

PROJECTS AND RUBRICS FOR FUTURE ELEMENTARY TEACHERS

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OUTLINE OF PRESENTATION

What is a rubric?

- A printed set of scoring guidelines for evaluating work and for giving feedback

What does a rubric do?

Answers the questions:

- By what criteria will work be judged?
- What is the difference between good work and weaker work?
- Are judgments valid and reliable?
- How can students and teachers focus on excellent performance?

Background:

- Students take two 3-credit courses
- Part of each course grade is based on projects
- Students do only two-four projects in a given class
- Classes are taught by faculty with a variety of background
- Consistency between classes is important

Why Projects?

- NCTM and Beyond Crossroads both recommend using different teaching methods to address diverse student populations
- Alternative assessment
- Collaboration and cooperative learning
- Individual research based projects
- Practical applications

Evolution of Rubrics

- No rubric, too subjective
- Minimal rubric
 - Requirements not clear for students
 - Grading not clear for students or teachers

- Merely adequate projects getting full credit
- Revised Rubrics
 - More quantitative
 - More detailed
 - Expectations are clearer
 - Easier and less time consuming to grade
 - Grading more consistent
- Two versions of the new rubrics
 - C, B, A level
 - Table style, circle the points earned

Detail of two projects:

- Non-standard algorithms
 - C, B, A level rubric
 - Student-research based
 - Individual
 - Explanation of project
 - Handout p. 9
 - Explanation of rubric
 - Handout p. 10
- Statistics Project
 - Table style rubric
 - Small group collaboration
 - Data gathering and reporting
 - Explanation of project
 - Handout p. 25
 - Explanation of rubric
 - Handout p. 26, 27

Brief overview of other projects in packet

Time for questions, sharing of ideas

References: Resources for Rubrics and Rubric Development

<http://www.winona.edu/air/resources.htm>

<http://www.winona.edu/air/rubrics.htm>

<http://www.calstate.edu/acadaff/sloa/links/rubrics.shtml>

http://www.cu.edu/academicaffairs/assessment/assessment_toolbox/rubrics

<http://rubistar.4teachers.org/index.php>

<http://edtech.kennesaw.edu/intech/rubrics.htm>

http://edweb.sdsu.edu/triton/july/rubrics/Rubric_Guidelines.html

PROJECTS AND RUBRICS

MTH 151 Project #1 Description: Problem Solving

For this project you are going to be a mathematics education researcher. One way of collecting research data in mathematics education is by conducting interviews with various people (subjects). During these interviews the subjects talk about and do mathematics.

Pick any ONE “problem solving problem” we have done either in class or as homework. If you aren’t sure if the problem you want to collect data on is a problem-solving problem, ask me. Try to match the problem you pick to your subject’s age, ability level and mathematical background.

Choose a subject. DO NOT identify your subject by name to me, to protect the subject’s confidentiality. Your subject may be a friend, roommate, family member, or co-worker, but NOT a member of our MTH 151 class. You will provide me with relevant information about your subject.

Ask your subject to solve your chosen problem while he/she thinks out loud. Provide the subject with paper and pencil (and any other resources you think he/she needs to solve the problem, e.g. calculator, pattern blocks, etc). Take notes on how your subject solves the problem and also keep any written work he/she does. If the subject is unable to solve the problem in a reasonable amount of time, that’s OK, just keep track of what work the subject was able to do. You may answer your subject’s questions about the problem, but be sure to tell me what questions were asked and what your answers were.

Write up your interview as follows

- Provide me with relevant information about your subject, except for his/her name.
- List the problem you used for your interview, and what resources you provide your subject.
- Describe the subject’s solution process and attach a copy of written work.
- Tell whether the subject was able to solve the problem correctly.
- Describe how the subject seemed to feel about solving this problem and about mathematics in general.
- Tell what you learned about how people solve problems from doing this interview project.

For A and B level modifications for this project, read the rubric which follows this project description. Be sure to attach the rubric to your project.

Project #1 Grading Rubric: Problem Solving

Read through this carefully before you start to work on your project. Staple this rubric to your project before you hand it in.

C Level Project

Maximum Possible Points: 15/20

Complete ALL of the following objectives:

___/1 point: State the problem (don’t just give a page number).

___/1 point: List the resources (if any) that you provided for the subject.

___/1 point: Provide background information for the subject.

___/ 8 points: Describe the subject's solution process:

___/2 Give a detailed description of the steps the subject used to solve or attempt to solve the problem.

___/2 Identify by name the problem solving strategies used.

___/1 Tell if Polya's model seems to be used and if so describe how it is used.

___/2 Tell what answer the subject came up with and if it is correct.

___/1 Provide the subject's written work

___/ 2 points: Describe the subject's attitudes towards math in general and this problem in particular.

___/2 points: State what you learned about how people solve problems from completing this project.

B Level Project

Maximum Possible Points = 17/20

Complete ALL of the C Level Objectives (see above) AND do EITHER of the following:

___/2 points: Give the same subject an additional problem to solve, state the problem, describe the subject's solution process and whether the subject correctly solved the problem.

OR

___/2 points: Give a different subject the same problem you used for the C level objectives, and compare this subject's solution process with that of your first subject.

A Level Project

Maximum Possible Points = 20/20

Complete ALL of the C Level Objectives (see above) AND EITHER of the B level objectives, PLUS the following:

___/3 points: Read and briefly review (a couple of paragraphs) an article on problem solving in either of NCTM's two journals for teachers: Teaching Children Mathematics or Mathematics Teaching in the Middle Grades (available in Park or Ronan). NOTE: You may NOT also use this article for Project #3 (Article Review).

Project Grade ___/20 points

MTH 151 Project #2 Description: Quilt Project

This is an individual or group project. No groups larger than 3, please!

An important part of mathematics is recognizing, describing, and creating patterns. Patterns can and often do involve written numbers, but they can also involve colors, shapes, sizes, etc of physical objects such as beads or quilt blocks.

In class you made a “quilt” with your group composed of many copies of one quilt block. The quilt block itself is a pattern. Each block is composed of shapes such as squares, triangles, or curved pieces, and that is another kind of pattern. When you put many copies of the same quilt block together, the quilt as a whole has yet another kind of pattern.

Choose a quilt block you did not make in class. It has to be made up of geometric shapes and involve at least one pattern. You will need to give the name of the block and some background information (origin of the block’s name, historical information, source of the block, name of each shape in the block). Show one block before you color it, with lines of reflection symmetry drawn in and angles of rotation symmetry listed. Show a colored block, with lines of symmetry drawn in and angles of rotation symmetry listed. Show a quilt (a rectangular arrangement of at least 12 of your colored blocks) and discuss the reflection, rotation, and translation symmetry of the quilt as a whole.

Options: If you like, you may use cutout and glued-on pieces of construction paper, scrapbooking paper, origami paper, fabric, or any combination of these. If you know how to sew, you can make your blocks out of fabric and sew them together.

Sources: To find quilt blocks, historical information and so on, try the Park Library or any public library for books and magazines about quilting (the magazine *Quilter’s Newsletter* is particularly good), Wal-Mart, JoAnn Fabric, or your local quilt store for fabric and quilt magazines, any grocery or drugstore for quilt magazines, or the internet for all kinds of quilt-related information. **When listing your source(s), give the complete title and author’s name (book), the magazine title, article title and author’s name (magazine), and the URL of the website (internet).**

Read the grading rubric for A and B level project modifications. Be sure to attach a copy of the grading rubric to your completed project.

Project #2 Quilt Project Grading Rubric

Read through this carefully before you start to work on your project. Staple this rubric to your project before you hand it in.

C Level Project

Maximum Possible Points = 15/20, plus Extra Credit

Complete ALL of the following Objectives:

___/3 Give the name of the block and background/historical information on the block.

____/2 Give the source (URL of website, title and author of book, etc) for the background information.

____/5 Provide an uncolored block, name all the shapes found in the block, and analyze the symmetry of the block.

____/5 Provide a quilt containing at least 12 of your blocks, colored. Analyze the symmetry of a colored block, and of the quilt as a whole.

Extra Credit: (up to 2 points) for any of these: use of interesting paper (not just construction paper—try origami or scrapbook paper, or gift wrap paper), use of fabric (you can glue it if you can't sew), use of sewing (hand or machine).

____/2 EC Points

B Level Project

Maximum Possible Points = 17/20, plus Extra Credit

Complete ALL of the C Level Project objectives (see above), doing the extra credit if you want to, AND EITHER of these objectives:

____/2 points: Design your own original quilt block (the uncolored block should have different symmetry than the one you used for your C Level Objectives), provide an uncolored block with symmetry analyzed, and make a 6 (or more) colored quilt, analyzing the symmetry of a colored block and of the quilt as a whole.

____/2 points: Find a different quilt block from the one you used for the C Level Objectives (the uncolored block should have different symmetry than the one you use for C Level), make a 6 (or more) block quilt with this block, analyzing the symmetry of the uncolored block, a colored block, and the quilt as a whole.

A Level Project

Maximum Possible Points = 20/20, plus Extra Credit

Complete ALL of the C Level Project objectives, one of the B Level objectives (see above), doing the extra credit if you want to, AND EITHER of these objectives:

____/3 points: Read and briefly review (a couple of paragraphs) an article teaching mathematics with quilts in any of NCTM's 3 journals for teachers: Teaching Children Mathematics, Mathematics Teaching in the Middle Grades or The Mathematics Teacher (available in Park or Ronan). NOTE: You may NOT also use this article for Project #3(Article Review).

____/3 points: Provide a lesson plan involving quilts that involves at least 3 of the following content areas: math, art, language arts, social studies, music. You can give your lesson plan in outline form, but be explicit about where each content area is being used and be sure to provide your intended grade level for this lesson. Be sure to give enough detail ("We will make a quilt and sing a song and read a story" is NOT enough detail!!).

Project Grade _____/20

ARTICLE REVIEW for MTH 152

This is an individual project.

Read an article in either Teaching Children Mathematics or Mathematics Teaching in the Middle Grades, both of which are published by the National Council of Teachers of Mathematics. These are available at the campus libraries and may also be found online. The article must have been published later than January 2001. For a possible grade of C, you will just review one article. For a possible grade of B, you must find an additional article that is at least 10 years older on the exact same topic, review this article and then do a comparison/contrast of the two articles. For a possible grade of A, you will also go the NCTM website and evaluate an illumination online activity that relates to the topic of your article reviews. <http://illuminations.nctm.org/> Be sure that you do an illumination activity online, not a lesson plan.

One of the objectives for this assignment is to improve your critical eye for these articles, so a major question you need to ask yourself is whether the article is grounded with research, that is, did the author(s) do some research before they wrote the article, was it based on research the author(s) did in their own classroom, or is it merely experiences that the author(s) had. (If the article includes the black line masters for student pages, this is not the type of article I am asking you to read, but it is useful for you to know these are available when you are out there teaching.) This is usually evident in the first few paragraphs and the endnotes, where resources for the article are listed. If you do not see other works referenced, the article is probably a practice-oriented article. That is, the article is based on personal observations, not on research. You must address this issue in your review.

The article MUST cover a topic we are doing in class this semester. After we discuss fractions, decimals, ratio, proportion, you may choose an article on one of those topics to read and analyze. Other topics are geometry of measurement, or shape, statistics and probability. While problem solving is a continuing theme, please do not choose that unless it specifically addresses one of the other topics above. Technology is also appropriate, if the article is also using concepts above. Otherwise, ask me before using that article.

1) Find your article(s). It may be easier to find an older article first, and follow that with the newer one. Read carefully, and thoughtfully. Be sure the topic is one we cover in this course.

2) Write your review of the article. To be eligible for full credit you must follow these guidelines:

- Type or word process
- Use complete sentences and paragraphs. Spelling, grammar and punctuation all count. Your entire review should be **no longer than 4-5 double spaced pages**.
- At the top of the first page, list the author(s), the title(s) of the article, the publication date, and the name of the periodical in which the article was published, or if it is a website, list the author/sponsoring entity, title, publication date if available, and the entire URL to find this site.

- Tell why you chose to review this particular article. (One short paragraph.)
- Summarize the article. (One paragraph to 2 pages.) You will not be able to restate the entire article, so hit the main points. What was REALLY emphasized by the authors? What is the main topic or idea of the web page? BE sure to use YOUR OWN WORDS. If you do use the author's words you must use proper reference style.
- Evaluate the article. (One paragraph to one page). Was reading it a worthwhile experience? Why or why not? Did you learn anything new? What? How does the author's presentation of the material compare with the way it was covered in our class? Would you read another article by this author? Why or why not? What would you have liked to see included in the article that was not included?
- For the illumination, give a brief overview of the activity. What grade level is it geared for? What is the purpose of the activity? Do the activity, and see if you can understand the concept(s). Explain the activity, and the lesson it is teaching. Then compare this to the articles you read. Is it similar? Different? Do you think it is useful? Would you use it as a teacher? Why or why not? Could you improve it? If so, how?

Be prepared to give a copy of the article(s) to me, but do NOT include it in the paper.

Article Review Project Rubric

Read through this carefully before you start to work on your project. Staple this rubric to your project before you hand it in.

C LEVEL PROJECT: 14/20 maximum possible points

Read ONE article (this cannot be an article you have used for any other projects for this class) in either of the NCTM journals (Teaching Children Mathematics or Mathematics in the Middle Grades) completing ALL of these objectives:

- ___/2 points: Give the title of the article, the author's (or authors') full name(s), background information on the author(s), title of the journal, and publication date of the article.
- ___/2 points: Use correct grammar and spelling.
- ___/2 points: Tell why you chose this particular article to review.
- ___/5 points: Summarize the main points of the article.
- ___/3 points: Evaluate the article.

B LEVEL PROJECT: 17/20 maximum possible points

Complete ALL of the C level Project objectives (see above) AND

- ___/3 points: Read another article on the same topic as the one you used for the C level objectives, reviewing it the same way, and then compare the two articles.

A LEVEL PROJECT: 20/20 maximum possible points

Complete ALL of the C AND B level Project objectives (see above) AND

___/3 points: Evaluate an NCTM Illuminations Activity, after doing the entire activity. Include the URL for the actual activity you do, and give a brief summary of the activity and its objectives, as well as evaluating the activity.

Project grade _____/20

MTH 151 Project #4 Description: Non-Standard Algorithms

This semester you have been taught many nonstandard algorithms for addition, subtraction, multiplication, and division. Now you get a chance to teach a nonstandard algorithm to someone else.

The object of this project is to teach one non-standard algorithm to at least 3 different people. NONE of the people should be currently enrolled in MTH 151. If possible, try to include at least one child as one of your interview subjects. After each subject has been taught to use the algorithm, give the person 3 problems to solve. For the first two problems ask the subject to use the new method. On the third problem, the subject may use any method (except a calculator!).

You will write a paper in which you

- Tell which operation (addition, subtraction, multiplication, division) and what algorithm you taught the subjects.
- Provide background information about the subjects (NOT their names) such as their age, gender, and year in school.
- Describe how each subject feels about math in general.
- Describe each subject's reaction to the new algorithm:
 - Have they seen the algorithm before?
 - Do they feel the algorithm is a legitimate way to compute?
 - Are they successful with the algorithm?
 - Do they use the new algorithm on the third problem?
- Now write a conclusion in which you analyze the data you collected as a whole rather than looking at the individual performance of each subject. Compare the responses of your subjects. Were there age differences? Gender differences? Did anything about the data surprise you and if so, what was it? What did you learn about teaching and learning mathematics? What value do you think there is in teaching alternative algorithms? Use complete sentences, proper grammar, and correct spelling. Word-process your paper. DO NOT use a notebook, binder, or plastic page protectors.

See the grading rubric on the next page.

Project #4 Non-Standard Algorithm Grading Rubric

Read through this carefully before you start to work on your project. Staple this rubric to your project before you hand it in.

C Level Project

Maximum Possible Points = 15/20

Complete ALL of these objectives.

___/1 point: Identify the operation (addition, subtraction, etc) and algorithm (lattice, etc) you are using for all your subjects.

___/6 points: Provide complete information about all of your subjects: age, gender, feelings about math, confidence about math, reaction to the new algorithm (see detailed list under “reaction to the new algorithm” in the project description)

___/2 points: Use correct grammar and spelling.

___/6 points: Write a thoughtful conclusion, comparing the subjects, identifying any surprises in your data, and identifying what you learned about math and teaching math from doing this project.

B Level Project

Maximum Possible Points = 17/20

Complete all of the C Level Project objectives (see above)

___/2 points: Teach an additional, different algorithm to each of your three subjects OR the same algorithm to 3 more new subjects, providing information as you did for C level.

A Level Project

Maximum Possible Points = 20/20

Complete all of the C and B Level Project objectives AND

___/3 points: Read and briefly review (a couple of paragraphs) an article on teaching alternative algorithms in either of NCTM’s 2 journals for teachers: Teaching Children Mathematics, or Mathematics Teaching in the Middle Grades. NOTE: You may NOT also use this article for Project #3 (Article Review).

Project Grade _____/20

Fraction Interview Project

WORK ALONE on this project. For this project you are going to be a mathematics education researcher. One way of collecting research data in mathematics education is by conducting interviews with various people (subjects) that involve them talking about and/or doing mathematics.

Choose 2 subjects. DO NOT identify your subjects by name to me, to protect the subject’s confidentiality. Your subject may be a friend, roommate, family member, co-worker, but NOT a member of MTH 151 or 152 courses. You will provide me with relevant information about your subjects, such as their ages, their grade level, their math backgrounds, their attitudes about math

in general and fractions in particular, etc. Try to choose different ages or backgrounds in your subjects.

Before you do ANY interviews, be sure that you can do ALL of the problems completely and correctly, using the manipulatives and pencil/paper algorithms.

For each interview, have pencils, paper and the manipulatives ready. You will need your pattern blocks, Cuisenaire rods, fraction strips and extra paper for paper folding, with markers or crayons. You will want paper for you to take notes of what your subject says and does. DO NOT allow your subject to use a calculator; in fact there is no need to even have one available.

You will explain what the manipulatives are to your subjects, and then let them play with them to solve the problems in part I. Keep track of any work that they write down, and what they say. If the subject is not telling you what they are thinking, ask them to think out loud as they work on it. If a subject cannot solve a problem in a reasonable length of time that is okay, just keep track of what he/she was able to do. You may answer your subjects' questions about the problem, but be sure to tell me what questions were asked and what your answers were. Before you have them do the problems in part II, demonstrate how to do each problem with the manipulative listed by that problem. After you have taught all of the problems, sit back and let the subject solve the problems in part III. Keep the manipulatives available, but the subject does not have to use them. (You can encourage them to try to do it that way, but pencil/paper is okay too.)

Write up: You will provide me with relevant information about your subject, except for his/her name. Describe the subject's solution process and attach a copy of his/her written work. Report the solutions that each subject gave, as well as whether each was able to solve the problem correctly. If he/she came up with an incorrect solution or was not able to completely solve the problem, give your best conjecture as to what the subject's misunderstanding may be. Provide at least a one paragraph summary and comparison of both subjects. Then tell what you learned about how people think about fractions from doing this project.

Length: 2 or more pages of word-processed text, plus copies of the subject's work.

Problems:

Part 1: Free play, just tell them what the manipulatives are named, then let them pick out the relevant pieces, and answer the questions as you ask them. You may provide a written copy of the questions to your subjects.

1. Use the pattern blocks. If the yellow hexagon pattern block = 1, then what is the red trapezoid? The green triangle?
2. Use the Cuisenaire rods (c-rods). If the dark green c-rod = 1, what is the red rod? The white rod?
3. Build a triangle with your pattern blocks that is $\frac{2}{3}$ red and $\frac{1}{3}$ green.
4. Build a color train that is $\frac{2}{3}$ blue and $\frac{1}{3}$ light green.

Part 2. Be sure to teach your subject how to use the manipulative to do the first set, then have them solve the second set any way that they like.

1. Add $2/3 + 1/4$ using the fraction strips.
2. Subtract $5/8 - 1/4$ using the fraction strips.
3. Multiply $2/3 \times 1/4$ using paper folding. (Be sure you show them how to find $2/3$ OF $1/4$ by doing $1/4$ first and getting $2/3$ of that $1/4$.)
4. Divide $1/2 \div 1/4$ using fraction strips. (Be sure to explain the meaning of division: how many $1/4$'s are in $1/2$?)

Part 3.

1. Add $1/3 + 3/4$
2. Subtract $5/6 - 1/3$
3. Multiply $1/3 \times 2/5$
4. Divide $1/3 \div 1/6$

Fraction Project Rubric: Mathematical content **Subtotal** _____/12

12 points	There were no mathematical errors in the interviewer's work and all errors in subject's work were correctly and clearly identified. The mathematics of each subject was clearly understood and analyzed correctly for errors and understanding is exceptional.
10 points	There were minor mathematical errors in the interviewer's work or in the work reported on, errors and understanding of subjects was acceptable, but not exceptional.
8 points	There were minor mathematical errors in the interviewer's work and in the work reported on, errors of subjects were reported, explanation was attempted, but not clear.
6 points	There were major mathematical errors in the interviewer's work or in the work reported on, some, but not all errors of subjects were reported. Explanation was attempted, but not clear.
4 points	There were major mathematical errors in the interviewer's work and in the work reported on, most errors of subjects were NOT reported, OR explanation was NOT attempted, and/or was not clear.
2 point	There were major mathematical errors in the interviewer's work and in the work reported on, errors of subjects were NOT reported AND explanation was NOT attempted, and/or was not clear.
0 points	Only interviewed, write up does not clearly report anything relevant to the mathematical content or understanding of the subjects.

Presentation/Organization Points **Subtotal** _____/6

6 points	Report is thoughtful and articulate. All objectives were met, organization is clear and logical, no grammar or stylistic errors, communication is clear and concise. Introduction, body, summary and conclusion are exemplary in form and content.
5 points	Report is thoughtful but not quite articulate. All objectives were met, organization is clear and logical, fewer than 3 grammar or stylistic errors, communication is clear and concise. Introduction, body, summary and conclusion are present.

4 points	All objectives were met, organization is clear and logical, fewer than 5 grammar or stylistic errors, communication is fairly clear. Introduction, body, summary and conclusion are present, but one or more is weak.
3 points	Not all objectives were met. Grammar or style flaws interfere with readability. Communication is not clear, introduction and conclusion are weak or missing, OR summary is weak or missing
2 points	Few objectives were met. Grammar or style flaws interfere with readability. Communication is unclear, and introduction and conclusion are weak or missing, AND summary is weak or missing
1 point	A written report was turned in, but the grammar/style are poor, the organization is minimal or lacking, summary is poor or missing, introduction and/or conclusion is missing.

Project Grade _____/18

Decimal Interview Project

WORK ALONE on this project. For this project you are going to be a mathematics education researcher. One way of collecting research data in mathematics education is by conducting interviews with various people (subjects) that involve them talking about and/or doing mathematics.

Choose 2 subjects. DO NOT identify your subjects by name to me, to protect the subject's confidentiality. Your subject may be a friend, roommate, family member, co-worker, but NOT a member of MTH 151 or 152 courses. You will provide me with relevant information about your subjects, such as their ages, their grade level, their math backgrounds, their attitudes about math in general and fractions in particular, etc. Try to choose different ages or backgrounds in your subjects.

Before you do ANY interviews, be sure that you can do ALL of the problems completely and correctly, using the decimal squares, base 10 pieces and base ten grid paper as well as pencil/paper algorithms. Pay special attention to using the correct terminology and the correct sizes of grid paper.

For each interview, have pencils, paper and the manipulatives ready. You will need your base 10 blocks and several pages of the decimal squares and base 10 grids, along with markers or crayons. You will want paper for you to take notes of what your subject says and does. DO NOT allow your subject to use a calculator; in fact there is no need to even have one available. Before you have them do the problems in **Part 2, or Part 3**, choose which part you wish to teach. You will only teach one of these two parts.

You will explain what the manipulatives are to your subjects, and then let them play with them to solve the problems in **Part 1**. Keep track of any work that they write down, and what they say. If the subject is not telling you what they are thinking, ask them to think out loud as they work on it. If a subject cannot solve a problem in a reasonable length of time that is okay, just keep track of what he/she was able to do. You may answer your subjects' questions about the problem, but be sure to tell me what questions were asked and what your answers were. Next, demonstrate how to do each problem with the manipulative listed by that problem in **Set 1**. After you have taught all of the problems, sit back and let the subject solve the problems in **Set 2**. Keep the manipulatives available, but the subject does not have to use them. (You can encourage them to try to do it that way, but pencil/paper is okay too.)

Write up: Provide me with relevant information about your subject, except for his/her name. Describe the subject's solution process and attach a copy of his/her written work. Report the solutions that each subject gave, as well as whether each was able to solve the problem correctly. If he/she came up with an incorrect solution or was not able to completely solve the problem, give your best conjecture as to what the subject's misunderstanding may be. Provide at least a one paragraph summary and comparison of all both subjects. Then tell what you learned about how people think about fractions from doing this project.
Length: 2 or more pages of word-processed text, plus copies of the subject work.

Problems:

Be very certain you use the correct size grids as you teach them.

Part 1: Free play, just tell them what the manipulatives are named, then let them pick out the relevant pieces, and answer the questions as you ask them. You may provide a written copy of the questions to your subjects.

1. Use the base 10 pieces. If the flat = 1, then what is the littlest square? The long?
2. Use the decimal squares. Shade in 0.9, 0.90 and 0.09. Which two are the same size? (Read these out loud as parts of tens, such as 9 tenths, 90 hundredths, etc.)

Now, you will choose whether to teach Part 2 or Part 3. Be sure you do all of that section. Be sure to teach your subject how to use the manipulative to do the first set, then have them solve the second set any way that they like.

Part 2.

Set 1:

Subtraction as take away: Use the decimal grid paper to teach:

- 1) $0.36 - 0.12$ 2) $0.36 - 0.2$ 3) $0.36 - 0.18$

Subtraction as comparison:

- 1) $0.36 - 0.12$ 2) $0.36 - 0.2$ 3) $0.36 - 0.18$

Division as repeated subtraction/measurement:

- 1) $0.36 \div 0.12$ 2) $0.36 \div 0.2$

Division as partitioning/sharing:

- 1) $0.39 \div 3$ 2) $0.040 \div 5$

Set 2: for the subject to solve:

Subtraction as take away:

- 1) $0.48 - 0.12$ 2) $0.48 - 0.2$ 3) $0.48 - 0.12$

Subtraction as comparison:

- 1) $0.48 - 0.12$ 2) $0.48 - 0.2$ 3) $0.48 - 0.12$

Division as repeated subtraction/measurement:

- 1) $0.48 \div 0.12$ 2) $0.48 \div 0.2$

Division as partitioning/sharing:

- 1) $0.48 \div 5$ 2) $0.020 \div 5$

Part 3.

Set 1

Use the base 10 pieces and/or the base 10 grid to teach how to use these to interpret and solve the following:

- 1) 3×0.15 2) 3×0.025 3) 0.4×0.8 4) 0.4×1.8

- 5) 1.4×1.8

Set 2: for the subject to solve:

- 1) 3×0.24 2) 3×0.036 3) 0.3×0.9 4) 0.3×1.9

- 5) 1.3×1.9

Decimal Project Rubric: Mathematical content Subtotal _____/12

12 points:	There were no mathematical errors in the interviewer's work and all errors in subject's work were correctly and clearly identified. The mathematics of each subject was clearly understood, analyzed correctly for errors and understanding is exceptional.
10 points	There were minor mathematical errors in the interviewer's work or in the work reported on, errors and understanding of subjects was acceptable, but not exceptional.
8 points	There were minor mathematical errors in the interviewer's work and in the work reported on, errors of subjects were reported, explanation was attempted, but not clear.
6 points	There were major mathematical errors in the interviewer's work or in the work reported on, some, but not all errors of subjects were reported. Explanation was attempted, but not clear.
4 points	There were major mathematical errors in the interviewer's work and in the work reported on, most errors of subjects were NOT reported, OR explanation was NOT attempted, and/or was not clear.
2 points	There were major mathematical errors in the interviewer's work and in the work reported on, errors of subjects were NOT reported AND explanation was NOT attempted, and/or was not clear.
0 points	Only interviewed, write up does not clearly report anything relevant to the mathematical content or understanding of the subjects.

Presentation/Organization Points Subtotal _____/6

6 points	Report is thoughtful and articulate. All objectives were met, organization is clear and logical, no grammar or stylistic errors, communication is clear and concise. Introduction, body, summary and
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	conclusion are exemplary in form and content.
5 points	Report is thoughtful but not quite articulate. All objectives were met, organization is clear and logical, fewer than 3 grammar or stylistic errors, communication is clear and concise. Introduction, body, summary and conclusion are present.
4 points	All objectives were met, organization is clear and logical, fewer than 5 grammar or stylistic errors, communication is fairly clear. Introduction, body, summary and conclusion are present, but one or more is weak.
3 points	Not all objectives were met. Grammar or style flaws interfere with readability. Communication is not clear, introduction and conclusion are weak or missing, OR summary is weak or missing.
2 points	Few objectives were met. Grammar or style flaws interfere with readability. Communication is unclear, and introduction and conclusion are weak or missing, AND summary is weak or missing.
1 point	A written report was turned in, but the grammar/style are poor, the organization is minimal or lacking, summary is poor or missing, introduction and/or conclusion is missing.

Project total _____/18

Polygon/Polyhedra Scavenger Hunt

You may work WITH A GROUP on the project or alone. NO groups of more than 4.

You will hand in ONE project with all of your names on the project. You will need a camera for this project, so I recommend you do it as a group, especially if some of the group members don't own cameras. If no one in your group owns a camera, go in together to purchase a disposable camera at any discount store. You should be able to find one for less than \$10. Don't wait until the last minute to take your photos-you will need to allow time to get them printed or developed. You may use a digital camera and either print the photos on white paper (it doesn't have to be photo paper) or make a PowerPoint presentation.

Find and photograph different examples of distinct, different examples of at least 14 of these polygons.

Square, rectangle, rhombus, parallelogram, trapezoid, isosceles trapezoid, right triangle, acute triangle, obtuse triangle, scalene triangle, equilateral triangle, isosceles triangle, pentagon, hexagon, octagon, polygon with 7 sides, polygon with *more* than 8 sides.

Find and photograph different examples of at least 6 of these polyhedra:

Pyramid, prism, cube, tetrahedron, octahedron, dodecahedron, or other different polyhedra (Be sure that you know the definitions and ways to name before you go to take photos!)

(You may include a Cylinder or Cone as 1 of the 6, 3-D shapes you photograph, but be sure you label them correctly.)

Presentation: On each page clearly label your photograph with the appropriate name of your polyhedron or polygon and its location (be fairly specific: e.g. "window in my apartment", "table on the 3rd floor of Ronan," etc.) You need to include the correct definition in some fashion. Do not remove your shape from its surrounding photo, though you may find a creative way to emphasize where the shape is. Each photo should clearly emphasize the shape you name, and should include the entire shape, clear and focused. You must have at least one photo of each shape, but to really teach a shape it helps to use examples of each that are and are not that particular shape. You will want to avoid too many confusing shapes in any one photo for presenting the idea, but may use more complex photos to "test" the eyes of the person using your project after they have learned. Your presentation should involve the reader in some way, the more

actively involved, the better the learning! You should think about a way that the reader may assess his/her understanding of the concept. (How will the reader know that he/she has learned to correctly name the shapes?)

You may use a scrapbook format or PowerPoint format to present your project to the class. (If you do a power point, you will need a printout to turn in, burn a CD or see me for other ways to submit the electronic version.) This should be a quality product, a college level product. Be creative in your display. You should make it something you can take with you as you teach for a child to look through the book to practice identifying shapes. NO POSTERS!

Scavenger Hunt Grading Rubric

Name(s):

Square, Rectangle, Rhombus, Parallelogram, Trapezoid, Isosceles Trapezoid, Right Triangle, Acute Triangle, Obtuse Triangle, Scalene Triangle, Equilateral Triangle, Isosceles Triangle, Pentagon, Hexagon, Octagon, Polygon with 7 sides, Polygon with *more* than 8 sides,
 (other: _____)

Pyramid, Prism, Cube, Tetrahedron, Octahedron, Dodecahedron, Polyhedron with more than 12 faces, Cylinder, Cone (other: _____)

Category	3 points	2 points	1 point	0 points
Number of shapes provided, (redundant or mislabeled shapes will not be counted)	More than the required 14 shapes and 6 3-D objects listed are used.	The required 14 shapes and 6 3-D objects listed are used.	1 or 2 less than the required 14 shapes and 6 3-D objects listed are used.	3 or more shapes missing.
Photos of each shape	Extra examples for each shape, some are that shape, some are not, so reader can deduce the definition. The photos are clear, focused, and centered on the desired object. Each page is neat, not cluttered, making the objective clear and easy to focus on.	At least one example of each shape. The photos are clear, focused, and centered on the desired object. Each page is neat, not cluttered, making the objective clear and easy to focus on.	At least one example of each shape. Not all photos are clear, focused, and centered on the desired object or each page is not neat, cluttered or making the objective unclear and not easy to focus on.	2 or more Pages are not neat, not clearly focused on the desired object, the objective is unclear.
Definition of shapes	Correct definition is given to confirm the conclusion. All terms are spelled correctly.	Correct definition is given for each shape. All terms are spelled correctly.	1 or 2 definitions are incorrect, or 1 or 2 are misspelled.	1 or 2 are misspelled AND incorrect or more than 3 errors.
Theme	There is a definite theme, well carried out.	Theme attempted, minor variance, adequately carried out.	Theme may have been attempted, not clear.	No theme attempted.
Interactivity	The project is interactive, with easy to follow directions, entertaining or	The project attempts to be interactive, minor problems in directions or use.	Interactivity attempted, major flaws in execution.	No interactivity.

	educational.			
Self-evaluation	Complete self-evaluation activity is included for the reader with correct solutions.	Adequate attempt at self-evaluation for reader, or minor flaws in solutions.	Some attempt at self-evaluation for reader, major flaws in solutions.	No self-evaluation for reader.
Presentation		College level work, thought about goal and objectives of project evident.	Not quite college level, some thought about goal and objectives evident.	Inadequate time and thought put into the project.

Project Grade: _____/20

Geometry projects: Creating a mathematical artifact.

These are individual OR group projects, but groups no larger than 3.

You will create a mathematical artifact that is of a quality that you may keep it for use later in your teaching. Choices for projects are:

1. Kaleidoscopes: Make one that works
2. Flexagons: What are they? Create at least 5 different flexagons that work, and may be used by me and/or classmates
3. Archimedean Solids: Create at least 5 models, your model must be large enough to handle, sturdy enough to handle, and large enough to be easy to show in a classroom.

Choose from 1, 2, or 3. You will research that object. You will turn in a report with your project that has your name, the project you chose, some of the history of that object and the mathematics of the object, and explain your investigations. Materials to create these are available many places, and there is information on these online as well.

Part I is graded on creating your artifact. You should make every attempt to be neat, careful, and thorough. Working models must work well for full credit. Your project should be durable enough for classmates to try it several times. The majority of the points for this part concern whether you create the artifact well, and does it do what it should or show what it should? **To receive the full credit for this part, the object must be clearly superior in quality, and work as it is supposed to work.** This includes using interesting methods/colors/materials, or extra effort.

Part II is grading on the written part of your project. Describe your artifact, and tell how it is mathematical. Explain where you found your information and materials, what you learned about your artifact, how you might use it in a lesson tied to other areas of curriculum such as history, language arts, social studies, geography, etc. **To receive full credit the report must have good mathematical detail.**

Grading Rubric: Geometry Artifacts:

Written Report: Subtotal _____/10

	2 points	1 point	0 points
Source	More than one source, correctly cited.	At least 1 source, correctly cited.	Missing citation or lack of source.
Description of artifact	Complete, clear, college level.	Description attempted.	Very weak, unclear or missing.
Mathematics of artifact	Detailed information about mathematics is given, some understanding of the math involved is clear.	Some information is given, understanding of content is not clear.	Little information or misunderstanding of math involved.
Historical background	Detailed, complete historical background.	Some historical background given.	Not addressed or very weak.
Lesson plan	Lesson plan outlined, integration of at least 3 subjects other than math.	Lesson plan outlined, not clear or not using at least 3 other areas.	Missing.

Archimedean Solids: Subtotal _____/10

	2 points	1 point	0 points
Number of solids	More than 5	5	Less than 5
Durability	Laminated/very durable.	Card stock or very heavy paper.	Not very solid.
Color	Use of color enhances use of artifact.	Colorful, attractive.	Not colorful or use of color distracts from use.
Neatness of fit	Solids appear professional, all corners, edges match neatly fit precisely.	3-5 solids are nearly professional, most match neatly, minor flaws in corner or edge matching.	More than 3 solids do not fit together well.
Size	Sizes are consistent and are at least the size of a softball.	Most of the solids are about the same size, all larger than a baseball.	Not matched sizes or smaller than a baseball.

Kaleidoscope: Subtotal _____/10

	2 points	1 point	0 points
End piece	End cap may be exchanged to change viewing objects, end cap rotates to change view.	End cap rotates, but may not be exchanged with another.	Fixed end cap, does not move.
Objects for viewing	Contains freely flowing objects of a variety of colors and shapes.	Has a variety of shapes and colors, not freely moving.	Only 1-dimensional shapes and/or does not move.
Durability	Made of PVC pipe or other very durable material, end caps will withstand repeated use.	Durable to withstand repeated use.	Not durable. Lightweight cardboard tube, etc. end cap won't last.
Reflections	Sharp clear reflections, or configuration other than equilateral triangle executed very well, glass mirrors.	Minor flaw, may see seams in mirror, or slightly off in angle of mirror, glass or superior	Major flaws, reflection not clear, plastic mirror or other inferior reflective surface.

		reflective material, used equilateral triangle.	
Overall appearance	Exterior design enhances project.	Exterior does not detract from project.	Exterior detracts from project.

Flexagons: Subtotal _____/10

	2 points	1 point	0 points
Number	More than 5.	Exactly 5.	Fewer than 5.
Working	All work easily, freely, smoothly.	All work, maybe some not as well.	1 or more fails to work properly.
Color	Color or patterns enhance the experience.	Color and pattern are used; do not detract from use.	Color/patterns detract from use.
Durability	Very durable materials used, laminated, etc.	Mostly durable, can handle without tearing.	Material not heavy enough for repeated use without tearing.
Size	Each is larger than 4 inches across widest point.	Each is least 3-4 inches across widest point.	Some smaller than 3 inches across widest point.

Overall Project:

Written report _____/10
Artifact _____/10
Project total _____/20

Project: Geometry of Measurement:

You may work WITH A GROUP on the project or alone. No groups bigger than FOUR, please. You will hand in ONE project with all of your names on the project.

You are going to plan the redecoration of a room. The room MUST be NOT perfectly rectangular; it must have an alcove, or unusual shape, like 5 or more sides.

You will be **making a scale drawing** of the room's floor plan, marking the windows, doors and any other features that affect your measurements. You will also include scale elevations of each wall of the room, with windows and doors, and any other architectural features. Use of graph paper for this is strongly encouraged. You may use metric or American measure; either is fine, but be consistent and label your figures. You will plan to paint the room, replace the flooring, and install a wallpaper border along the top edge of your room. You will need to allow for windows or doors, or other features. (Photos of the space as a before picture are encouraged, digital or black and white are fine.)

You will need to **determine the surface area to be painted**, and the amount and price to allow for paint. You will want to find out how much paint one gallon of paint will cover for this. Supply the paint chips for three different color choices, and note the one you choose. Your calculations should be clear, and logical. If the three kinds/colors of paint have different coverage/price you should have work for all three.

You also need to find **the area for flooring, and length for the border**, and choose three types of flooring, (e.g. carpet, wood, linoleum) and three different borders that go with each of the

three paint chips. Samples of these need not be supplied; a good color photo is fine. **Calculate the price for each** of these, and make a final selection for your re-decoration, and **give the final costs**. (You will have many possible combinations; at least three should be calculated for total cost, then choose the one you like best to be the final cost.)

Calculate the volume of your room, and find an air conditioning unit that will cool the room correctly, based on that volume, and give its price, and brand information.

Put together a nice demo board (maximum size 24" by 24") with all three samples for each of the three combinations, paint, border and flooring, to turn in with your report as if you are doing this for a client, and give your best choice as the least expensive option that looks good!

YOU WILL BE GRADED NOT JUST ON THE CORRECTNESS OF YOUR ANSWER BUT ALSO ON HOW WELL I CAN FOLLOW YOUR WORK. BE SURE TO CLEARLY INDICATE YOUR UNITS. DO NOT ASK ME or any other instructor TO CHECK YOUR WORK BEFORE YOU HAND IN YOUR PROJECT! I will check it when I GRADE it, as part of the grade!

Rubric: Geometry of Measurement

Scale drawing	Neat, clear and accurate, showing all features like windows, doors, other features that may affect the measurement and amounts of materials needed.	Somewhat neat, may have minor inaccuracy in scaling or may be lacking features.	Not neat, room features are unclear, major inaccuracy in scaling.
Surface area of room	Correct, neat calculations for all the walls are provided and windows, doors or other features are appropriately dealt with.	Minor error in calculation or minor error in dealing with room features.	Major error in calculations, or not enough work shown to verify.
Surface area of floor	Correct, neat calculations for the floor are provided and any alcoves, bends or curves are appropriately dealt with	Minor error in calculation or minor error in dealing with floor features	Major error in calculations, or insufficient work shown to verify.
Perimeter of the room for the border	Correct, neat calculations for the room are provided, and any alcoves, bends or curves are appropriately dealt with.	Minor error in calculation or minor error in dealing with room features.	Major error in calculations, or insufficient work shown to verify.
Cost for each type of paint, flooring, and border	Correctly, neatly calculated. There are at least three combinations.	Only one error and/or only two combinations considered.	More than one error, or insufficient work shown to verify, and/or only one combination considered.
The total costs for the final combination	Correctly, neatly calculated.	One minor error in computation.	More than one error or insufficient work shown to verify.
Report	Discusses the options, choices, and explains the reasoning for the choice, with summary of the costs for each option under consideration. All grammar and structure is appropriate for the report style.	Only summarizes costs, or gives minimal reason for choice. Grammar and/or structure have minor flaws.	Missing summary or reasoning for choice, and/or major flaws in grammar and/or structure.
Samples	Includes color samples for the paint, the floor covering and borders, or very clear color photos of the floor covering and/or border.	Includes some samples, not complete set for each of three combinations.	Only paint samples attached, or no samples.
Volume calculations*	Volume calculations for the room are correct, neat, clear and explains how that may impact the choice of an air conditioning unit*.	Minor error in volume calculations, not clear or choice of unit not clearly explained.*	Major error in volume calculations and/or choice of unit not addressed*.
Overall impression	Professional, college level job of excellent quality.	Minor flaws in quality of work, acceptable quality.	Unacceptable quality.

* Some units just use surface area of the floor, if those are chosen, the reasoning for not needing to know the height of the room should be addressed.

Project grade _____/20

Statistics Project

You may work with a group on this project (or alone). No groups of more than four. You will hand in ONE project with all of your names on the project. You are going to collect, organize, and analyze data about the vehicles parked in Lot 22 (the large lot across the street from Pearce and Anspach) **DO NOT CHOOSE A DIFFERENT LOT WITHOUT DISCUSSING WITH ME FIRST!**

Design your study:

You will collect data* on a **sample** of **50** vehicles parked in Lot 22. Identify what the **population** is from which you are sampling. Tell whether or not your sample is a **random sample** (see course packet page and class notes) of the population. Explain why it is or is not a random sample, and how you chose. In your report, explain your study design well enough that I or another person could repeat your study. Predict what your study will show you.

***Choose at least 3 (more for full credit) characteristics** (variables) of your population on which you will collect data. Clearly identify what variables you have selected. State whether the variable is quantitative or categorical, and if categorical, whether it is binary. Do not use more than one binary variable for your study. Some characteristics used in the past include color (list several choices), make of vehicle, models of vehicle, number and types of stickers, type of hubcaps, number of doors, etc. See rubric for more detail.

Organize the data using a table or tables. You may use Excel or your calculator, or do this by hand. Then create good graphical images to help display the data. Use at least 3 different types of graphical representations that are appropriate for your data. You may use screen dumps from your calculator or graphs from spreadsheet programs, but be certain that they are used appropriately. (For example, if it is a color bar graph, make the colors the same as your data, like blue bar for blue colored car, etc. and don't use graphs that may be misleading like 3-D pie charts that are tilted to skew the size of the pieces.) **Summarize your data** verbally, and if it is appropriate, using summary statistics such as averages. In your summary, address the issue of prediction based on your sample and your data. Were your predictions good? Why or why not? Also, from your study could you predict what percent of the vehicles would have your characteristics on any given day? Why or why not?

Use word processing for your written report. Do NOT use a plastic binder, either staple the pages together or use a flat cardboard folder to hold your pages. Your report should include, in order, the rubric, how you designed and carried out your study, summary of your report, the graphs and the table(s) of your data.

To earn the full 20 points, there must be work that goes above and beyond the basic understanding. There will be a clear demonstration of understanding of what random sampling means, how and why your sample is or is not random, the summary will be excellent, using and explaining the data clearly, and completely, with no misunderstanding of the mathematics involved. Averages and predictions will be clearly explained, and used appropriately. Graphs will be neat, clearly labeled and appropriate for the type of variable.* Predictions will be made

before the study on the expected percentages for each variable, and predictions based on the results of the study will be addressed.

* Spreadsheet graphs MUST be appropriate and not distort data or be difficult to interpret.

Study design: The grade on this part of the project will be median of the circle for all four categories, rounded to the nearest whole number.

Points	Variables	Variables labeled/defined	Explanation of procedure of study	Randomness
6	4 or more, mixed types	All 4 defined correctly as categorical or quantitative, and if binary.	Readily possible to redo the study, process is clearly set out and explained, clear how sample was chosen, and how the data was collected.	Addressed the topic, clearly explained what a good random sample is, data selection was truly random.
5	4 or more, one type	4, most defined correctly as categorical or quantitative, and if binary.	Almost possible to redo the study, process is set out and explained, may be a minor question about how sample was chosen, or how the data was collected.	Addressed the topic, clearly explained what a good random sample is, data not quite randomly selected, but reasoning given.
4	3 mixed types	All 3 defined correctly as categorical or quantitative, and if binary.	May be possible to redo the study, process is set out and explained data was collected, but how sample chosen OR data collection is not clear.	Addressed the topic, clearly explained what a good random sample is, data collection not truly random, no reason given.
3	3, not mixed types	3, not all defined correctly as categorical or quantitative, and if binary.	May be possible to redo the study, process is set out and explained data was collected, but how sample chosen AND data collection is not clear.	Addressed the topic, seemed to understand what a random sample is, attempted random sample based on level of understanding.
2	Fewer than 3, mixed types	1 or 2, defined correctly as categorical or quantitative, and if binary.	Difficult to redo the study, process is set out but may be major questions about how sample was chosen, or how the data was collected.	Addressed the topic, not clear concepts are understood, may have attempted random collection.
1	Fewer than 3, not mixed types	1 or 2, not defined correctly as categorical or quantitative, and if binary.	Not really possible to repeat the study. Not clear how sample was chosen, or how the data was collected.	Topic mentioned, not understood, collection not random.
0	Missing	Missing	Missing	Missing

Subtotal previous page _____/14
Subtotal this page: _____/6
Project total: _____/20

Part 1: Statistics, Data collection, Representation

	2 pts.	1 pts.	0 pts.
Statistics use	At least one quantitative	All categorical, not all	All binary.

	variable.	binary.	
Statistics calculations	Statistics calculated correctly, used correctly.	Statistics miscalculated or used incorrectly.	Computed statistics on inappropriate variables or other misuses of statistics.
Data collection	Table is neat, clear and readable.	Table is present, not clear, or not neat.	Table is missing.
Graphs	At least 2 types of appropriate graphs.	All graphs same but appropriate.	One or more graph is inappropriate.
Verbal summary	Present, clear, appropriate use of information.	Present but inadequate.	Not present.
Predictions	Made predictions before study, addressed accuracy in summary as well as conclusion/summary made appropriate predictions based on study.	One of two is missing or summary predictions are inappropriate or inadequate.	Both missing.
Readability of report	Clear, neat graphs, college level writing No more than 2 minor grammatical errors.	Clear, neat graphs, 5 or fewer grammatical errors, not quite college level writing.	6 or more grammatical errors, style errors, sloppy or inadequate work.

Semi-total, points for this page: _____/14

Simulations and Theoretical Probability Project

20 points

Do alone or in a small group. No groups bigger than 4.

Materials needed: the plastic spinner circle from your manipulative kit and a calculator, protractor.

Simulations use experimental probability to solve “real world” problems that might be difficult to solve with theoretical probability. In this project you are going to carry out a simulation with a large number of trials and then compare your simulation answer with the theoretical probability answer which you are going figure out using a tree diagram.

The problem: Sandy Student drives to campus every morning. There are 3 traffic lights on her travel route. The probability that any one light is green during Sandy’s morning commute is 30%. The 3 lights operate independently of each other. What is the probability that:

1. all the lights are green when she gets to them?
2. none of the lights are green when she gets to them?
3. at least one light is green when she gets to it?

Part ONE: Solve the problem with a simulation.

For your model, you will use a 10-part spinner with parts 1,2 and 3 colored green.

Use your protractor to make the partitions of a circle into 10 equal parts. Be sure that this will fit under your spinner. Note that a 3-part spinner doesn’t work because the probability given in the

problem is 30%, not 33%. Also note that we don't know what percent yellow is or what percent red is, but we do know that together red and yellow are 70%. For each trial of the probability experiment, you will spin the spinner THREE TIMES (because there are 3 lights). You will do a total of at least 200 trials, summarizing your data in a chart. You will use your data to compute the experimental probabilities for the 3 questions in the problem. Write your answers as fractions and as percents.

Part TWO: Solve the problem with theoretical probability.

Make a neat, clearly labeled tree diagram for the problem the way we have done in class. Use your tree to compute the theoretical probabilities, writing your answers as fractions. Then change your answers to percent so you can compare with the experimental probabilities you found in part one.

Compare your answers. With 200 trials, we would expect (by the Law of Large Numbers) that the experimental probability should be quite close to the theoretical probability (although remember that we are dealing with chance, so anything is possible). If your experimental and theoretical probabilities differ by more than 10 or 15%, I would recommend you re-check your theoretical probabilities because you may have made errors there.

Probability Simulation Project Rubric

	2 points	1 point	0 points
Spinner	10 parts in perfect proportions, accurate, colorful.	10 parts, minor inaccuracy.	Clearly not evenly partitioned.
Data	Sample of first 20 trials of raw data is given in neat form.	Raw data is given, less than 20, or not clear.	Missing.
	Data is summarized in chart, graph or table.	Summary not clear, table or graph attempted.	Missing.
	More than 200 trials.	200 trials.	Less than 200 trials or number not clear.
Experimental probability	All calculation shown, neat and correct.	Minor errors, but work is shown.	Major errors or no work.
Theoretical probability Tree	Clear neat and completely labeled, branch probabilities calculated, listed neatly.	Adequate and correct, or missing some labels.	Missing, inadequate or major errors.
	End of branch probabilities are correct, outcomes are clear and correct.	End of branch probabilities are mostly correct, outcomes are mostly clear and correct.	Missing or major errors.
Theoretical probability computations	All calculation shown, neat and correct.	Minor errors, but work is shown.	Major errors or no work.
Comparisons	Final probabilities converted to decimal and/or percent correctly, neatly.	Minor errors in conversions of final probabilities.	Major errors in conversions of final probabilities.
	Statement of comparison addresses differences, differences close or evidence supports rechecking, good explanation given.	Statement of comparison addresses differences, differences not close and/or lacking evidence to support rechecking, explanation weak.	Statement of comparison missing or inadequate, no evidence of rechecking, no explanation given.

Total project points _____/20