

## Geometry Formulas Project

Calling all architects. I am interested in building a new house for myself and a new building for my company. I am looking for proposals. I am looking for exciting combinations of geometric shapes to be incorporated into these buildings. Your proposal should include floor plans for each level of your house or building. It should also include a 3-D scale model. Please make sure you include a scale relating both the floor plans and the scale model to the real life size of the building. This way I can get an idea of how big your proposed edifice will be when actually built.

### Student Goals:

1. Students will be able to measure the dimensions of a variety of geometric shapes
2. Students will be able to calculate the perimeter, area, surface area, and volume of a variety of 2 and 3-d geometric shapes using the appropriate formulas.
3. Students will be able to use scale to determine the actual size of objects from smaller models
4. Students will be able to communicate about how geometric shapes exist in the natural world and how man adapted them for use in real world occupations.

This project has 3 deliverables:

#### 1. List of Geometric Shapes found in nature and in architecture.

We will take a tour of the school area and inside the school stopping at various locations. You will be required to keep a list of all two and three dimensional geometric objects that you notice at each of these locations. You will need to identify if they are natural or manmade. This is worth 50 points

#### 2. Geometry Notebook

You will create a geometry notebook that contains one page for each of the following geometric shapes: Triangle, Square, Rectangle, Parallelogram, Trapezoid, Circle, Cube, Rectangular Prism, Triangular Prism, Cone, Cylinder, Square Based Pyramid, Tetrahedron, and Sphere. On each page you will create a picture of the shape using construction paper, three dimensional shapes will be made and kept in a shoe box. For each shape you will use a ruler to identify all the important dimensions of that shape and these will be recorded on that shape's page. You will then write the appropriate formulas for perimeter, area, volume and surface area as for each shape. Finally, you will use the dimensions you measured and the appropriate formula to find the area, perimeter, volume, and surface area for each shape and record this on the appropriate page. This is worth 100 points.

#### 3. Scale Model House or Other Building

You will need to include the following:

Floor Plans:

- Layout of each floor. I. E. What rooms are located where and what shape are they?
- Dimensions of each room. I.E. Length, Width, Height, and/or Radius in circular shaped rooms.
- Scale from floor plan to full size building.
- Location of doors, windows, and closets
- Legend is included

Scale Model:

- Detailed exterior view of building.
- Scale from model to full size building.

Both:

- Demonstration of use of a variety of 2-D and 3-D geometric shapes.
- Scales correspond to each other.
- Neat, good quality floor plans and model.

**Scoring: 200 points**

All measurements are accurate. (10pts.)  
Area, Perimeter, Volume, and Surface Area  
Calculations are made to determine  
amount of material needed to construct  
the full size building (50 points)  
Floor plans are neat and accurate (30pts.)  
Legend is present and includes scale. (10pts.)  
Scales from floor plans and scale model correspond (30pts.).  
Scale model is neat and well made. (50pts.)  
A variety of 2-D and 3-D shapes are used in your designs. (30pts.)

## Mathematics Newspaper

Directions: You will work in a group of five people to create a newspaper. Each person will be responsible for one section. The sections are Main, Sports, Entertainment, Classifieds, and Editorial. All articles and information in each section must be related in some way to math. Each section must have a minimum of four items.

Main Section - This section is where the day's news would be. You can write articles about famous mathematicians, current events and other interesting math related information. This section will require some research to find the information to write about. Another thing that would work in this section would be to interview someone and find out how they make use of math in their job. You could also take a concept such as Pi and research its history and how it still occupies mathematicians today. You could also write a story that requires graphs or charts to illustrate it. If you have something that you think might work for this section, but are not sure then check with me before you begin writing it

Sports - All through the sports pages you find statistics. You can explain how those statistics are developed. You could focus on a particular player or team and run down their stats and what they mean. You could also develop your own system for rating a player based on some combination of their statistics. For example, the paper publishes QB ratings each week based on a specific combination of statistics that rate their skills.

Entertainment - This section includes the funnies, movie reviews, TV ratings, advice columns, book reviews, theater reviews, and other social items. You can write a comic strip, read and review a math related book or movie, write an advice column that helps readers solve math problems., discuss the Nielson ratings or other similar items.

Classifieds - this is section that has ads for people wanting to buy or sell things, job opportunities, apartment listings and personals. Create ads for selling math related products or for jobs with strong math abilities needed

Editorials - This section contains people's opinions, both from professional columnist and private citizens. You must write one editorial that is the opinion of the paper so to speak. The topic of this editorial and the paper's opinion on it must be decided on by and agreed to by your whole staff. Then, the person responsible for the editorial section will actually write the article.

Once you have all your articles written you will assemble your paper. Each section editor will be responsible for assembling their section. That does not mean that the editor of the section has to write all the material contained in that section. The section editor is responsible for making sure that the four articles or other items are completed on time and then deciding how those articles will be laid out on the page. You can split up the writing duties however you want. As a staff, you must together come up with a title for your paper that will be on the front page of the paper. The person in charge of the editorial section is also in charge of the paper as a whole. It is this person's job to assemble the editorial page, assure that all the other sections are completed on time, and finally, to oversee final assembly of the complete paper. This is a true group effort. If one person fails to complete their assigned articles and/or section of the paper the grade for the whole staff will suffer. Please note that for this project there will also be an individual grade. This will follow the same criterion listed below, but will only be based on the section of the paper you are directly responsible for.

Scoring:

Variety of Material Included (50 points)

Math Connectedness (50 points)

Creativity (50 points)

Depth of Coverage (50 points)

Total Points: - 200

## Angle Study Project

### Student Objectives:

1. Students will be able to determine what kind of angle a given angle is
2. Students will be able to identify triangles by angle and side relationships
3. Students will be able to determine if triangles are congruent or similar using the appropriate tests.
4. Students will be able to identify and calculate complementary and supplementary angles.
5. Students will be able to compare parallel and perpendicular lines.
6. Students will be able to use vertical angles and alternate interior angles to determine the measures of missing angles.

**Directions:** You will design and create a kinetic sculpture. It must include the following elements, which you must be prepared to locate and explain how you know what they are:

- 1) Scalene, Isosceles, Equilateral Triangles
- 2) Obtuse, Acute, and Right Triangles
- 3) Parallel and Perpendicular Lines
- 4) Vertical Angles
- 5) Complementary Angles
- 6) Alternate Interior Angles
- 7) Supplementary Angles
- 8) Similar Triangles
- 9) Congruent Triangles
- 10) Movement

Keep in mind that many of these elements can be combined into a single part of your work. For example, you can have two congruent equilateral acute triangles that intersect at a pair of vertices to form vertical angles. In this way you have taken care of 4 of the required elements in one blow. The more creativity you show in using and combining the required elements will also help your grade. The last element is important. Kinetic sculpture is by definition a sculpture that has movement. This does not mean that it must be self-powered. The movement can come from you or other outside source. If your sculpture does not move you will lose points.

### Scoring:

Presence of the first 9 required elements (90 points) - Each of the first 9 elements listed above must be present either alone or in combination with other elements.

Presence of movement (50 points) - Your sculpture must move either in part or in whole. This movement can be caused by either external or internal means. This means the movement may be caused either by your hand pushing it or electric power. Once moving the sculpture must remain moving unaided for a period of not less than two minutes.

Creativity of use and combinations of elements (50 points) - The 10 elements should be combined in unique and interesting ways. This means that I don't want to see a bunch of

triangles piled on top of each other. Instead, I want to see them combined to create a sculpture that is expressive of something. It could be a mood, a place, a thing. Also, please make use of color in your project. Please feel free to use other types of shapes. You do not need to limit yourself to triangles and angles.

Paper/Presentation (50 points) - You will either write a paper or give a presentation that will describe how you made use of the 10 required elements.

Total Points: 240

## Problem Solving Study

Directions: We will be studying problem solving and the methods by which we solve various problems. Each class we will introduce a new problem solving method and solve various problems that use that method. You will create a portfolio of original problems each using a different method to solve it. You will have at least one problem for each method we talk about. We will also have a test on this material.

### Student Objectives:

1. Students will be able to distinguish between the following problem solving strategies: Guess and Check, Work Backwards, Look for Patterns, Start with a Smaller Problem, Draw a Diagram, Make a List, Use Objects, and Make a Table
2. Students will be able to solve problems using the problem solving strategies: Guess and Check, Work Backwards, Look for Patterns, Start with a Smaller Problem, Draw a Diagram, Make a List, Use Objects, and Make a Table

### Deliverables:

1. Daily Problems - There will be 8 of them. Each will be worth ten points. They will be scored on correctness of answer and use of selected method for solving the problem. This means that to score the full ten points, your answer must be correct and you must show evidence that you used the selected method to reach the solution the problem.
2. Problem Solving Workbook - I will be looking for a minimum of 8 problems, one for each method of problem solving. They must be original. They must have solutions. Please indicate which method you would use to solve each problem. You should package your portfolio in a colorful and interesting fashion.
3. Test - There will be 10 problems on the test. Each will be worth ten points. You will be scored on correctness of your answers. However, you can earn partial credit, so please show all your work. If you only show me an answer and its wrong you can get no partial credit and you lose all ten points for that question. If you show me your work, then I have a basis on which to see where your mistake happened and then I can give you some points for the problem

### Scoring:

Daily Problems: (80 Points)

Problem Solving Workbook: (120 Points)

Detailed Breakdown:

Cover- (20 points) – The cover will be colorful and reflect the various problem solving strategies that we have looked at. You can adorn your cover with colorful symbols and words that somehow describe the strategies that we have looked at. You can give your portfolio an interesting title

Contents - (10 points) - You will include a table of contents that indicates what strategy you would use to solve each of your eight problems

Problems - (40 points) - You will create eight problems that can be solved using the strategies as indicated in the table of contents

Style - (40 points) - Your problems will each be creative and challenging. You might want to include pictures or other visuals with your problems.

Answer Key - (10 points) - You will include an answer key that shows how you solved each of your problems and has the correct answer for each problem

Test: (100 Points)

Total Points: (220 Points)

## Transformation Jigsaw Rubric

Directions: You will create a jigsaw puzzle using the four types of transformations. We have spent parts of four classes reviewing each of the four types of transformations. Your puzzle image must make use of shifts, rotations, reflections, and dilations. You will also write a one-page paper explaining how you made use of each of the four in creating your image. You will need to make two copies of your puzzle. One image you make will actually be cut into the puzzle itself. The second image will be used so that we can see what the completed puzzle should look like. You can either transfer your design onto a precut puzzle blank or onto cardboard or poster board or cut it yourself. On the due date we will assemble each other's puzzles and peer evaluate them. My evaluation will be based on creativity and complexity of design, use of the four transformations, difficulty of assemblage, and overall quality.

### Student Goals

1. Students will be able to use the algebraic transformations of shifts, reflections, dilations, and rotations to manipulate images on a coordinate plain.
2. Students will be able to use the correct algebraic notation and computation to manipulate Algebraic functions using the 4 transformations.

### Scoring:

Use of four transformation - (80 points) Score will be based on the presence and effective use of each of the four transformations. In other words, the transformations combine to create a dynamic image. They are simply not tossed into the image so that you can say I used them. They should be used to create one fluid image rather than **four** distinct images that each uses one of the four transformations.

Complexity and Creativity - (30 points) Score will be based on the originality of picture. I want to see color. I want to see an image that makes the puzzle difficult to put together. I want more than just a pencil drawing of a house and tree. These can be abstract images or more realistic images. It is easier to do this with more abstract images

Peer Evaluation - (20 points) Your peers will evaluate you on the following: Difficulty of assembly, enjoyment of assembly, how they liked the design of the puzzle, and an overall rating. These will be scored on a scale of 1 to 5.

Paper - (50 points) Score will be based on thoroughness of explanation. The more detail you can use the higher the score. If you make use of the various types of notations we talked about your score will be higher. An example might be, in order to create the effect of the ripples on the water I first drew a circle and then created succession of dilations of that circle each time using a factor of two to enlarge the previous circle. You will lose points if you fail to include explanations for how you used each type of transformation in your puzzle.

Quality - (20 points) Is the image drawn neatly? Is there evidence that real effort has been put into the creation of this puzzle? Has puzzle been put onto a good surface or is it just loose pieces of paper? The more this has the look and feel of a real puzzle the better your score.

Total Points -200

## 8th Grade Final Project Independent Study

**Directions:** You are to pick a topic that interests you and is related in some way to mathematics. Over the three years that you have been in middle school you have been exposed to a wide variety of math topics and concepts. We have looked at everything from math history to probability to angles. It is your task to either continue your study of one of these topics that piqued your interest or venture to explore a topic completely new to you. You will be expected to do the following tasks. First, you will create some kind of product related to your topic. Finally, you will prepare a presentation that will allow the rest of class to share in your exploration.

**Product:** You must create something that will enhance your project. This could be a video, a computer program, a skit, or other type of product. **(100 points)**

**Presentation:** You will prepare a presentation to share your work with your classmates. Part of your grade for this project will be based on your peer's evaluation of your work through this presentation. It should be between 15 and 20 minutes in length. It can be straight forward or more creative. For example, suppose you are doing Euclid. You could pretend in your presentation that we have time traveled back to ancient Greece. Keep in mind that the more creative and interesting your presentation the better evaluation you are likely to get.  
**(50 Points)**

**Paper:** You will write a 3 to 5 page paper that will accomplish three goals. First, it will describe your finished project. Second, it will show how mathematics is connected to or used in your project. Finally, it will discuss the research you did to create your project and discover how mathematics was related to it. **(50 Points)**

Here is an example of a project. The topic is the abacus. First, I would research the history of and how to use the abacus to perform the basic mathematical operations. My product would be to build my own abacus and learn how to use it. In my presentation I would take on the persona of an abacus expert, perhaps dressing in Oriental clothing to enhance the effect. Then, I would demonstrate on my homemade abacus how to use it as well as sharing its history. This should give you an idea what the project looks like.

**Scoring:** This project will be worth 200 points of your grade for the last trimester. Thus, if you do not do it the best grade you can hope for is a C.

### **Elements:**

- 1) Connection to math (50 points) – Your project must contain a direct connection to mathematics. Math must be used in the construction, manipulation or design of your final product.



- 2) Creativity and Use of Product (100 points) – Your final product must be displayed and used as part of your presentation. The more creatively it is used and the better quality of product it is will earn you more points.
- 3) Presentation (50 points) – Your presentation must be engaging, informative, and reflect the product you create. It must also provide enough good information that we, your audience fully understand what your product is and how it is connected to math. In other words, just talking to us for twenty minutes will not score you the full 20 points.
- 4) Paper (50 points) – Your paper must contain a direct connection to mathematics. Math must be used in the construction, manipulation or design of your final product. You must provide a bibliography of resources you used to in your research.

Any item turned in after its due date will cause points to be deducted from your overall project score. The last day I will except any work from you will be the day your presentation is scheduled. If you are not read to go on the day you are scheduled to present you will lose all points for presentation and I will take whatever you have completed

## FRACTION PROJECT

### Directions:

You will complete one of the projects described below. The grade for this project will primarily be based on your ability to demonstrate your understanding and ability to solve a variety of problems involving fractions and mixed numbers. The more kinds of problems you include the better your grade will be.

**Option 1: Fraction/Mixed Number Workbook** – You will create your own workbook. It should cover the whole range of skills that fall under the heading of fractions and mixed numbers. Include a variety of worksheets. For example, a word search for vocabulary or where solving problems leads to the answer to a riddle. Be creative and colorful.

**Option 2: Fraction Game** – You will create game. It can be entirely original or based on another game you are familiar with. It can be formatted as a board game or game show. It must involve the players having to solve fraction and mixed number problems in some capacity. You must include a set of rules, and answer key for all problems posed, and a description of the game.

**Option 3: Fraction Rap/Song** – You will create a rap or a song that teaches other students how to solve problems involving fractions and mixed numbers. You will need to include a copy of your lyrics. You can set your song to original music or to a familiar tune. You will be required to perform your tune.

**Option 4: Fraction Skit** – You will create and perform a skit that teaches other students how to solve fraction and mixed number problems. You must turn in a copy of your script. Your skit should last about 15 minutes in length.

**Option 5: Short Story:** You will write a short story that incorporates into it solving fraction and mixed number problems. It should be fiction and between 4 and 8 pages long. It should be typed and double spaced. Be creative.

### Rubric-

Math Content- Student will demonstrate through project that they have a solid understanding of fractions and mixed numbers. This can be shown through problems, explanations, descriptions, or other devices. Students must show understanding of the following topics

1. Equivalent Fraction
2. Comparing Fractions
3. Reducing Fractions
4. Adding and subtracting fractions with like and unlike denominators.
5. Multiplying and dividing fractions
6. Converting back and forth between improper fractions and mixed numbers
7. Add, subtract, multiply and divide with mixed numbers

Creativity- These projects are meant to be a fun, hands-on, and creative way to demonstrate your understanding of the concepts related to fractions and mixed numbers. Thus, the more colorful, inventive and creative your projects are the better your grade. It is very easy to tell when a student has put effort into their projects. The difference between a well prepared quality piece of work and one thrown together at the last moment is light years.

Scoring-

Math content (40points)

Creativity (40points)

Presentation (20 points)

### Decimals Project

Your goal for this project is to prepare and then teach a lesson on your assigned topic. You will be in a group of three people. In order to successfully complete this project you must do the following.

1. Make sure that all members of your group are able to do the required math. For example if your group is doing multiplication of decimals. Everyone in your group must be able to do this.
2. Prepare a lesson that will instruct the rest of class in how to do the math. Make sure it is well planned.
3. Prepare an assessment that class will take to determine how well they learned your topic.
4. Make sure that all group members participate in the teaching of the lesson.
5. Make sure your lesson is interesting and creative. Bored students do not learn as well as involved students.
6. Provide good visuals to enhance your lesson.

Your grade for this project will be based on an evaluation of all these elements. Each element has a point value of 10 or 20 points. The whole project is worth 100 points.

## Multicultural Math

### Final Project

This project consists of three parts. First, you will create and design a number system of your own. Second, you will write a short one-page paper, preferably typed, in which you will describe the culture that might have used your number system. Finally, you will present your number system to the rest of class.

Part 1: We have looked at all kinds of number systems. They are pictorial, alphabetic, positional, multiplicative, and simple grouping. Your job is to create a number system of your own. Decide on a set of symbols and what each one represents. Then, decide how you will use those symbols to create larger numbers. Remember, most number systems have symbols for the first ten numbers, then those symbols are combined in various ways to build larger numbers. Make a poster that shows your symbols, what they stand for, and how to translate numbers from your system to ours. The more colorful, creative, and interesting your number system is the higher score you will get.

Part 2: We have also looked at various cultures from the Minoan to the Greek. Now you need to imagine what kind of culture used your number system. Is it a race of aliens from another galaxy or a primitive, undiscovered tribe? Why did they use your number system? Did it come out of the materials available to use like the Babylonians or Egyptians, or did it arise in connection with the alphabet like the Greek or Roman? Maybe, there is a completely different reason. How did they use it? Do they write it like we do or do they have some other way of displaying their numbers, like the Egyptians or Babylonians? You will write a one-page paper that describes what your culture is like, why your number system makes sense for them to use, and how they use it. Again, the more creative you are the higher your score.

For both parts one and two it is very important that your number system makes mathematical sense and that it makes sense for your culture to use it. It would be easy to simply draw some designs on a paper and say here is what they mean and then stick them together randomly and say here *is* how they make a larger number. However, it is likely that there will be no connection between the number system and the culture. You will do better if you develop the culture and the number system together. This is how it happened in the real world.

Part 3: Finally, you will have approximately 8 minutes to share your number system with the rest of class. You will need to show us your symbols and how they are used as well as tell us about the culture that uses them. You will earn more points if you go beyond simply showing us your poster and reading your paper. It would be good if you could demonstrate your number system at the board and maybe have a few students try it as well. Again, be creative.

#### **Student Goals:**

1. Students will understand how number systems are created, function, and why they exist.
2. Students will be able to create an original number system.
3. Students will be able to explain how their number system works and how it connects to the culture that uses it.

**Scoring:**

1. Mathematical sense of number system – Does your number system, no matter how complex or simple allow for understandable representations of numbers. (50 points)
2. Creativity of number system – The more colorful, exciting, and interesting your number system is to experience the better. (50 points)
3. Creativity of culture – The more inventive and well developed the idea of your culture is the better (50 points)
4. Connection between culture and number system. – Is there a logical, meaningful reason why your culture would use your number system. (50 points)
5. Display contains examples of symbols for all numbers in your system. (20 points)
6. Display contains examples of large numbers written using symbols from your number system. (20 points)
7. Creativity of display (20 points)
8. Quality of project (20 points)

Total Points: 280

## Flatland Project

**Directions:** Complete one of the following options.

1. Create a map of Flatland. Based on the description of Flatland in the book design a map of the way Flatland might look. Include both a map of all of Flatland and a map of the state of Colorado and a map of the capitol city of Flatland and a map of Denver. It might be a good idea to look at examples of state and city maps to get an idea of what they look like. You will need to include a legend that includes descriptions of any symbols you use.
2. Create a game that reflects some aspect of Flatland life. For example, you could do a Flatland version of the game of Life where the goal is to become a circle rather than a millionaire. You could do a game of identification that required players to identify members of Flatland society using the methods described in the book. Be creative and inventive.
3. Create a skit or other theatrical presentation that brings to life some part of book. The exchanges between the narrator and the representatives of the other lands would be a good place to start. Be accurate in your portrayal of the scenes and characters you choose. While you don't have to take your dialogue straight from the book make sure it reflects what actually happens in the book.
4. Create a picture album of the life of a citizen of Flatland. You can choose a person of any rank. You could also choose an irregular or a woman. Create a series of pictures that illustrate what the life of your chosen person is like. Take into account what their geometric shape implies about their social status. Draw the Flatlanders as the geometric shapes they are. Be sure to include a caption for each picture you create.

This project is worth 100 points. It will be scored on creativity (25 points), accuracy of reflection of Flatland (50 points), and quality of product (25 points).

## Survey Project

**Directions:** You will be working with a partner to complete a survey. You will need to meet the following requirements:

- 1) The survey must be composed of 4 questions. At least two of those questions must require more than a yes or no answer.
- 2) All 4 questions must be related to a common topic.
- 3) You must poll a group of people that encompasses people beyond school.
- 4) You must graph the data from three of your four questions. You must provide one line graph, one circle graph and one bar graph.
- 5) You must find the mean, median, and mode of each set of data for which it is possible.
- 6) You must devise and solve three percent problems using your data. One of each of these types.
  - a) Find the percent of a number (i.e.: 40% Of 15)
  - b) Find what percent (i.e. What percent of 35 is 21)
  - c) Find the total number(75% of what number is 480)
- 7) Write a one page report analyzing your data.
  - a) Who did you poll?
  - b) How did you choose them?
  - c) Do you think your results reflect the opinions of the population at large?
  - d) What do your results say about the population?
- 8) Make a poster illustrating your results.
- 9) Present your survey and results.

Once again you will have half the block each class time to work on this project. If you use your time well you will be able to complete everything in class with the exception of actually giving your survey. My suggestion is to use is to use the first class time to devise your survey questions. Then plan on giving the survey between that class and the next. That way, you will have your data ready to use by the second class.

### **Rubric:**

Survey (20 points) The survey has four questions all of which connect to a central topic. Questions are such that they provide useful data.

3-Graphs (30 points) Three graphs are present and are accurate representations of the data.

Percent Problems (10 points) Three percent problems are present and use data from the survey.

Analysis Paper (20 points) Analysis provides a complete explanation for how the data was gotten and what it tells us about the general population.

Mean, Median and Mode (20 points) Student has found and interpreted the mean, median, and mode of the data sets.

Visual (20 points) Students makes a poster that illustrates their findings.

Presentation (20 points) Student shares their survey with the rest of class in a well-prepared fashion.

Total Points 140

## Do You See The Light

Concepts: Derivatives and Optimization problems

Lights Out Inc.  
P.O. Box 2358  
Big City, PU 11235  
August 20<sup>th</sup>, 2004

Calculus I Students  
DeVry University  
Westminster, Colorado 80241

Dear Calculus Student:

We at Lights Out are just starting our business manufacturing high tech light bulbs. We need you help to figure out how many light bulbs we should manufacture to maximize our profits.

Here is what we know. Our factory is designed to successfully produce 3800 light bulbs per day. More than that and our risk of producing too large a number of deficient light bulbs is too high. We would also risk increased maintenance costs on our manufacturing machines. We have done extensive market research, which has allowed us to determine that we can realistically expect our daily revenue to be modeled by the following revenue function:  $R(x) = 139x - .01x^2$  where  $x$  = the number of units we produce in a day. We have also determined that our daily production costs are modeled by the following cost function:  $C(x) = 0.01x^2 - x + 25,000$ . Beyond this we are clueless.

What we would like you to do is first provide us with a model we can use to determine our daily profit for any number of light bulbs we might be able to produce. Second, we would like to know what the maximum number of bulbs we should plan to produce in a day is, if we want to maximize our profit. If we produce that number of light bulbs, what can we expect our daily profit to be? Finally, if we must produce  $x$  number of light bulbs per day can we do so without exceeding the operating requirements of our factory?

Any help you can provide us would be greatly appreciated. As you know the demands of the market place are constantly changing. We will be updating our revenue and cost models as demand for our product and the costs of making it change. We would like to be able to repeat the process you used to get the profit function, discover the maximum number of units that should be produced per day, and our daily profit. I am in charge of all of this. I took an accounting class in college so I know how to do the arithmetic basics beyond that I am at a loss. Please be sure to include a detailed explanation of your work so that I, a math idiot, will be able to do it on my own from here on out.

Thanks for all your help. It will enable us to turn the lights on.

Sincerely,  
Ally Glow  
Lights Out Inc.



Name \_\_\_\_\_

### Math - Problem Solving : Electronics Analysis Problem

CATEGORY	A:90 - 100 Points	B:80 - 89 points	C:70 - 79 points	D: 60-69 points
<b>Mathematical Concepts</b>  <b>25 points</b>	Explanation shows complete understanding of the mathematical concepts used to solve the problem(s).	Explanation shows substantial understanding of the mathematical concepts used to solve the problem(s).	Explanation shows some understanding of the mathematical concepts needed to solve the problem(s).	Explanation shows very limited understanding of the underlying concepts needed to solve the problem(s) OR is not written.
<b>Mathematical Errors</b>  <b>10 points</b>	90-100% of the steps and solutions have no mathematical errors.	Almost all (85-89%) of the steps and solutions have no mathematical errors.	Most (75-84%) of the steps and solutions have no mathematical errors.	More than 75% of the steps and solutions have mathematical errors.
<b>Diagrams and Sketches</b>  <b>5 points</b>	Diagrams and/or sketches are clear and greatly add to the reader's understanding of the procedure(s).	Diagrams and/or sketches are clear and easy to understand.	Diagrams and/or sketches are somewhat difficult to understand.	Diagrams and/or sketches are difficult to understand or are not used.
<b>Mathematical Terminology and Notation</b>  <b>5 points</b>	Correct terminology and notation are always used, making it easy to understand what was done.	Correct terminology and notation are usually used, making it fairly easy to understand what was done.	Correct terminology and notation are used, but it is sometimes not easy to understand what was done.	There is little use, or a lot of inappropriate use, of terminology and notation.
<b>Explanation</b>  <b>20 points</b>	Explanation is detailed and clear.	Explanation is clear.	Explanation is a little difficult to understand, but includes critical components.	Explanation is difficult to understand and is missing several components OR was not included.
<b>Neatness and Organization</b>  <b>10 points</b>	The work is presented in a neat, clear, organized fashion that is easy to read.  The work is typed in correct business letter format	The work is presented in a neat and organized fashion that is usually easy to read.  The work is typed in mostly correct business letter format	The work is presented in an organized fashion but may be hard to read at times.  The work is handwritten in business format or typed but not in the correct format.	The work appears sloppy and unorganized. It is hard to know what information goes together.  The work is handwritten and in incorrect format.
<b>Audience</b>  <b>25 points</b>	A person who has only a business understanding of math with no Algebra or Calculus can easily understand what the purpose of each step is, why each step is needed and how to complete	A person who has only a business understanding of math with no Algebra or Calculus can understand with some difficulty what the purpose of each step is, why each step is needed and	A person who has only a business understanding of math with no Algebra or Calculus can understand with a lot of difficulty what the purpose of each step is, why each step is needed and how to	A person who has only a business understanding of math with no Algebra or Calculus can't understand what the purpose of each step is, why each step is needed and how to complete each step

	each step of the mathematical process	how to complete each step of the mathematical process	complete each step of the mathematical process	of the mathematical process
--	---------------------------------------	---	--	-----------------------------

## Calculus II Flowchart Project

Over the course of Calculus I and Calculus II we have learned many methods for integrating functions. These range from using a basic formula and substitution to more complex rules like by parts and trig substitution. In your project do the following:

- 1) Create a flowchart that will allow anyone, given a random problem, to decide which of all the rules, processes, and/or procedures they should use to solve it. You must include all of the following in your flow chart:
  - a. Basic Formulas
  - b. Substitution
  - c. Numerical Integration
  - d. Integration by Parts
  - e. Integration using trigonometric rules
  - f. Integration using trigonometric substitution
  - g. Integration tables
  
- 2) You will be given a random integration problem. You will write a minimum 2 page paper. It will explain how you would use your flow chart to get from an integration problem to the best most logical method for solving it. You will also explain how you worked through your flow chart to find the method you would use to solve your random problem. After reading the paper anyone should be able to use your flowchart to reach the appropriate formula or method to solve any random integration problem. So, it is of key importance to provide lots of thorough and well thought out discussion of the pathways through the chart, such as what integral from might lead you down a certain fork in the pathway versus another. The paper must be well written with few if any spelling or grammar errors.

### Flow Chart Rubric

A –

- Flow Chart contains decisions relating to the use of all of the following: basic integration formulas, numerical integration, integration by substitution, integration by parts, integration using trig rules, integration using trig substitution, and integration tables.
- Flow chart is easy to follow and accurately leads to best choice to solve any given problem.
- Paper thoroughly explains how to use your flow chart and how you used it to arrive at the best method to solve your random integration problem.
- Paper is a minimum of two pages in length
- Paper has no errors in spelling or grammar

B-

- Flow Chart contains decisions relating to the use of at least 90% of the following: basic integration formulas, numerical integration, integration by substitution, integration by parts, integration using trig rules, integration using trig substitution, and integration table.
- Flow chart is easy to follow and usually leads to the best choice to solve any given problem.
- Paper explains how to use your flow chart but may lack some detail.
- Paper is a minimum of 1 page in length

- Paper has a few errors in spelling and grammar but they do not detract from understanding of the content of the paper.

C –

- Flow Chart contains decisions relating to the use 70 to 80% of the following: basic integration formulas, numerical integration, integration by substitution, integration by parts, integration using trig rules, integration using trig substitution, and integration table.
- Flow chart is difficult to follow and/or sometimes does not lead to best choice to solve any given problem
- Paper is lacking key information in aiding understanding of how it should be used and/or does not describe a logical path to the best method to solve your random problem.
- Paper is less than one page in length.
- Paper has errors in spelling and grammar that do detract from understanding the content of the paper

D –

- Flow Chart contains decisions relating to the use 50 to 60% of the following: basic integration formulas, numerical integration, integration by substitution, integration by parts, integration using trig rules, integration using trig substitution, and integration table.
- Flow chart is very difficult to follow and/or rarely leads to best choice to solve any given problem
- Paper is lacking any explanation for how to use the flowchart that enables one to get from a problem to a logical method to solve it.
- Paper is one paragraph.
- Paper has many errors in spelling and grammar that make it difficult to understand the content of the paper.

F -

- Flow Chart contains decisions relating to the use of less than 50% of the following: basic integration formulas, numerical integration, integration by substitution, integration by parts, integration using trig rules, integration using trig substitution, and integration table.
- Flow chart is impossible to follow and/or never leads to best choice to solve any given problem.
- Paper is not present.

**The Money**  
**By**  
**Louis Freese**

Concepts: Slope and Linear equations

Inept Industries  
121 Klutz Court  
Tripper, Idaho 32135  
March 8<sup>th</sup>, 2004

Mathematics Department  
DeVry University  
120<sup>th</sup> and Pecos  
Westminster, Colorado 80224

Dear Math Students:

I recently began working in the human resources department for Inept Industries. Boy did the previous person in this role leave me a mess. Part of my job is to track and calculate employee salaries. Due to the mess left behind by the previous occupant I have run into some trouble. I am hoping you can help me out.

Apparently all the computer records were lost during the transition. All I have are a few notes scratched on a piece of paper to guide me. We have three pay levels. Level 1 employees begin at \$15,000. The notes say that in the third year the salary should rise to \$19,000. Level 2 employees start at \$30,000 and according to the notes their salary should rise to \$36,000 in year 3. Finally, Level 3 employees start at \$50,000 and the notes say that they should be making \$58,000 by the end of year 3. The only other piece of information I have is that the growth of salary over time is supposed to follow a linear growth pattern - whatever that means. The notes also say that once a Level 1 employee has worked long enough to reach a salary of \$30,000 he or she should either be promoted to Level 2 or fired. The same applies to Level 2 employees when they reach \$50,000 in salary. Can you help me out?

I need first to know the exact rate of increase for each level of employee over time. I would also like a mathematical model that will allow me to input the number of years the employee has been working for us and give back their current salary. Finally, I would like to know after how many years of working for us a Level 1 employee should expect to be promoted to Level 2 and after how many years of working for us should a Level 2 employee be promoted to a Level 3. With this information I can begin to bring some order back to Human Resources. Please fully explain how you figured all this out. If my boss asks where these numbers are coming from, I want to explain to him what you did.

I know that you can help me out of this predicament. Thanks for all of your help.

Sincerely,  
Ima Bumbler

**To Sub or Not to Sub**  
**By**  
**Louis Freese**

Concepts: Transformations of functions and finding intercepts.

HMS Nautical Inc.  
2200 Seaview Blvd.  
North Shore, HI 09231

Math Class  
DeVry University  
122<sup>nd</sup> and Pecos  
Westminster, CO 80241

Dear Students:

I have recently been employed by HMS Nautical Inc. to work on their submarine program. I have only some basic data to work with and no idea how to use it to get the information I need.

Here is what I know. First, I know that our Subs have a maximum running depth of 500 feet below sea level. I also know that a sub functioning at acceptable levels should be able to reach maximum depth in 10 minutes. Finally I know that I need to multiply the decent by a factor of 5 to achieve an accurate model. I also have a chart that lists times and depths for the sub.

Time (minutes)	1	5	9	10	11	15
Depth in Meters	-95	-375	-495	-500	-495	-375

Finally, I know that the sub follows a quadratic model when it descends and then ascends.

I have been told that you will be able to take this data and make sense of it. I would like a model for the path of the submarine as it descends to its running depth and then returns to the surface. I want to be able to use this model to predict where the sub will be at any time during its decent/ascent cycle. I would also like to know after how many minutes I should expect the sub to breach the surface of the water again.

Please explain clearly how you came up with the model so that I can repeat the process for new additions to our fleet of submarines. I appreciate any help you can give me in this matter.

Sincerely,

Nemo Hook  
HMS Nautical Inc.

## Algebra Rubric For writing project

Name \_\_\_\_\_

- Please attach this page with a paper clip to your writing assignment when you turn it in.
- This list will be used to grade your writing assignment and will be returned to you with comments. Keep a copy of your paper for your reference.
- Use this checklist as a guide for yourself while writing the assignment

<b>Form:</b>	<b>40 points</b>
Does this paper	1. Clearly restate the problem to be solved (including the essential details)?
	2. Explain what level and types of math will be used?
	3. Solve the question that was originally asked?
	4. Provide all required mathematic models?
<b>Content:</b>	<b>40 points</b>
Does this paper	5. Give a precise and well-organized explanation of how the answers were found?
	6. Define all variables, terms, and notation used?
	7. Explain how each formula is derived or where it can be found?
	8. Clearly label diagrams, tables, graphs, or other visual representations of the math.
	9. Contain correct mathematics?
<b>Presentation:</b>	<b>20 points</b>
Does this paper	10. Use standard business letter format?
	11. Use correct spelling, grammar, and punctuation?
	12. Look Neat

**Comments:**

**Grade:**

**Statistics**  
**Student Café Final Project**

Name \_\_\_\_\_

You work for a student run café. The college has asked you to run an analysis of the business. You have collected 47 days worth of sales figures. The data set includes information on sales and amount of various product sold organized by day of the week. You are looking to make a case for keeping the café open both by making recommendations for changes if needed and by comparing sales to a competing café with  $\mu = \$153.25$  in sales with  $\sigma = \$50.37$ .

Date	Day Code	Day of Week	Bread Sand Sold	Bread Sand Waste	Wraps Sold	Wraps Waste	Muffins Sold	Muffins Waste	Cookies Sold	Cookies Waste	Fruit Cup Sold	Fruit Cup Waste	Chips	Juices	Sodas	Coffees	Total Soda and Coffee	Sales
1/19/2010	2	Tue	5	3	25	5	5	1	5	3	1	4	12	8	20	41	61	199.95
1/20/2010	3	Wed	6	8	7	17	3	5	1	6	0	3	0	0	13	33	46	195.74
1/21/2010	4	Thu	8	2	14	0	4	0	1	0	0	3	0	13	23	34	57	102.68
1/22/2010	5	Fri	4	2	5	7	5	0	3	1	3	0	20	0	13	27	40	162.88
1/25/2010	1	Mon	3	0	10	0	8	0	3	0	2	0	0	5	13	20	33	101.76
1/26/2010	2	Tue	7	1	5	3	1	0	5	0	2	0	4	4	33	23	56	186.94
1/27/2010	3	Wed	6	6	19	3	6	0	10	0	2	0	5	15	32	47	120.18	
1/28/2010	4	Thu	0	0	7	0	6	1	0	0	0	0	20	6	27	31	58	228.78
1/29/2010	5	Fri	3	4	4	9	0	4	3	2	1	1	3	4	12	30	42	88.02
2/1/2010	1	Mon	2	6	13	3	3	0	6	0	2	0	16	7	19	27	46	119.57
2/2/2010	2	Tue	3	7	10	2	5	0	5	0	1	0	2	0	33	30	63	172.31
2/3/2010	3	Wed	4	4	15	0	4	1	4	1	2	0	9	6	20	27	47	137.65
2/4/2010	4	Thu	9	1	13	0	14	0	13	0	3	0	13	6	29	26	55	197.56
2/5/2010	5	Fri	1	1	6	2	2	0	1	1	0	0	10	1	14	24	38	70
2/8/2010	1	Mon	3	5	14	2	2	0	8	0	1	0	9	2	17	18	35	97
2/9/2010	2	Tue	8	0	16	0	11	0	9	1	2	0	11	8	31	22	53	181.43
2/10/2010	3	Wed	7	0	12	0	5	0	7	3	1	0	14	3	24	21	45	125.57
2/11/2010	4	Thu	8	0	19	0	12	0	9	0	2	0	4	2	31	28	59	180.63
2/12/2010	5	Fri	2	0	4	0	0	0	2	0	2	0	25	2	15	23	38	75.87
2/15/2010	1	Mon	3	3	12	0	6	0	8	2	2	0	7	2	26	31	57	150.51
2/16/2010	2	Tue	8	0	22	0	1	0	3	1	3	0	13	5	39	29	68	177.41
2/17/2010	3	Wed	6	0	8	1	9	0	10	1	1	0	11	2	24	48	72	153.84
2/18/2010	4	Thu	4	2	19	0	10	0	9	0	3	0	8	12	35	25	60	205.36
2/19/2010	5	Fri	4	0	10	0	4	2	4	0	0	0	14	4	11	31	42	118.54
2/22/2010	1	Mon	6	0	16	0	9	0	7	0	1	0	11	2	25	25	50	138.04
2/23/2010	2	Tue	7	0	23	0	12	0	12	0	4	0	21	5	36	35	71	236.01
2/24/2010	3	Wed	6	0	15	0	1	0	6	1	1	0	11	5	33	33	66	149.58
2/25/2010	4	Thu	5	3	22	0	8	0	4	0	4	1	10	4	37	35	72	206.17
2/26/2010	5	Fri	2	0	5	0	28	1	8	0	0	1	11	21	22	16	38	93.1
3/1/2010	1	Mon	3	2	9	1	5	0	6	1	2	0	10	7	36	24	60	151.91
3/2/2010	2	Tue	8	0	21	1	10	0	9	1	2	0	12	7	54	20	74	217.29
3/3/2010	3	Wed	4	0	13	0	8	2	8	2	3	0	9	4	34	11	45	148.24
3/4/2010	4	Thu	4	0	14	0	6	0	8	0	2	0	8	5	43	21	64	168.08
3/5/2010	5	Fri	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
3/15/2010	1	Mon	6	0	17	0	3	0	4	0	2	0	9	3	24	8	32	130.77
3/16/2010	2	Tue	7	1	19	0	5	2	13	0	1	0	11	4	48	8	56	164.54
3/17/2010	3	Wed	3	3	13	0	3	4	6	0	0	0	7	4	35	4	39	121.41
3/18/2010	4	Thu	5	3	15	3	1	2	5	2	4	0	8	5	33	4	37	127.93
3/19/2010	5	Fri	2	0	4	7	5	2	3	3	1	0	1	3	24	3	27	61.94
3/22/2010	1	Mon	4	2	13	4	3	0	2	4	2	0	8	7	30	5	35	128.59
3/23/2010	2	Tue	8	0	14	4	7	0	4	3	2	2	7	6	50	6	56	159.23
3/24/2010	3	Wed	4	0	9	0	8	0	5	4	2	0	7	5	45	4	49	148.08
3/25/2010	4	Thu	6	0	18	1	3	0	3	1	2	0	9	4	50	13	63	164.86
3/26/2010	5	Fri	1	1	4	1	3	1	5	1	1	1	3	2	26	4	30	74.13
3/29/2010	1	Mon	2	4	9	2	3	0	1	0	0	1	4	0	26	16	42	82.96
3/30/2010	2	Tue	6	0	25	0	11	1	9	0	4	0	9	10	55	14	69	240.87
3/31/2010	3	Wed	4	0	15	0	1	0	9	4	3	0	6	4	42	10	52	151.52
4/1/2010	4	Thu	4	0	16	0	6	0	6	0	1	0	11	3	45	11	56	150.99

Your task is to prepare a report for the owner of your cafe. This report will discuss the following:

- 1) What does this data set tell you about typical sales at this particular cafe?
- 2) What problems, if any, are revealed by your investigation? How are they revealed in the statistics?
- 3) What changes, if any, would you make to improve the business? On what statistical basis would you justify those changes? For example, would you make changes to the menu or days on which the café was open?
- 4) What variables might influence the sales levels at this cafe that might cause those levels to be different from the entire population of cafes?
- 5) What can we infer about sales at your café as compared to the sales at the other cafe?

In other words your boss wants to know everything you can tell him about sales based on this data set and what recommendations you would make to strengthen the business. You can present your report as either a Powerpoint slide show or a written report.

**Grading:**

You start with zero points. Each piece of information you provide me increases your score. The more information you give me the more points you earn. Think back over the 7 weeks of this course. What have you learned that can help you answer the questions above? The relevant chapters are 1, 2, 3, 7, 8, and 9. You will earn more points the broader your investigation is. For any statistic, graph, or test you use in your report you should be able to interpret it, show how you arrived at it, and explain how or why it helps answer the questions above.

## Introductory Statistics Final Project

Directions: You will propose a hypothesis. Select and use an appropriate tool to test it. Finally, you will analyze the data using many of the statistical tools we will study. What I am looking for in this project is whether or not you are able to collect and analyze data using basic statistical knowledge.

Requirements:

- 1) A hypothesis
- 2) A valid testing tool and a discussion of why you chose it.
- 3) The results of the test and a discussion of their validity.
- 4) Calculations for mean, median, mode.
- 5) Calculations for Range, Standard Deviation
- 6) Discussion of population/sample population/ sample size
- 7) Graphic representations (Histogram, Stem and Leaf, Scatter Plot, other)
- 8) A frequency table
- 9) Calculate a confidence interval for  $\mu$ .
- 10) Do a Hypothesis test for  $\mu$ .
- 11) A conclusion about the hypothesis.
- 12) A written analysis of the data.
- 13) Presentation

You may use a graphing utility or computer program to help with calculations and graphs. However, you must also turn in all calculations and graphs in hand-written form.

This project is worth 200 points and 20% of your grade.

The rubric below is designed with the following in mind. A grade of a B meets expectations for this project. To get an A requires you to go a little bit beyond the basics to explore your chosen topic in a complete and meaningful way. The only way you can score zero points for a given grading criterion is if it is completely missing.

Rubric -

**A-**All the requirements are present in a way that demonstrates a deeper understanding of the material.

Multiple Graphic Representations are used, are accurate, and are appropriate.

The analysis of the data is accurate, done in depth, and represents a complete exploration of the given topic.

The conclusion reached is supported by the data with references to all calculations, tests and graphs.

All calculations are present and accurate with an explanation of what they mean in regards to the hypothesis.

Presentation is at least 15 minutes in length, includes a variety of visuals, and completely covers the chosen topic.

**B-**All the requirements are present.

Multiple Graphic Representations are used and are accurate.



The analysis of the data is accurate and done in depth.  
The conclusion reached is supported by the data with references to 3 or more calculations, tests, and graphs.  
All calculations are present and accurate with an explanation of what at least 3 of them mean in regards to the hypothesis.  
Presentation is between 10 and 15 minutes in length, contains at least one visual, and an attempt is made to talk about all the important aspects of the project.

**C-10** of 12 requirements are present including the analysis.

At least one graphic representation is used and is accurate.

The analysis of the data is accurate.

The conclusion reached is supported by the data with at least one reference to a calculation or graph..

All calculations are present and accurate

Presentation is less than 10 minutes in length and/or includes at least one visual element.

**D-** 6 to 9 of 12 requirements including the written analysis are present.

A graphic representation is present but some inaccuracies may exist.

Analysis is present and mostly accurate.

Conclusion is supported by the data.

All calculations are present but some inaccuracies may exist.

Presentation is between 10 and 15 minutes in length or has no visual elements.

**F** – Less than 6 of 12 requirements are present.

A graphic representation exists but there are many inaccuracies.

Analysis is weak or is missing key discussion points as outlined in the requirements.

Conclusion is not supported by the data.

Calculations are missing and/or many errors in calculation exist.

Presentation is less than 10 minutes and has no visual elements.

At the A level each item in the rubric is worth a maximum of 34 points. At the B level each item is worth a maximum of 29 points. At the C level each is worth a maximum of 26 points. At the D level each is worth a maximum of 23 points. At the F level each item is worth a maximum of 19 points. However, it is unlikely that if you are at the F level that you will score anywhere close to 19 points per item.

I will use this rubric as follows. I will highlight the level you reach for each item. I will then look at the quality of the work to determine where to score that element. For example, if you have all elements present you would score at the A level for that item. I would then decide based on quality whether to score you between the minimum score of 30 and the maximum score of 34. Once I have scored each item I will add the scores for the five items together to determine your overall grade.