THE INSTITUTIONAL PORTFOLIO:

A Performance-Based Model for

Assessment of General Education

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Steps in Designing an Assessment Process:

1. Identify Outcomes

2. Articulate and Operationally Define Outcomes

3. Select Assessment Methodology

4. Establish Standards

5. Devise System for Use of Assessment Results

6. Devise System to Evaluate Assessment Model

7. Pilot Test

8. Implement

"THOSE RECEIVING THE ASSOCIATE DEGREE ARE EXPECTED TO DEMONSTRATE THE ABILITY TO THINK AND TO COMMUNICATE EFFECTIVELY BOTH ORALLY AND IN WRITING; TO USE MATHEMATICS; TO UNDERSTAND THE MODES OF INQUIRY OF THE MAJOR DISCIPLINES, INCLUDING THE SCIENCES AND TECHNOLOGIES; TO BE AWARE OF OUR CULTURE AND OF OTHER CULTURES AND TIMES; TO ACHIEVE INSIGHTS GAINED THROUGH EXPERIENCE IN THINKING ABOUT ETHICAL PROBLEMS; TO DEVELOP THE CAPACITY FOR SELF-UNDERSTANDING AND PROBLEM SOLVING; AND FINALLY, TO GAIN SUFFICIENT DEPTH IN SOME FIELD OF KNOWLEDGE TO CONTRIBURE TO SOCIETY."

FACULTY ASSESSMENT COMMITTEES:

1. MATHEMATICS
2. SPEAKING
3. WRITING
4. CULTURE AND ETHICS
5. MODES OF INQUIRY
6. PROBLEM SOLVING

Assessment Methodologies: Three Major Categories

1. "Real-World" Experiences

2. Course-Related/Course Connected

3. Testing

Course-Related

- Capstone Courses
- Capstone Experiences
- Portfolios
- Competency Analysis
- "Other"

Testing

- **Standardized Tests**
- **Locally Developed Test**
- **"Embedded" Test Items**

PRINCIPLES UNDERLYING DESIGN OF THE MODEL

- No standardized testing
- General Education is the responsibility of the faculty as a whole – not individual departments
- It should be minimally intrusive for both faculty and students
- It should somehow use existing examples of student work

What Comprises an "Institutional Portfolio"

* **Collection and review of student work ("artifacts") produced throughout the curriculum for each of six major outcomes:**

  Mathematics
  Speaking
  Writing
  Culture and Ethics
  Modes of Inquiry
  Problem Solving

* **Review conducted by faculty teams using holistic scoring criteria (rubrics)**

* **Results compiled, analyzed, and reported in the aggregate by the Office of Institutional Research**

  Analyses may include demographic breakdowns on variables such as credit hours earned, prior courses completed, etc.

* **Results reported to Faculty Assessment Committee which, in turn, reports to the faculty Educational Affairs Committee**

* **Faculty acts on assessment results**

Characteristics of the Institutional Portfolio Model

* The outcomes and scoring teams are multidisciplinary thus "responsibility" rests with the institution/faculty as a whole, rather than single departments

* It is invisible to students, obviating the motivation and other significant problems with standardized tests

* It is minimally intrusive for faculty

* It requires no special "sessions," no sacrifice of class time (e.g. for testing), no external incentives for students to perform well

* It is labor intensive and requires significant institutional resources (faculty release time and/or overload pay, technical support)

* It is a dynamic process

* It's "messy"

Assessment Plan Logistics

Who Scores:	Three-to-Five person interdisciplinary faculty teams
How Scored:	Individually by team members or as a group
How Many Artifacts:	100 per outcome per year
When Scored:	Fall artifacts in spring; spring artifacts in fall
Who Selects Courses:	Office of Institutional Research
Who Selects Artifacts:	Faculty in each targeted class
Who Collects, Copies, Distributes Artifacts:	Office of Institutional Research
How Results are Used:	Results compiled by Office of Institutional Research; reviewed by faculty who propose curricular improvements
Budget/Resources:	$30,000 annually for faculty overload pay and $30,000 for a half-time support position in the Office of Institutional Research
Assessment of Assessment Plan:	Annual review by Faculty Assessment Committee

Mathematics Outcome

Outcomes Statements: Upon receipt of an associate degree from Johnson County Community College, a student should be able to:

1. Identify relevant data (numerical information in mathematical or other contexts) by
   a. extracting appropriate data from a problem containing extraneous data and/or
   b. identifying appropriate data in a word problem.

2. Select or develop models (organized representations of numerical information, e.g., equation, table, graph) appropriate to the problem which represent the data by
   a. arranging the data into a table or spreadsheet and/or
   b. creating pictorial representations (bar graphs, or pie charts, or rectangular coordinate graphs, etc.) with or without technological assistance and/or
   c. selecting or setting up an equation or formula.

3. Obtain and describe results by
   a. obtaining correct mathematical results, with or without technological assistance and
   b. ascribing correct units and measures to results.

4. Draw inferences from data by
   a. describing a trend indicated in a chart or graph, and making predictions based on that trend and/or
   b. describing the important features of data presented in a table or spreadsheet, and making predictions based on that trend and/or
   c. describing the important features of an equation or formula, and making predictions based on those features and/or
   d. making reasonable estimates when given problems involving quantities in any organized or disorganized form and/or
   e. drawing qualitative conclusions about the original situation based on the quantitative results that were obtained.

The mathematics outcomes consist of four major outcomes, numbered 1 to 4. These major outcomes are each subdivided into several subpoints labeled by letters. A major outcome is demonstrated when at least one subpoint has been demonstrated, except for major outcome 3, where subpoint 3a must be demonstrated. A subpoint is demonstrated when at least one instance of the subpoint has occurred, except for subpoints 3a (which requires at least 70 percent accuracy of the items examined) and 3b (which requires at least 2 instances involving different measures).

Rubrics: The following rubric will measure the mathematics outcomes.

5 = All four major outcomes are demonstrated by the use of more than one subpoint per major outcome.
4 = All four major outcomes are demonstrated.
3 = Three major outcomes are demonstrated.
2 = Two major outcomes are demonstrated.
1 = Only one major outcome is demonstrated.
0 = No major outcomes are demonstrated.

Standards: At least 75 percent of all JCCC students earning associate degrees should obtain a score of 4 or more on the mathematics outcomes rubric. At least 95 percent of all JCCC students earning associate degrees should obtain a score of 3 or more on the mathematics outcomes rubric.

Possible Assignments: You should submit the class set of the one (ungraded) assignment (homework, test, project, etc.) which would allow the student the best chance to meet the criteria outlined in the mathematics outcome statement of the Assessment Plan. Briefly, such an assignment would allow students to:

- work with extraneous data, word problems, or applications;
- create tables, graphs, or diagrams, or select and use equations or formulas;
- obtain several mathematical results; and
- draw qualitative conclusions from their mathematical work.

If you have created an assignment which gives the students the opportunity to do every one of the four items stated above at least once each, then that assignment would make an excellent submission for the assessment study. If you have not made an assignment in which a student could demonstrate all four items given above, then choose the assignment which would allow students to demonstrate as many of the four items listed above as possible.

Speaking Outcome

Outcomes Statements: Upon receipt of an associate degree from Johnson County Community College, a student should be able to make a clear, well-organized verbal presentation.

Rubrics: ***Very good/excellent (5-6)*** = The communicator presents a message that is exceptionally appropriate for the purpose, occasion, and audience with a purpose that is exceptionally clear and identifiable. The message is supported using material that is exceptional in quality and variety. The communicator uses an exceptionally clear and coherent organizational structure, provides a logical progression within and between ideas, and uses language that is exceptionally clear, vivid, and appropriate. The communicator makes exceptional use of vocal variety in a conversational mode; has exceptional articulation, pronunciation, and grammar; and demonstrates physical behaviors that provide exceptional support for the verbal message.

Satisfactory (3-4) = The communicator presents a message that is appropriate for the purpose, occasion, and audience with a purpose that is adequately clear and identifiable. The message is supported using material that is appropriate in quality and variety. The communicator uses a reasonably clear and coherent organizational structure, provides a logical progression within and between ideas, and uses language that is reasonably clear, vivid, and appropriate. The communicator makes acceptable use of vocal variety in a conversational mode; has acceptable articulation, pronunciation, and grammar; and demonstrates physical behaviors that provide adequate support for the verbal message.

Unsatisfactory (1-2) = The communicator presents a message that is not appropriate for either the purpose, occasion, or audience or is without a clear and identifiable purpose for the message. The message is supported with material that is inappropriate in quality and variety. The communicator fails to use clear and coherent organizational structure, does not provide a logical progression within and between ideas, and uses unclear or inappropriate language. The communicator fails to use vocal variety; fails to speak in a conversational mode; fails to use acceptable articulation, pronunciation, and grammar; or fails to use physical behaviors that provide adequate support for the verbal message.

Standards: Ten percent of students who have net the requirements for an associate degree at JCCC will earn 6 (excellent) on each of the speaking rubrics. Thirty percent of students earning an associate degree will score 5 (very good) or 6 (excellent). Eighty percent will earn scores of 4 (satisfactory) or higher and the top 98 percent will earn scores of 3 (minimal accomplishment of educational goals) or higher. The remaining 2 percent of the associate degree recipients are expected to earn the score of 2 (unsatisfactory) on the speaking rubrics. The score of 1 represents a skill level beneath the expectation of all associate degree recipients at JCCC. Hence, no associate degree recipients are expected to score at the level of 1 on the speaking rubric.

Possible Assignments: You should submit the class set of one assignment (video of speech, presentation, oral report, etc.). Which would allow students the best chance to meet the criteria outlined in the speaking component of the Assessment Program. Briefly, an appropriate assignment would allow students to demonstrate oral presentation skills by asking them to:

1. Develop a clear central idea appropriate for purpose, occasion, and audience
2. Develop main points with appropriate and convincing supporting materials
3. Utilize appropriate and effective organization of content
4. Demonstrate a clear, coherent, and conversational speaking style using effective verbal and nonverbal skills

If you have created an assignment which gives students the opportunity to do all of the items stated above, then that assignment would make an excellent submission for the assessment study. If you have not made an assignment in which a student could demonstrate all items given above, then choose an assignment which allows students to demonstrate as many of the items listed above a possible.

Writing Outcome

Outcomes Statement: Upon receipt of an associate degree from Johnson County Community College, a student should be able to write a clear, well-organized paper using documentation and quantitative tools when appropriate.

Outcome Rubrics: 6 = Essay demonstrates excellent composition skills including a clear and thought-provoking thesis, appropriate and effective organization, lively and convincing supporting materials, effective diction and sentence skills, and perfect or near perfect mechanics including spelling and punctuation. The writing perfectly accomplishes the objectives of the assignment.

5 = Essay contains above average composition skills including a clear and thought-provoking thesis, although development, diction, and sentence style may suffer minor flaws. Shows careful and acceptable use of mechanics. The writing effectively accomplishes the goals of the assignment.

4 = Essay contains strong composition skills, including a clear, insightful thesis, although development is insufficient in one area and diction and style may not be consistently clear and effective. Shows competence in the use of mechanics. Accomplishes the goals of the assignment with an overall effective approach.

3 = Essay demonstrates competent composition skills including adequate development and organization, although the development of ideas may be trite, assumptions may be unsupported in more than one area, the thesis may not be original, and the diction and syntax may not be clear and effective. Minimally accomplishes the goals of the assignment.

2 = Composition skills may be flawed in either the clarity of the thesis, the development, or organization. Diction, syntax, and mechanics may seriously affect clarity. Minimally accomplishes the majority of the goals of the assignment.

1 = Composition skills may be flawed in two or more areas. Diction, syntax, and mechanics are excessively flawed (7 or more major errors on out of class work). Fails to accomplish the goals of the assignment.

Standards: Ten percent of students who have met the requirements for an associate degree at JCCC will earn 6 (excellent) on each of the writing rubrics. Thirty percent of students earning an associate degree will score 5 (very good) or 6 (excellent). Eighty percent will earn scores of 4 (satisfactory) or higher and the top 98 percent will earn scores of 3 (minimal accomplishment of educational goals) or higher. The remaining 2 percent of the associate degree recipients are expected to earn the score of 2 (unsatisfactory) on the writing rubrics The score of 1 represents a skill level beneath the expectation of all associate degree recipients at JCCC. Hence, no associate degree recipients are expected to score at the level of 1 on the writing rubrics.

Possible Assignments: You should submit the class set of one assignment (paper, homework, test, project, etc.). Which would allow students the best chance to meet the criteria outlined in the writing component of the Assessment Program. Briefly, an appropriate assignment would allow students to demonstrate composition skills by asking them to:

1. Develop a clear theses statement
2. Develop main points with appropriate and convincing support materials
3. Utilize appropriate and effective organization of content
4. Demonstrate a clear and coherent writing style using effective diction and sentence skills
5. Demonstrate correct mechanical skills including spelling and punctuation

If you have created an assignment which gives students the opportunity to do all of the items stated above, then that assignment would make an excellent submission for the assessment study. If you have not made an assignment in which a student could demonstrate all items given above, then choose an assignment which allows students to demonstrate as many of the items listed above a possible.

Culture and Ethics Outcome

Outcomes Statements: Upon receipt of an associate degree from Johnson County Community College, a student should be able to:

1. Demonstrate a fundamental knowledge of world geography.
2. Demonstrate knowledge of the major cultural issues of a person's own culture as well as other cultures.
3. Demonstrate knowledge of major historical events affecting one's culture and other cultures.
4. Demonstrate familiarity with contemporary global issues.
5. Demonstrate an understanding of major ethical concerns.

Rubrics: Demonstrates knowledge of world geography:

4 = Compares and contrasts geographies and their relationship to their respective cultures.
3 = Analyzes the relationship between geography and culture.
2 = Analyzes the relationship between geography and economy.
1 = Identifies major characteristics of political and natural geography.

Demonstrates knowledge of the major cultural issues of a person's own culture as well as other cultures:

4 = Compares and contrasts cultural issues affecting one's culture and other cultures.
3 = Analyzes major cultural issues.
2 = Identifies major cultural issues in other cultures.
1 = Identifies major cultural issues from one's culture.

Demonstrates knowledge of major historical events affecting one's culture and other cultures:

4 = Compares and contrasts historical events affecting one's culture and other cultures.
3 = Analyzes major historical events.
2 = Identifies major historical events in other cultures.
1 = Identifies major historical events in one's culture.

Demonstrates familiarity with contemporary global issues.

4 = Compares and contrasts the effect of global issues on cultures.
3 = Analyzes contemporary global issues.
2 = Identifies several contemporary global issues.
1 = Identifies a contemporary global issue.

Demonstrates an understanding of major ethical concerns:

4 = Develops a comprehensive, rational argument for an ethical position and describes its implications for personal and social behavior.
3 = Analyzes an ethical issue, the pro and con positions and its consequences, and the issue's relation to other ethical issues.
2 = Identifies the ethical dimensions of academic disciplines.
1 = Identifies a general ethical issue.

Standards: The standard of judgment is 60 percent of the students will score 2.00 or higher on each outcome.

Possible Assignments: The Culture and Ethics rubrics for evaluating artifacts that are based on *content* and *levels of critical thinking.* Therefore, artifacts best suited for outcomes assessment will be those that reflect both of these facets of learning.

Among the artifacts best suited for evaluation would be:

1. Essay questions or oral reports that require synthesis or evaluation of subject matter relevant to the outcome (e.g., compare and contrast A and B; describe, discuss, analyze, etc., the relation of A to B; evaluate the arguments for and against, the strengths and weaknesses of, the implications of, etc., A).
2. Research papers, oral reports, journals, or portfolios on subject matter relevant to the outcome.

Artifacts that might suffice for evaluation would be:

1. Essay questions that require analysis or identification of subject matter relevant to the outcome (e.g., discuss, describe, analyze, identify, etc., the main characteristics of A; create an argument pro or con for A).
2. Written or oral quizzes or multiple choice tests that require analysis of subject matter relevant to the outcome.
3. Written or oral quizzes or multiple choice tests that require correct identification of subject matter relevant to the outcome.

These are only suggestions, and in no way intended to create an authoritative model. Instructors are encouraged to consider other possible artifacts that might be suitable for evaluation with the Culture and Ethics rubrics.

Modes of Inquiry Outcome

Outcomes Statement: Upon receipt of an associate degree from Johnson County Community College, a student should be able to demonstrate understanding of the modes of inquiry by identifying an appropriate method of accessing credible information and data resources; applying the selected method; and organizing results.

Rubrics: Every artifact will be evaluated to determine whether the student has demonstrated the ability to perform each component of the outcome. These components have been separated for modes of inquiry and for problem solving, and each example of the artifacts will be given scores for either or both areas, as appropriate. The following components comprise the modes of inquiry outcome:

1. Identifies an appropriate method of accessing credible information and data resources.
2. Applies the selected method.
3. Organizes results.

If an artifact presents evidence that a student demonstrated the ability to perform a component, the artifact work will be given a plus (+) score for that component.

If an artifact presents evidence that a student did not demonstrate the ability to perform a component, the artifact will be given a minus (-) score for that component.

If it appears that the assignment did not present an opportunity for students to perform a component, the artifact will be given a zero (0) score for that component. For example, this may be a result of instances where the instructor's assignment defined the problem or method of gathering information. The subcommittee scorers should concur on those particular components which receive zeros.

Artifacts scored for Modes of Inquiry must allow the student to perform at least 2 of the 3 components. Only components with plus or minus scores will be counted. A zero score is not counted and does not impact the outcome standard. It is not necessary for the subcommittee scorers to concur on components which receive plus or minus scores. The artifacts are scored as follows:

3 = the student demonstrated the ability to perform all 3 components.
2 = the student demonstrated the ability to perform 2 components.
1 = the student demonstrated the ability to perform only 1 component.
0 = the student was unable to demonstrate the ability to perform any components.

Standards: At least 80% of the Modes of Inquiry examples of student work should receive a maximum score possible, that is, 3 out of 3 or 2 out of 2.

Possible Assignments: The artifacts should provide an opportunity for the student to demonstrate understanding of the **modes of inquiry** by identifying an appropriate method of accessing credible information and data resources, applying the selected method, and organizing results.

An assignment which might provide the required information could be a research paper, semester project, any assignment involving some problem solving/data collection process, or perhaps an essay question on a test.

The modes of inquiry artifacts should require the student to collect information or materials and explain how they were collected, selectively use the collected materials to reach some result, and present the results in some tangible form. An assignment which provides some opportunity for the student to describe and explain the process of gathering and evaluating information would be particularly appropriate.

Problem Solving Outcome

Outcomes Statement: Upon receipt of an associate degree from Johnson County Community College, a student should be able to demonstrate understanding of solving problems by recognizing the problem; reviewing information about the problem; developing plausible solutions; and evaluating results.

Rubrics: Every artifact will be evaluated to determine whether the student has demonstrated the ability to perform each component of the outcome. These components have been separated for modes of inquiry and for problem solving, and each of the artifacts will be given scores for either or both areas, as appropriate. The following components comprise the problem-solving outcome:

1. Recognizes the problem.
2. Reviews information about the problem.
3. Develops plausible solutions.
4. Evaluates results.

If an artifact presents evidence that a student demonstrated the ability to perform a component, the artifact will be given a plus (+) score for that item.

If an artifact presents evidence that a student did not demonstrate the ability to perform a component, the artifact will be given a minus (-) score for that item.

If it appears that the assignment did not present an opportunity for students to perform a component, the artifact will be given a zero (0) score for that item. For example, this may be a result of instances where the instructor's assignment defined the problem or method of gathering information. The subcommittee scorers should concur on those particular items which receive zeros.

Artifacts scored for Problem Solving must allow the student to perform at least 3 of the 4 components. Only components with plus or minus scores will be counted. A zero score is not counted and does not impact the outcome standard. It is not necessary for the subcommittee scorers to concur on which items receive plus or minus scores. The artifacts are scored as follows:

4 = the student demonstrated the ability to perform all 4 components.
3 = the student demonstrated the ability to perform 3 components.
2 = the student demonstrated the ability to perform 2 components.
1 = the student demonstrated the ability to perform only 1 component.
0 = the student was unable to demonstrate the ability to perform any of the components.

Standards: At least 80% of the Problem Solving examples of student work should receive a score of 3 or 4.

Possible Assignments: Artifacts should provide an opportunity for the student to demonstrate understanding of **problem solving** by recognizing the problem, reviewing information about the problem, developing plausible solutions, and evaluating results.

An assignment which might provide the required information could be a research paper, semester project, any assignment involving some problem solving/data collection process, or perhaps an essay question on a test.

The problem solving artifacts should require the student to identify and state a problem, collect and review information about the problem, develop possible solution(s) to the problem, and evaluate and apply selected solutions. An assignment which provides an opportunity for the student to articulate a problem to be solved and describe and explain the process of solving the problem would be particularly appropriate.

Johnson County Community College
General Education Outcomes Assessment
Writing (N = 98)

	Students with > 60 credit hrs.			Students w/assoc. deg.			JCCC stand.
Score	#	%	Cum%	#	%	Cum%	%
6	1	2	2	1	6	6	10
5	16	38	40	9	56	62	30
4	20	48	88	5	31	94	80
3	4	10	98	1	6	100	98
2	1	2	100	0	0	100	
1	0	0	100	0	0	100	
Total	42			16			

Correlation: writing artifact scores with Comp. I course grades = .2448 (n = 22) (p = .272)
Correlation: writing artifact scores with cumulative GPA = .3232 (n = 42) (p = .037)

General Education Outcomes Assessment
Mathematics (N = 144)

	Students with >60 credit hrs.			Students w/ associate deg.			JCCC stand.
Score	#	%	Cum%	#	%	Cum%	%
5	4	6	6	1	4	4	
4	16	25	31	11	46	50	75
3	27	42	73	8	33	83	95
2	8	12	86	1	4	88	
1	5	8	94	2	8	96	
0	4	6	100	1	4	100	
Total	64			24			

Correlation: mathematics artifact scores with grade in highest required (for degree) math course taken = .4531 (n = 49) (p = .001)
Correlation: mathematics artifact scores with cumulative GPA = .2091 (n = 64) (P = .097)

DATE DUE

Writing Assignment #2

Project questions are intended to give students an opportunity to explore concepts of classwork by discovering the use of mathematics in the "real world".

Students will work in pairs on this assignment. All persons helping with the question must be listed in the report, as must all sources of information. Your report must include:

1. answers to the question
2. your procedure for gathering the data
3. your approach to analyzing the data
4. your conclusion
5. a bibliography of sources (written, persons, media, etc)

Evaluation of the process is as important as the answer!
A checklist for points will be distributed soon.
Rough drafts may be turned in prior to 11/7/95.
Please turn in a blank cassette tape with your rough draft.

Choose one of the following questions:

1. Microwave ovens heat food by using waves from the portion of the electromagnetic spectrum called microwaves. Discuss how microwaves are used to heat and cook food. Include in your discussion the range of frequencies of microwaves. Some microwave ovens are rated 600 watts and others 750 watts. What role does watt rating play for microwave ovens?

2. A computer is sometimes rated in *megahertz*. What is the definition of hertz and megahertz? Explain why a computer that is rated 25 megahertz operates more slowly than a computer that is rated 40 megahertz.

3. Write a short history of the sine function. Include references to its earliest known use, to how it was measured, and to how the word *sine* evolved.

4. Explain the meaning of the versin function, vercos function, and the exsecant function.Include information about the history and use of these functions.

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5. Assume that the time of sunrise can be modeled by a sine function. Let time t be the hour (as a decimal) at which the sun rises, and let d be the day of the year with d = 1 as January 1. Using an almanac, find the time of sunrise for the longest and shortest days of the year for this area. This information can be used to calculate the amplitude of the sine function. Determine the period of the function, using 365 days in one year. Now write the equation of the sine function, ignoring daylight savings time. Compare the sunrise times given by the equation with the actual values given in an almanac for at least one day in each season. Summarize your findings and methods and draw a conclusion concerning the accuracy of your equation and the reasons for its accuracy/discrepancy.

6. The terms *fundamental* and *overtones* are used in music. Write an essay in which you draw on your understanding of trigonometry to explain these terms.

7. Honeybees build their combs by using hexagonal cells that are constructed in such a way as to minimize the amount of wax required. Write an essay on the mathematics of the honeycomb. Include formulas for the volume of a cell and the surface e are a of a cell.

8. Who was Menelaus of Alexandria? What was his work in the area of trigonometry? Include information about the theorem known as *Menelaus s Theorem*..

9. In spherical trigonometry, each side of a triangle is a portion of a great circle. Explain what a great circle is and make a drawing of a spherical triangle. Associated with every spherical triangle is a trihedral angle. Explain what a trihedral angel is and show its location with respect to the spherical triangle in your drawing. What is the sum of the measures of the angles of a spherical triangle?

10. Right spherical triangles are solved by using *Napier s rules of circular parts*. What are Napier's rules and how are they used?

Research Assignment
Evaluation Checklist

	Excellent 10	Good 8	Fair 6	Poor 4
Introduction				
Statement/Explanation of Question				
Explanation of Solving Procedure				
Answer to question				
Answer to question				
Was this interesting to you? Why or why not?				
Graphs, charts, notations, or other visuals (if included)				
Overall Presentation: vocabulary, grammar, sentence structure, format, etc				
Conclusion				
Bibliography				

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TRIGONOMETRY ASSIGNMENT #2

Time of Sunrise as it Relates to a Sine Function

It is assumed by both man and beast that the sun will rise and set everyday. If ever there was a day in which this did not occur, it could very well mean the end of the world as we know it. While we all know the sun will always rise, there still remains a question of "How do we predict when a sunrise will occur?".

Any observer of nature realizes that the sun does not rise at the same time everyday. Instead, the time of sunrise varies day to day and season to season. In fact, the length of daylight is a sign of the seasonal changes in our temperate climate.

The task facing the researchers of this assignment was to model the time of sunrise by an equation of the sine function. By relating the time of sunrise to the sine function, a formula may be derived that would enable us to successfully predict the time of sunrise for any given day of the year.

In order to create this formula, data had to be gathered from various resources. The most frequently used resource was the almanac. It provided the time of sunrise for each day throughout the year. While it was not necessary to plot every single day's time of sunrise on our graph, it was necessary to plot some important sunrise values, such as the Summer and Winter Solstices and Spring and Autumn Equinoxes. Our first attempt to plot the sunrise sine graph resulted in a graph resembling only the first half of a cosine function. This was because we were starting our graph on January first, which is very near the winter solstice on December 23 (which happens to be the shortest day of the year). Our y-axis represents the time of day, with the earliest hours being furthest away from the origin. This is why our graph only resembled half of a sine function. We were starting with the latest sunrise, peaking at the shortest sunrise in the middle of the graph, and then ending with the latest sunrise again to make one complete year. We soon realized that, to resemble a true sine function, we needed to begin at a time when the sunrise was midway between the earliest and latest sunrises of the year, headed toward the latest. This time would also be known as our sinusoidal axis, which we now needed to establish. The following are the steps we took to arrive at this value, as we actually did them:

1. December 22 had the latest sunrise of the year, 7:19 a.m., which is expressed as 7.32 in decimal form.
2. June 21 had the earliest sunrise of the year, 4:31 a.m., expressed as 4.52 in decimal form.
3. The difference of these two dates was calculated to be 2.80 hours.
4. The difference divided by two was 1.4 which, when added to the earliest time or subtracted from the latest time, gives us a value of 5.92 hours. This number is our sinusoidal axis.

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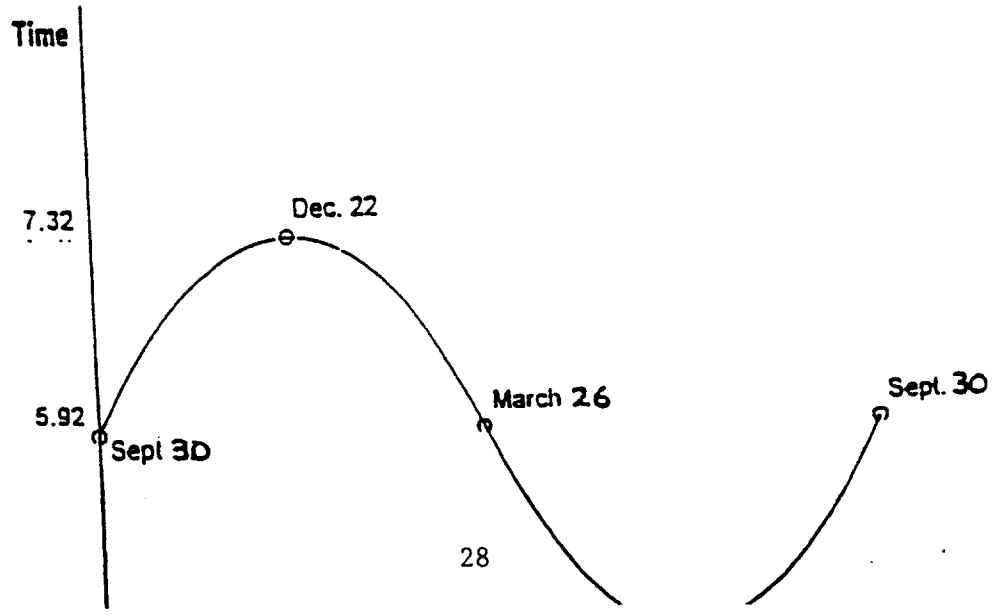
In an equation of the sine function, the component following the sinusoidal axis is the amplitude. The amplitude was found by simply taking the difference between the earliest and latest times of sunrise and dividing this number by two. This gives us an amplitude of 1.4. If this number is added to the sinusoidal axis, you will arrive at a value equal to that of our latest sunrise. Furthermore, if you subtract this amplitude from the sinusoidal axis, you will arrive at a value equal to that of our earliest sunrise. These simple calculations confirms that our amplitude and sinusoidal axis are correct.

As we stated before, plotting from the beginning of the year results in what resembles half of a cosine wave. To correct this we had to insert a horizontal shift. We now had to determine just how far it should be shifted. We understood that, to be a true sine graph, there had to be three points, all of which are on the sinusoidal axis, with equal values. The first and last point would be the same day, so that was no problem. But the middle point had to be a different day of the year in which the sunrise was approximately the same time. These days should have been the Spring and Autumn Equinoxes. However, we found them to be otherwise. After consulting the almanac again, two days were found to have the same sunrise time of 5:55 a.m., or 5.92 hours as expressed in decimal form. These days were March 26, the 85th day of the year, and September 30, the 273 day of the year. We also point out that these days are very close to the Spring and Autumn Equinoxes, respectively. Why they were not exactly the dates of the equinoxes we are unsure of. However, we do have some theories, which we express in the conclusion of this assignment, that we feel may explain this.

September 30 was determined to be the first day of the sine function because the values increased immediately after this day and then decreased, passing through this value again and on to the earliest sunrise of the year before increasing once again. Now that we knew the shift value and that it must go to the left, we were able to put this together with our previously determined sinusoidal axis and amplitude to arrive at 5.92 + 1.4 sin (d - 273) for our equation (d representing day of the year). We believed that this equation should produce the following graph:



Once this equation was established, we plotted the two equinoxes, the two solstices, and also the 21st day of each month. Unfortunately, this is where we ran into our greatest amount of difficulty. While everything seemed to indicate that this was the correct equation for the problem, we were reaching some bogus sunrise times when we inserted these days of the year and checked them against the values found in the almanac. What could be wrong? Our team looked to the Trigonometry text book for better understanding. Were the calculations for the shift correct? Although it seemed to be, things were still not working out and we also had questions about what the period of the function actually was. Another trip to the Math Resource Center proved to no avail when two math tutors were consulted and, after reviewing the problem and our findings, they were not able to help. Because the team was still unable to solve this problem and it seemed no one else could help, it seemed a consultation with the ultimate in trigonometry authority, was in order. However, was not available on Monday so, left to our own selves as resources, we made a startling discovery. The calculator, which was in radian mode for both of us, had to be in degree mode for the equation to work. Early on, we thought the proper mode would be radians due to the Earth's spherical shape. However, we now believe that the important factor is the period, which we calculated to be 365 days, or the length of one year. The reason the degree mode works is because there are 360 degrees, explaining why all of our values were very near what they should be, but not always exact.

After all was said and done, we believe we have come up with the most accurate way to use an equation of the sine function to model the times of sunrise throughout the year. The values were not always right on target but we feel this is due to reasons that we can not account for. For example, The Earth's orbit is elliptical and the shape of the Earth is not a perfect sphere. Neither of us have enough background knowledge to know just how much this affects the function, but we do know that the sine function deals performs in the unit circle, which is a perfect sphere and nothing we have been dealing with is. Also, the calendar we use is not totally correct. This is why we have to add an extra day once every four years. This could also throw our formula slightly off. Another reason, which we feel accounts for the inaccurate equinox times, is that sometimes, these days vary from year to year. This proves that there are inconsistencies in times of sunrises and, as we have found, it would be very difficult and maybe even impossible to use this function to predict the exact times of sunrise. Finally, our period of 365 days is 5 days more than the degree mode represented. We tried to think of another way to represent the period, but there seemed to be no other way. We were dealing with on year's time on a day to day basis. A period of 365 days, or 1 year, seemed to be the only logical answer. However, we both agree that if there is an error in our equation, this is where it must be. But, after checking them against the almanac, every single day of the year comes out to be no more than 10 minutes off of our predicted time, so our error should be minute, if it exists at all.

Although this problem turned out to be much more difficult than we had anticipated, both of us found it to be very interesting to solve because of two distinct reasons. The first is that we were able to learn more about a subject one would not expect

M0401

to learn about in a math class. It seemed more like a "real world" situation because research had to be performed on the topic before the actual math could be applied.

The other reason we found this assignment intriguing is that, through the use of this "real world" problem, we were able to gain a better understanding of the sine function and what each component of the equation actually represents. By dealing with something other than numbers that do not correspond to any event or thing, it created a greater desire to learn and understand the equation, so that we would get a realistic, comprehensible answer to a problem we were actually concerned about. This is not typical for either of us in a math class room setting, so, when the assignment was complete, we were both experienced a great feeling of accomplishment. We faced a difficult, mathematical challenge and came up with what we believe to be a valid solution. This, in our opinion, is the reason courses like Trigonometry are required. They teach us applications we can use to solve complex, yet everyday problems, like we just did.

mo401

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m0463

MICROWAVES

Microwaves have stemmed back through time since about World War 2. At this time scientists in England and hear in the U.S., at the Massachusetts Institute of Technology began studying the waves in an attempt to make practical advance in developing radar. We now know that microwaves are any electromagnetic wave whose frequency is in the range from about 1 to 300 gigahertz, this is part of the radio frequency spectrum. Microwaves are now more than just an attempt at radar, they have become useful in many forms of technology such as, satellite or tower- to-tower relay of telephone transmissions, telegraph, television signals, radio astronomy, and microwave ovens.

A microwave oven is an appliance that produces microwave radiation for cooking. The microwave radiation cooks food by penetrating the food and vibrating molecules inside of the food. Microwave radiation typically is generated at a frequency of 2,450 megahertz by a magnetron, a type of electron tube. The main advantage of a microwave is its ability to reduce cooking time.

Microwave oven cooking times will vary depending on the wattage of your microwave. Microwave's have different wattage ratings depending on the certain unit. These wattage ratings are a power scale, most microwaves a 750 watts which means they have more power and heat than the 600 watt microwaves which are noticeably smaller and will usually take longer to cook larger items because it is taking the actual wave frequencies longer to penetrate the food.

At first we did not have much interest on the thought of microwaves, however, after the

solving procedure, which consisted of researching for data and information through books and magazines it became a good topic increased the more we researched the topics.

The brief study of microwaves gave us a better working knowledge of what and how microwaves effect our lives. The microwave is much more complex than a simple kitchen appliance.

C403

The purpose of the topical paper is for you to broaden your knowledge base in one area of psychology and further develop your writing skills. Psychology is a very broad subject and in the introductory course there is not time enough to take one topical area and develop it fully. Each student has different areas of interest that he/she would like to explore. This paper will give you the opportunity to explore a topic in more detail.

You may choose any topic that is psychology related. A good place to start selecting a topic is from the topical outline provided in your syllabus. You should then go to the library to see how much information is available on the topic you chose. You must have five references in addition to your text book. If you have any questions about choosing a topic, please see me before or after class. Remember, choose something that is interesting to you.

The paper must be in the American Psychology Association (APA) style. I will provide you with guidelines, but you can also get help from the Writing Center.

Be sure to put the information into your own words. If you do copy information, please be sure to quote pages and the source. Again, the Writing Center is an excellent place to obtain help on how to put this information into your own words.

The date the topic is due is in your course syllabus. Any paper that is turned in late will be marked down ten percent. No paper will be accepted more than one week late.

The body of the paper should be ten pages typewritten, double spaced, with a cover page and a list of references for a total of twelve (12) pages.

The criteria for grading the paper will be as follows:

Correct length	20 points
APA style	20 points
Five references	20 points
Introduction and close	20 points
Information from references	100 points
Grammar	20 points

C00315

OUTLINE

I. What does LSD effect
   A. Locus coeruleus
   B. Mimics Serotonin
II. LSD was created in 1938
   A. Circulatory and respiratory stimulant
   B. Stimulated contraction of the uterus
III. LSD blocks serotonin receptors to the brain
   A. Reseachers are still trying to determine whether LSD inhibits or stimulates serotonin
   B. Recent research thinks LSD does both inhibit and stimulate serotonin
IV. George Aghajanian
   A. Injected rats with LSD
      1. Recorded electrical activity
      2. LSD caused serotonin neurons to stop firing
   B. Researched Locus Coeruleus
      1. firing of Locus Coeruleus was enhanced when rats were treated with LSD
      2. Locus coeruleus integrates all sensory input
   C. Synethesia
   D. Colored hearing

CW0315

The Psychedelic Experience

From the Pharmacologist's point of view, Psychedelic drugs are agents of negligible worth. Achemist whose task is to develop drugs to relleve symptoms, and if possible, cure diseases has little use for a drug that has no theraputic use and has the ability to provoke psychosis. However, many brain researchers value the psychedelic agents above any other type of drug. These scientists are immensely interested in why the changes, both physical and psychological, are produced by LSD. The research on LSD suggests amazing sense of oneness with the universe which might reflect an extreme activation with the Locus Coeruleus. Fairly recent studies show that LSD exerts potent effects on serotonin receptors, in which LSD mimics the effects of serotonin. Whether the effects on the Locus Coeruleus and on serotonin receptors are closely linked in evoking a psychedelic experience or not, the research of some scientists may give the reader a better understanding of what LSD might do to the brain and to a person experiencing an LSD trip.

LSD was first synthesized in 1938 by Albert Hofmann, a chemist at the Sandoy pharmaceutical laboratories in Basil, Switzerland (Henderson, 1994). The research was part of a systematic investigation into the properties of ergot (a rye grass fungus) as a source of new medicine. LSD was orlglonally created

with the idea that it might be a cirulatory and respiratory stimulant. But after testing the drug, it showed that it stimulated contraction of the uterus (Leary, 1994). LSD was the twenty-fifth semi-synthetic ergot with different amines (Snyder, 1986). The result was lysergic acid diethylamine, LSD-25 (Snyder, 1986). LSD bears a close chemical resemblance to the neurotransmitter serotonin. These neurotransmitters have significant roles in sensory perception and control of mood (Henderson, 1994). Two of the four rings in LSD's chemical structure are similar to the ring system in serotonin, and the side chain attached to the ring structure of serotonin is identidcal to another part of the LSD molecule.

In spite of all these structural similarities, it has proved extremely difficult to pinpoint the exact mechanisms by which LSD might affect serotonin. According to Snyder, in 1953, the British pharmacologist John Gaddum, conducted experiments that suggested on hypothetical mechanism of action, though just as rapidly, other reseachers noted contradictions. Gaddum had been measuring the ability ofserotonin to contract the uterus. It does this by acting at specific serotonin receptors. Gaddum obswerved that low concentrations of LSD blocked the effects pf serotonin upon the uterus, and on the assumption serotonin receptors in the brain are similar to those in the uterus, he then assumed that LSD exerts its psychedelic effects by blocking serotonin receptors to the brain. One contrafiction is that mescaline, another effective psychedelic drug, is not a serotonin antagonist (King, 1990). This evidence raised serious doubts about the validity of Gaddum's research. Along these same lines, Henderson and Glass found that LSD has a high affinity to the

neurotransmitter serotonin and interferes with the normal function of the serotonin receptors. An associtlon between brain serotonin and the action of LSD was proposed as early as 1954, and serotnin receptors have been confirmed as the major sites of action of LSD (King, 1990). Nonetheless, the exact mechanisim that produces psychedelic effects is still not fully understood. Henderson stated that reseachers are now trying to identify the specific serotonin receptors that are affected, and to determine whether LSD inhibits or stimulated the neurotransmission of serotonin. Recent research suggests that it can do both, and that its effects may vary at different locations of the brain.

According or King and Gaylord, George Aghajanian, a professor at Yale University, injected rats with small doses of LSD and then recorded the electrical activity of serotonin cells in the animals rapie nuclei. His electrical tracings showed that LSD caused the serotonin neurons to abruptly stop firing. This effect was all the more interesting because no other neuronal cellin the rapie nuclei seemed to be affected in the same way. But, unfortunately, Aghajanian ran into the same problem Gaddum did. Consequently, the psychedelic compound, mescaline, did not consistently slow the firing of the serotonin cells like LSD did.

So instead, Aghajanian researched the locus coeruleus when he was investigating the effects of LSD on the brain. Rats show the same hyper-responsiveness to environmental stimuli as humans--jumping abruptly to a puff of air in the face--when they have been treated with LSD. So, in 1980, Aghajanian began a series of studies to evaluate how LSD effects the locus coeruleus. He showed that any

kind of sensory stimulation, sight, sound, smell, or taste, speeds up firing of the locus coeruleus in rats, and the accelerated firing is greatly enhanced by treating the rats with LSD. What is interesting about Aghajanian's findings is how well they fit together with what we know ablut the effects of LSD in humans, and how they explain the way LSD excites all of our sensory perceptions. Snyder states, "The locus coeruleus is a funneling mechanism that integrates all sensory input." Looking at it this way, the observations of Aghajanian can explain synesthesia. Synethesia is defined as a condition in which a stimulus causes a sensation beyond what is usual and normal (Leary, 1994). The most common form is "colored hearing" in which music, voices, or other noises evoke perceptions of specific colors and shapes (Henderson, 1994). If the lous coeruleus puts together all types of these sensory messages into a general system within the brain, then one can appreciate that stimulating the locus coeruleus will cause the user to feel that sensations are crossing the boundaries of his mood.

The sensations that a person experiences when on LSD are called hallucinations. Hallucinations are classified as an altered state of sensory perception, thought, and feeling (Monroe, 1994). They occur when a person sees or hears something that does not exist but believes that these sights and sounds are real. The hallucinations produced by hallucinagenic drugs are different. They are usually visual, resulting when information about what the eye sees is distorted on its way to the brain. Henderson stated that LSD does affect the visual pathways. It appears to affect visual processing int the retina, as well as interfering with the electrical conduction of

visual information to the brain. Henderson also stated that in a comparison of the effects of LSD in blind and sighted humans, similar electrical activity occurred in the retina in both groups. Blind subjects who could once see, and whose optic nerves retained some function could perceive hallucinations. Hallucinations could occur in people with abnormal retinas, but could not occur if the optic nerves were destroyed. In short, people who are hallucinating see what we see, but they perceive it differently.

According to Monroe, visual disturbances are the main characteristic of an LSD trip. The types of disturbances she reported remained remarkably consistent over time for different subjects. Images may be perceived with the eyes open or closed. Geometric shapes are common, as is the perception of images or figures in patterns. Flashes of colors occur, and colors are generally intensified. Stable objects may seem to move, usually in the peripheral vision. Objects may seem to have halos. Afterimages can cause a trailing phenomenon, in which images remain as an object moves across the visual field. Hallucination of taste, smell, and hearing are rare. Other sensory/perceptual changes include an overall heightened sense of beauty, sounds or texture. Time can be grossly distorted, it may seem to slow down, to speed up, or even to run backwards.

According to Henderson, Euphoria is often the first reaction to LSD. Users grin, giggle, or laugh. A person on LSD is emotionally suggestible. Their feelings are intensified and may change abruptly in response to changes in setting. Over the course of the trip, users' emotions change rapidly; paranoia and hostility may develop,

followed by periods of calm or excitement. Occasionally psychotic statesa develop, but these are usually limited to a short period.

Another effect of an LSD trip is described by Leary. He states that a person's body develops a feeling of detachment. "This has been variously called deperson alienation, disassociation, derealization, body image distortion, and even levitation", Leary wrote. Users may temporarily lose their sense of identity, but are not usually delirious. Thoughts are dreamlike, flowing freely. Short term memory and abstract reasoning are impaired, as are judgement and impulse control. The user usually compensated for these effects by withdrawing and maintaining a lower level of activity. Some users have reported a transpersonal state of consciousness. It is often described as feeling that the mind is transcending the boundaries of the individual self. Space, time, and identity are all disarranged. The user may interpret this as a religious, mystcal, or metaphysical experience. The LSD users who have experienced this sort of feeling carry a recollection of it as strange, awesome, and beautiful; often yeilding a profound knowledge of oneself.

Albert Hofmann was the first man to experience an LSD trip. He tested this drug on April 19, 1938 by ingesting .25 milligrams of LSD (Snyder, 1986). Knowing its potency, this was a massive dose. Hofmann described the surprising power of the experience: "The following were the most outstanding symptoms: vertigo, visual disturbances; the faces of those around me appeared grotesque, colored masks; everthing in my vision wavered and was distorted as if seen in a curved mirror. . . I was seized by a dreadful fear of going insane. I was taken to another world, another place, and another

time. My body seemed to be without sensation, lifeless, strange. At times I believed myself to be outside my body. ... I shouted half insanely and babbled incoherent words" (Hofmann, 1980). This LSD experience and others like it are greatly influenced by the setting, the emotional state and background of the user, and the expectations of the user.

In this paper I have tried to describe what LSD research is currently unraveling about the actions of LSD on certain areas and functions of the brain and on one's psychedelic experiences. But it must be recognized that these mechanisms are either currently accepted theories or likely hypotheses, and are not concrete certainties. Through my research, I have a profound interest in the drug LSD, but I know the dangers that come with the abuse of it. So as a closing statement I leave the reader with a quote from Timothy Leary. "Acid is probably the healthiest recreational pursuit ever devised by humans. . . This is not to say the real dangers of LSD were exaggerated. Consciousness altering drugs change minds and loosen old customs. Change triggers off intense fear reactions. *Acid is a scary thing.*"

C600315

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