = \pm 1$ ....

FUNCTIONS: POLYNOMIAL, RATIONAL, EXPONENTIAL, LOGARITHMIC, LINEAR, NON-LINEAR, INVERSE

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1. The following function is one-to-one. Algebraically find its inverse. Show your steps.

$$f(x) = \sqrt[3]{5x+2}$$

2. Given $f(x) = \dfrac{3x+5}{x-3}$, $g(x) = 2x - 5$ and $h(x) = x^2 + 4x$ algebraically find:

a) $(h-g)(x):$_____

b) $(h \cdot g)(3):$_____

c) $(g \circ h)(x):$_____

d) $f(-4):$_____

e.) $f^{-1}(x):$_____

f) $\dfrac{g(x+h)-g(x)}{h}:$_____

3. Which of the following polynomials has the same end-behavior as
$$p(x) = 2 + 3x^2 - 5x^5 + x + x^4?$$

a) $f(x) = -2x(x-2)(x+3)^2$

b) $w(x) = -.5(x-2)^2(x+3)$

c) $h(x) = -4(x-2)^2(x+3)^2$

d) $g(x) = 3x(x-2)(x+3)$

e) $k(x) = 5(x-2)^2(x+3)$

4. Simplify each logarithm, if possible.

    a) $\log_2 16 =$ _____

    b) $\ln\left(e^{3x}\right) =$ _____

    c) $\log_8\left(4\right) =$ _____

    d) $\log_7\left(0\right) =$ _____

5. Solve the following logarithmic or exponential problems.

   **a)** $\log_2 \dfrac{1}{16} =$ _____

    b) $10^{\log 7} =$ _____

6. Answer the following questions using the rational function, $g(x) = \dfrac{x^2 - 9}{x^2 - 16}$

    a) Find the *y*-intercept of *g*, if any.

    b) Find the *x*-intercept(s) of *g*, if any.

    c) Write the equations of **all** of the asymptotes of this function (vertical, horizontal, and/or oblique).

    d) Sketch a possible graph of the function, **showing all the key features** above as well as any turning points, end behavior, and behavior near asymptotes.
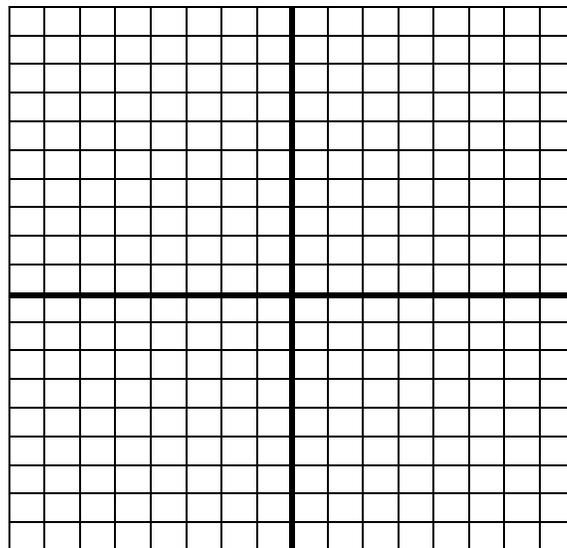
REPRESENTATION OF FUNCTIONS SYMBOLICALLY, NUMERICALLY, GRAPHICALLY, VERBALLY

7. Sketch the graph of the quadratic function given below. Give the coordinates of the vertex, the y-intercept, and a few other points on the graph, and show the line of symmetry (as a dashed line).

$$f(x) = -x^2 + 2x + 3$$

8. Label each function with the graph (**I** through **IX** below) that fits best.

a) $a(x) = |x|$ _____

b) $b(x) = \ln(x)$ _____

c) $q(x) = \dfrac{1}{(x-3)^2}$ _____

d) $c(x) = 2e^{.23x}$ _____

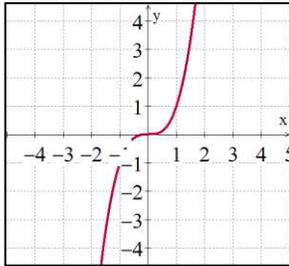**e)** $g(x) = x^3$ _____

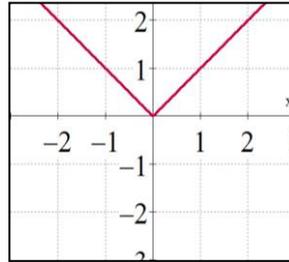**f)** $r(x) = \dfrac{x-3}{x^2}$ _____

g) $h(x) = \sqrt{x}$ _____

h) $f(x) = -x^2$ _____
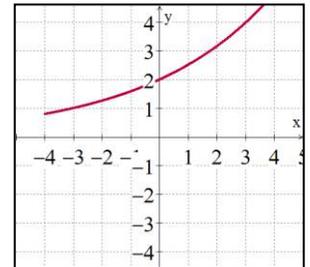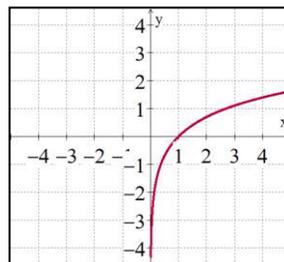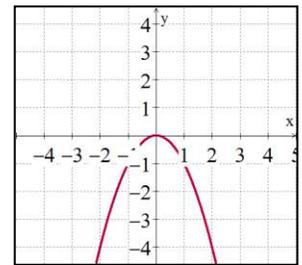
i) $p(x) = \dfrac{1}{x-3}$ _____

I.

II.

III.

IV.

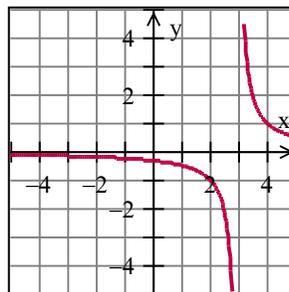**V.**

VI.

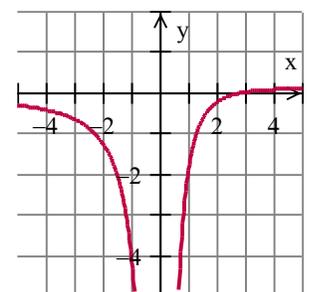**VII.**

VIII.

IX.
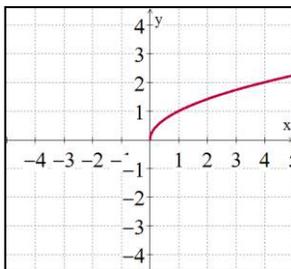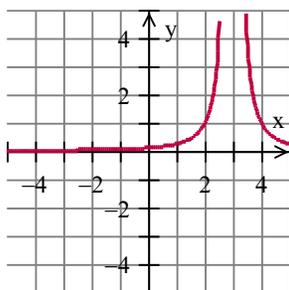
9. Indicate whether each statement is **True** or **False**:

_____The domain of every polynomial function consists of all real numbers.

_____The inverse of an exponential function is a linear function.

_____All even degree polynomial functions will have either a maximum or a minimum
       point.

_____ The leading coefficient of a polynomial determines its graph's end behavior.

_____ The function $f(x) = \ln(x)$ has a range of all real numbers.

_____ A polynomial function of degree n has n turning points.

_____ A function that is one - to - one has an inverse that is a function.

ELEMENTARY MATHEMATICAL MODELING

10. Use the exponential growth formula ($A = A_0 e^{kt}$) to determine the continuous **growth rate**
which would have Lane County, Oregon (population approximately 306,250 people) looking
like Los Angeles County, California (population of 9,800,000) in 60 years? (I discovered that
they cover approximately the same land area.) Show your steps, and express your answer
as a **percent**.

11. A function accepts as inputs a speed between 45 and 80 miles per hour and outputs the
average fuel economy in miles per gallon of a car traveling at that speed.
 Interpret f(60) = 38.

a) A car that is 60 years old has average fuel economy of 38 miles per gallon.

b) A car traveling at 60 miles per hour has an average fuel economy of 38 miles per gallon.

c) A car which has fuel economy of 60 miles per gallon, is traveling at 38 miles per hour.

d) A car traveling at 38 miles per hour has an average fuel economy of 60 miles per gallon.

12. A company producing electronic components used in television sets has established that on average, a new employee can assemble *f(x)* components per day after *x* days of on-the-job training, as given by $f(x) = \dfrac{50x}{x+4}$, $x \geq 0$.

a) Determine the horizontal asymptote of this function.

b) Interpret the meaning of the horizontal asymptote in the context of the problem.

13. A population of rabbits is growing exponentially. In 2008, the population is 400. In 2010, the population is 900. Give a formula for P (t) ; the number of rabbits, at t years after 2008.

PROBABILITY: COUNTING AND PROBABILITY, COMMON PROBABILITY DISTRIBUTIONS

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1. You're playing a game that involves using a spinner with the numbers 1 to 5 printed on it (each number is equally likely). Let X represent the value that the spinner yields after a fair spin.

    a) Create a probability model and histogram for the distribution of X.

    b) Calculate E[X].

    c) Calculate SD[X].

2. While at BestBuy, Kevin looks at new TV/BluRay combos. He finds that there are 120 TVs at BestBuy of which 80 are HDTVs, 50 have built in BluRay players, and 45 are both HDTVs and have BluRay.

    a) Create a diagram illustrating the situation.

    b) Suppose that a TV is pulled at random. Calculate P(BluRay OR

    c) Using probability rules, determine if the events of randomly grabbing a TV with BluRay and grabbing a TV that is an HDTV are independent.

DESCRIPTIVE STATISTICS:
       SAMPLING, CONFIDENCE INTERVALS, REGRESSION AND CORRELATION

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3. Compact fluorescent light bulbs have an average lifespan of 8000 hours, with a standard deviation of 2100 hours. Assume that the lifespans of these light bulbs are normally distributed.

    a) What percentage of light bulbs will have a lifespan **longer than** 7500 hours? Round to the nearest tenth of a percent.

    b) Find the **first quartile** of the light bulb lifespans in this distribution. Round to the nearest hour.

4. Researchers interviewed simple random samples of 500 female college students and 550 male college students. Each student is asked if he or she preferred cats or dogs. In all, 360 of the women and 284 of the men say "dogs." What type of test should we use if we want to test for a difference in the proportions of male versus female college students who prefer dogs over cats? What would the hypotheses be? (*You do not need to run the test.*)

5. Explain in simple language what the "90% confidence" part of a "90% confidence interval" means.

6. A coin is tossed 20 times, resulting in 6 heads. Is this strong enough evidence to reject the hypothesis that the coin is balanced (that is, that the probability of getting heads is 0.5) in favor of the alternative hypothesis that the coin is not balanced? Include a probability (P-value) in your answer.

7. The diastolic blood pressure for American women ages 18 to 44 is approximately normally distributed with a mean of 75 millimeters of mercury (mmHg). We suspect that regular exercise will lower the blood pressure. A random sample of 25 women who jog at least 5 miles per week was selected, and the sample mean and standard deviation of the blood pressures were $\bar{x} = 72$ mmHg and $s = 10$ mmHg. We want to investigate whether the sample provides good evidence that the mean diastolic blood pressure for the population of regular exercisers is lower than 75 mmHg.

a) Is it an observational study or an experiment? Explain how you know.

b) State your null and alternative hypotheses. (Remember to consider a 1-sided or 2-sided test.

c) Run the appropriate test and give the value of the test statistic (t or z) and the P-value.

d) State a conclusion in words (use $\alpha = 0.05$). Be sure to give context for your conclusion.

e) Can the sample be used to support the claim that "regular exercise lowers blood pressure"? Explain why or why not. (*Hint*: consider your answer to part (a).)

f) Suppose we found a mistake in the information – the sample size was actually 250, not 25, and the sample mean and standard deviation were the same as before. Calculate the new P-value and state a new conclusion in words.

GRAPHICAL DISPLAY OF DATA

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8. Wendy works at Red Robin and she records the following information about the number of people in the party and their tip:

Size of Party	Tip Amout ($)
3	6.50
1	5
2	6
4	8.50
8	12.50
5	8
10	16
SD	3.251	3.952
Mean	4.714	8.929
Correlation	.984	

a) Create a scatter plot with the above data.
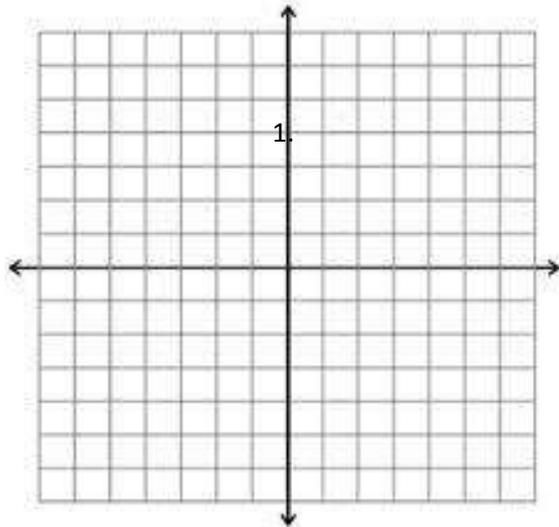
b) Determine the least-squares line. You can use StatCrunch to do this.

c) What does the slope mean in the context of the problem?

d) What is the residual for x = 10?   What does this mean?