



## ASSESSMENT OF STUDENT LEARNING OUTCOMES IN GENERAL EDUCATION

### SUMMARY REPORT

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**Name of Institution:** SUNY at New Paltz      **Academic Year:** 2021-2022

**Report compiled by:** Laurel M. Garrick Duhaney, Associate Provost for Strategic Planning & Assessment

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#### I. GENERAL EDUCATION CONTENT AREAS ASSESSED

We assessed The Arts, Mathematics, Foreign Language, and Basic Communication-Written in AY 2021-22. Although we carried out activities related to the assessments throughout AY 2021-22, the actual assessments were administered in spring 2022. Below we discuss the assessment process, the assessment results (pp. 2-35), survey results (pp. 36-41), and proposed actions to be taken on the assessments (p. 42).

#### II. ASSESSMENT PROCESS

The GE Board, Institutional Research, and the Associate Provost for Strategic Planning and Assessment (associate provost) coordinated the spring 2022 general education (GE) assessments. The GE Board and associate provost provided information about the administration of the GE assessments to the campus, including to faculty teaching the capstone courses in which the assessments were administered and to the faculty who teach the GE courses in the knowledge and skills areas assessed.

During fall 2021, faculty teams developed assessment prompts and scoring rubrics for the content areas being assessed. The prompts and instructions for completing them were placed in SharePoint and accessible to students and faculty from the site. The GE Board co-chairs and other board members emailed information about the assessments to faculty and solicited their support to encourage students to complete them. Faculty and students uploaded students' responses to the assessment prompts to the SharePoint site. We deployed two surveys in spring 2022; one to the faculty in whose capstone courses the assessments were administered and the other to faculty who teach courses in the four GE knowledge and skills areas that we assessed in spring 2022. The survey to the capstone course instructors invited comments on how the assessment was administered and on how we could improve the process. The survey to the GE content area faculty asked them to reflect on their teaching of the courses and on their expectation of students' performance.

### III. GE ASSESSMENT RESULTS FOR GE KNOWLEDGE AND SKILLS AREAS ASSESSED

This section presents the results of the GE assessments for The Arts, Mathematics, Foreign Language, and Basic Communication-Written.

*Some caveats:* Office of Institutional Research (OIR) created tables for each content area from the raw data submitted by the assessment raters. The tables are therefore all uniform in format and focus areas. As readers go through the report, they will observe that there are instances where OIR's numbers vary slightly (by one or two points) from those of the assessment raters. Although several factors could account for this, OIR believes the most likely ones are manual or some oddities with the counting formulas in the spreadsheet.

The narrative for math differs from the other three areas so to maintain consistency, OIR counted a student only once (as in the other content areas) and from there calculated the data as the others. In essence, OIR performed the data analysis on the math raw data as in the other three areas.

#### A. THE ARTS

##### ASSESSMENT RATERS

Andrea Kantrowitz (team leader), Frank Boyer, Aurora De Armendi, Rena Leinberger, Jovana Stokic

##### OVERVIEW

*Information about General Education classes:*

- 100 (58%) took their GE course at New Paltz, 58 (34%) took their GE course elsewhere, and 10 (6%) were not sure where they took their course. Three (2%) students did not respond to the question.
- 89 (52%) of the students completed the majority of their GE classes at New Paltz, 69 (40%) completed the majority of their GE classes elsewhere, and 7 (4%) were unsure of where they took their GE classes. 6 students did not respond to the question.

*GE Arts Disciplines covered*

- 99 (59%) took Visual Art related courses, 22 (13%) took theater classes, 14 (8%) took music courses, and 36 (21%) were unsure or left this question blank.
- 79 (46%) took hands-on, experientially oriented courses (such as Intro to Ceramics or Intro to Acting), 56 (33%) took academically oriented history or appreciation courses, and 36 (21%) were unsure or left this question blank.

*Effort:*

- 142 (82%) of the essays were relevant and long enough to evaluate using the rubric.
- 19 (11%) of the essays were too short to evaluate and/or irrelevant to the prompts given.
- 11 (7%) of the essays were blank.

*Student Learning Outcome:*

Students will demonstrate:

- understanding of at least one principal form of artistic expression and the creative process inherent therein.

In order to be approved for the arts category, offerings should:

- engage the creative process directly as well as foster understanding of a principal form of artistic expression.
- demonstrate both performance-oriented and scholarly/historical offerings in the expressive arts.

The rubric for assessing essays had six criteria.

- Describes the expressive content of a particular art experience or work of art/architecture Y / N
- Applies appropriate categories, genres, or concepts Y / N
- Explains the creative process or cultural context Y / N
- Uses a convention or methodology from a relevant discipline to analyze it Y / N
- Demonstrates an understanding of the role of the arts in documenting or commenting upon human experience Y / N
- Analyzes connections between artistic expression and other academic or life experiences Y / N

Any answer that matches four or more of the criteria for a particular learning outcome, MEETS the learning outcome. Matching three or fewer criteria counts as DOES NOT MEET the outcome.

## RESULTS

Office of Institutional Research created the following tables from raw data submitted by the assessment raters for The Arts (see caveats under III above).

<b>Effort</b>		
	<b>N</b>	<b>%</b>
Blank	12	7%
Irrelevant/Too short	17	10%
Relevant & Adequate	142	83%
Total	171	100%

<b>How many students met learning outcome</b>		
	<b>N</b>	<b>%</b>
Meets	113	80%
Does not meet	29	20%
Total	142	100%

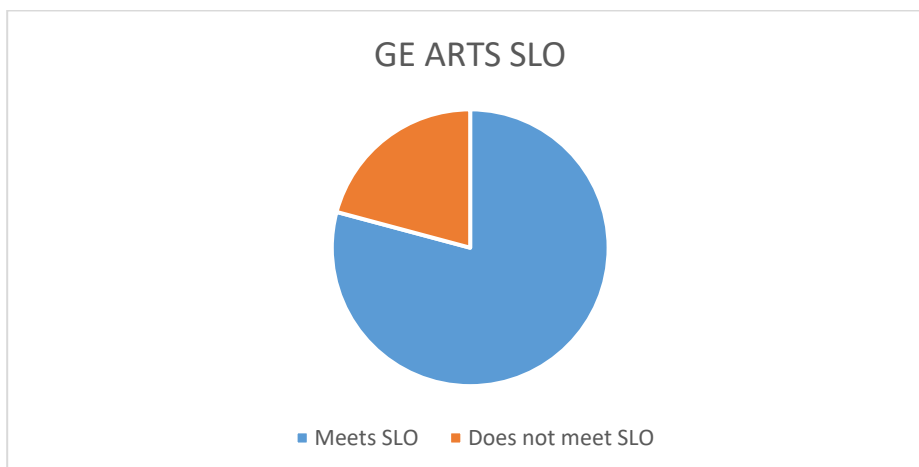
Rubric for Arts	Meets		Does not meet	
	N	%	N	%
Described the expressive content of a particular art experience or work of art/architecture	119	84%	23	16%
Explained the creative process or cultural context	116	82%	26	18%
Analyzed connections between artistic expression and other academic or life experiences	115	81%	27	19%
Demonstrated an understanding of the role of the arts in documenting or commenting upon human experience	113	80%	29	20%
Applied appropriate categories, genres, or concepts	93	65%	49	35%
Used a convention or methodology from a relevant discipline to analyze it	82	58%	60	42%

Whether student learning outcomes were met by where GE course was taken:

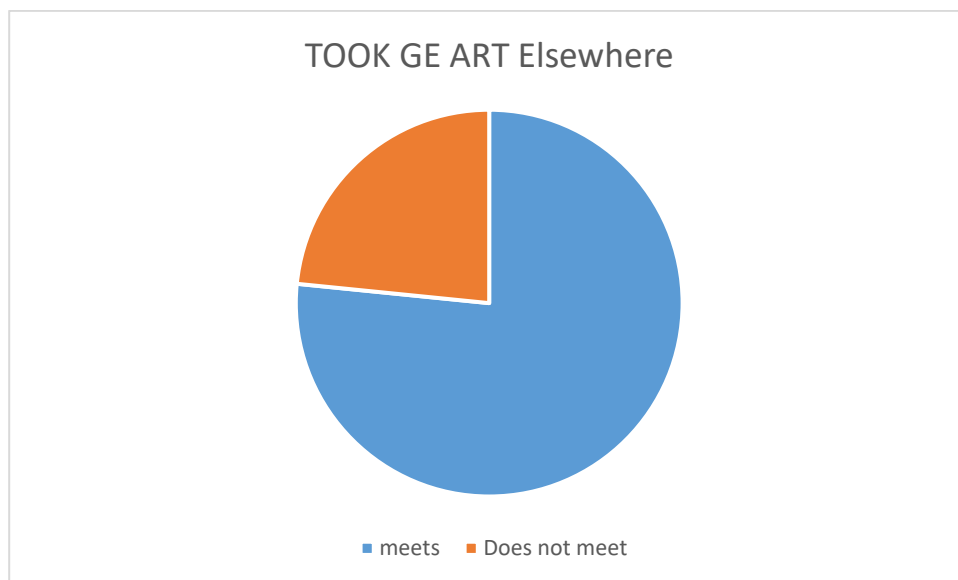
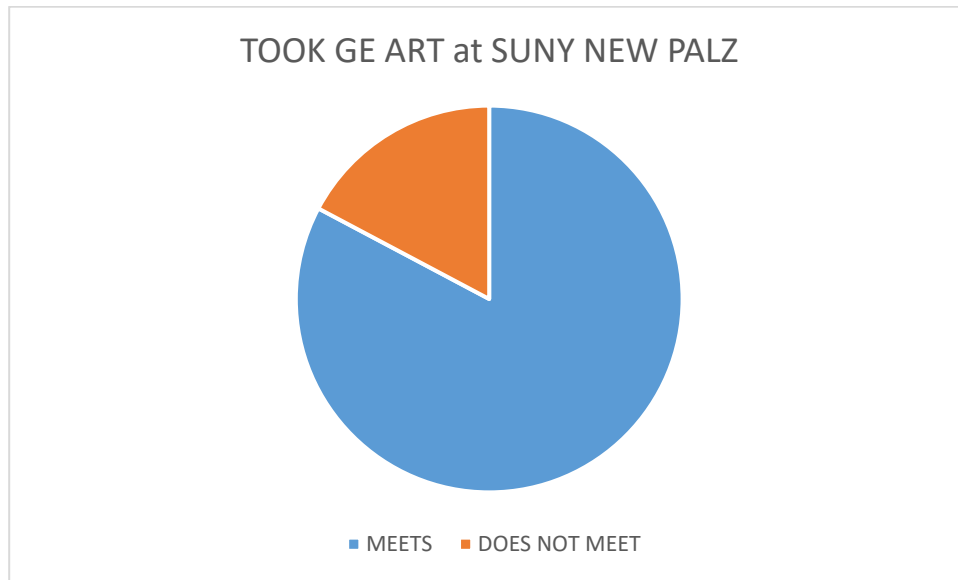
Rubric for Arts	At New Paltz	Elsewhere	Not Sure
	N	N	N
Meets	72	36	5
Does not meet	15	11	3
Total	87	47	8
	%	%	%
Meets	83%	77%	62.5%
Does not meet	17%	23%	37.5%
Total	100%	100%	100%

## RESULTS – ASSESSMENT RATERS’ SUMMARY

Of the 142 essays evaluated, 113 (78%) met the SLO and were able to demonstrate understanding of at least one principal form of artistic expression and the creative process inherent therein.



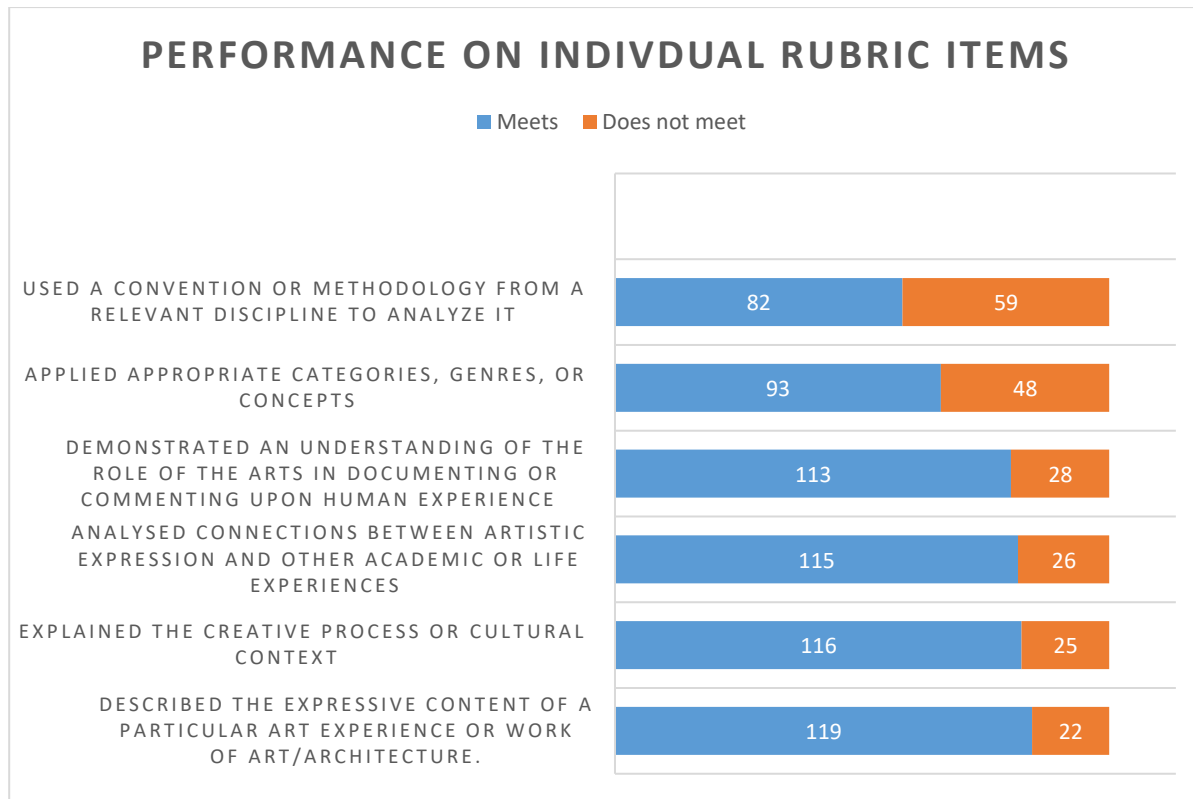
Of the 142 essays evaluated, 87 students took their GE ART courses at SUNY New Paltz. The essays of 72 (80%) students who took their GE Art course at SUNY New Paltz met the SLO whereas 15 did not. Thirty-six students who took their GE Art course elsewhere met the SLO and 11 students who took their GE Arts course elsewhere did not meet the SLO. Five students who were not sure where they took the GE course met the SLO and four who were not sure did not meet the SLO.



#### SLO criteria

- 119 (84%) described the expressive content of a particular art experience or work of art/architecture
- 116 (82%) explained the creative process or cultural context
- 115 (82%) analyzed connections between artistic expression and other academic or life experiences

- 113 (80%) demonstrated an understanding of the role of the arts in documenting or commenting upon human experience
- 93 (66%) applied appropriate categories, genres, or concepts
- 82 (58%) used a convention or methodology from a relevant discipline to analyze it



A large majority of students were able to describe the expressive content of a particular work of art/architecture or artistic experience, explain the creative process or cultural context, and analyze connections between the arts and other academic/life experiences. Success in these categories demonstrates general knowledge and familiarity with the arts. Fewer students (though still a majority) were able to apply discipline-specific categories, genres, or concepts, and even fewer used a convention or methodology from a relevant discipline to analyze it. Applying discipline-specific concepts and conventions and using them to analyze that discipline signifies a greater depth of knowledge and understanding of a particular discipline. This greater depth of knowledge and understanding is an important goal for the Arts GE category and faculty should keep centering it in their class designs and teaching in general.

## DISCUSSION

These results demonstrate that many students have a broader concept of the arts through their studies at SUNY New Paltz. They can describe and analyze many different kinds of works of art/architecture and arts experiences.

Many students described how their engagement with the arts at SUNY New Paltz enriched their lives in a broader way. For example, one student, describing their engagement with theatre, wrote, “The arts open my mind to the world around me. I feel I see more deeply into everything with my understanding of the power of

story.” Some students wrote thoughtful essays that described how their art experiences at SUNY New Paltz helped them notice connections between disparate domains. As one student, describing a class field trip to the Metropolitan Museum of Art in New York City, explained, “I learned that there can be intersections of academic concentrations that seem like opposites, but work well together. I like to bring in different areas of learning into my work.” In addition to their academic experiences, many students referred to the particularly arts-rich environment at SUNY New Paltz. Describing the wealth of available arts experiences, a student wrote, “One thing I’ve really come to appreciate about New Paltz is the constant ebb and flow of different art forms. There’s not a night that goes by that I don’t hear bands playing and it’s just such a beautiful expression of New Paltz.”

Some students expressed that they just do not relate to the arts, despite the GE requirement. As one student wrote, “I personally did not have any meaningful experience when it came to musical or theatrical performances, film, painting, sculpture, architectural space, or interdisciplinary artistic work. It has nothing to do with any school in particular but just who I am as a person. I am not driven or inspired by those things.” Others mentioned that taking online art courses during COVID was not a valuable experience, implying that they might have benefited more from an in-person class.

## **ASSESSMENT PROCESS**

### **The reflective essay prompt**

#### *Prompt design:*

All instructors in the GE ARTS category were invited to participate in designing and reviewing the reflective essay prompt; however, the studio art and art history instructors primarily participated in the design and review process. The faculty worked together to design an essay prompt that would be flexible enough to address the diverse artistic disciplines and broad range of hands-on, performance-oriented, and scholarly/historical coursework found within this category. As part of the design process, the faculty sent drafts of the prompts twice to all GE ARTs instructors and incorporated comments and revisions into the final prompt. Given the arts-rich environment at SUNY New Paltz, faculty decided to invite students to discuss arts experiences they found meaningful that they might have had outside of academic classes.

#### *The reflective essay prompt:*

Think of a particular work of art, performance, or artistic process that you experienced during your studies at SUNY New Paltz. Pick something that was personally meaningful to you and that you remember vividly. Was it a musical or theatrical performance, film, painting, sculpture, architectural space, or interdisciplinary artistic work?

- How would you explain why it moved you to another person not familiar with it?
- How has your understanding of this (and other) artistic work - including its form and process - shaped the way you think about creativity and the arts' ability to both document and comment upon the human experience?
- What connections have you found between artistic expression and your other academic and life experiences?

#### *Limitations of the prompt:*

Many of the essays indicated that the student had taken multiple art related courses, were involved with extra-curricular arts activities, or were arts majors. Two of the randomly selected courses were actually art studio

capstones for art majors. Although some students described how their GE arts courses impacted their other arts experiences, it was difficult to disentangle the impact of GE ART courses from other types of art enrichment students acquired during their time at New Paltz.

Since many students did not use discipline-specific concepts or conventions, it would be helpful to ask students to reference these as much as possible to encourage them to demonstrate their depth of knowledge and understanding. In the future, we could also provide a brief description of how their essays will be evaluated.

Some students, however, explained that they felt they had no understanding or engagement with the arts because it was irrelevant to their main area of study (e.g., STEM fields). Students also expressed frustration with GE requirements. This issue reflects some students' attitudes toward GE at New Paltz, which means editing the prompt will not necessarily encourage more participation.

#### *Limitations of the assessment process*

The GE Board has encouraged student participation in the assessment process by describing it as a reflective exercise that benefits them at the same time that it provides helpful information for the university. While many students gave substantive responses and seemed to express enjoyment and pleasure when recounting their thoughts and experiences, many of the essays were somewhat superficial in their descriptions with minimal analysis.

The participation rate is moderate. Two hundred eighty-nine students were asked to participate in GE ART assessment, and almost two thirds of these students participated (171 or 59%.) Just over half (141 or 49%) of the students who were asked handed in essays that could be evaluated.

Faculty were asked to set aside time during class for students to participate. It was clear, however, that some faculty may have encouraged more serious engagement, or simply provided more time for students' responses. There was a lack of accountability that made it easy to avoid participation.

#### *Possible sources for error*

Since most of the faculty who administered the assessment in capstone classes did not play a role in creating or evaluating it, there is a possibility of miscommunication and confusion. While the GE Board provided an introductory video and a FAQ for students and faculty to prevent misunderstandings, there is no guarantee that they looked at or used these resources.

#### *Improvements*

Having assessment take place online improved accessibility for students and made it easier for the GE Board to collect student work and distribute it to evaluators. Faculty distributed the document for the assessment assignment, collected students' work, and sent it to the raters or uploaded it to a designated folder. This may have increased participation from the previous year.



## B. MATHEMATICS

### ASSESSMENT RATERS

Madeleine Arseneault, David Hobby (GE Board), Christina Koehne, Rachel Lilley, and Ramon Prusak

### OVERVIEW

The GE Math assessment consisted of twenty-five questions, organized into five subjects: Statistics, Algebra, Graph Theory, Geometry, and Logic. Students were instructed to pick a subject, presumably the one they had a GE Math course in, and then to complete the five questions in that subject. In each subject, Question 1 assessed the first Math student learning outcome (SLO), Question 2 assessed the second, and so on. The assessment team then collectively devised grading keys for all the questions, and set a common cutoff score of 60% correct for students to be judged as meeting the SLOs.

We also collected demographic data on the 95 students who were given the assessments. These data related to where students took their GE Math courses, what the titles of those courses were, and where students took most of their GE courses overall. We found that 55% of students took their GE Math courses at New Paltz, 43% took it elsewhere, and the remaining 2% had not yet taken it. There was no significant correlation between where students took their course and how well they performed.

In our judgment, only 23% of the 95 students met the Math SLOs (see SLOs below). One could argue that the cutoff scores should have been lower. Our reply to that would be that the questions were easier than normal final exam questions, and that 60% is a standard cutoff score. (A commonly used curve puts that D/F boundary at 60%, and any grade above F gives credit for a GE course.) Other likely contributors to the low percentage of students meeting the SLOs were poor student motivation, bad implementation of the assessment, and multi-year gaps between the assessment and students' last Math courses.

### Student Learning Outcomes for Mathematics

*Students will demonstrate the ability to:*

- interpret and draw inferences from mathematical models such as formulas, graphs, tables and schematics;
- represent mathematical information symbolically, visually, numerically and verbally;
- employ quantitative methods such as arithmetic, algebra, geometry, or statistics to solve problems;
- estimate and check mathematical results for reasonableness; and
- recognize the limits of mathematical and statistical methods.

### DETAILS OF DESIGN AND IMPLEMENTATION

Math was not an easy category to assess. The GE Board realized this before GE assessments were moved to capstone courses, and determined that assessment questions would need to be tailored to the subject areas of students' GE Math courses. While other categories might be assessed with general essay prompts, this was not feasible in Math.

The main problem was that mathematics content is specific to particular subjects, and must be measured using questions appropriate to a particular subject. About a third of all students do their GE Math courses in Statistics, so Statistics was one of subject areas we used. We made sure that the questions were appropriate

for the lowest-level statistics course. At New Paltz this would probably be MAT 145 Statistics and Public Policy. (We included material in the assessment on the design of surveys that is covered in MAT 145 but may not be covered well in more advanced courses.)

Around half of all students' GE Math courses are either in Algebra or have an Algebra course as a prerequisite. (At New Paltz, College Algebra is the lowest-level algebra course that counts for the Math GE. Math Methods for Business, Precalculus, and Calculus 1 are other GE Math courses that have College Algebra as prerequisites. The situation at other schools is similar.) Again, assessment questions were chosen so that College Algebra sufficed to answer them.

New Paltz offers a good selection of other GE Math courses, but three other subjects sufficed to assess all of them. Geometry was a subject that could be used to assess MAT 240: Math for Elementary Teachers 2, as well as geometry courses from other schools. Graph Theory could be used to assess MAT 143: Math in the Modern World and many schools also have GE Math courses that cover some graph theory. Logic could assess PHI 201: Symbolic Logic and logic is also sometimes covered in other schools' GE Math courses. These five subjects seem to suffice to cover all of the GE Math courses which our students take; no students complained that they had not seen any of the subjects in their courses.

The questions and scoring keys are in Appendices 1 and 2. The plan would be to reuse them for the next assessment in around four years. With this in mind, we have slightly revised the questions. The instructions were clarified and a number of typos were fixed. We did not revise the scoring keys, and trust the group doing the next Math assessment will be able to modify them.

The implementation of the assessment this spring was deeply flawed. The questions had been designed to be given to students on paper so that they could do their work on paper and hand it in. This was necessary, since many questions had tables and graphs in either their statements, desired answers, or both. For unknown reasons, it was decided that the questions would be distributed as electronic files, and that students would be encouraged to do and submit their work electronically. We do not believe this was an appropriate decision as it made it harder for students to do the assessments. Although the questions were checked with a variety of programs, students were sometimes unable to view the graphs. (Some said so, and others were probably also unable to view them and just skipped the questions.) Thus this error had a significant impact on students' scores, as leaving even one question blank reduced their total scores by at least 10 points out of 50.

Students were also led to understand that they should input all their work using editing software, much of which had only rudimentary capabilities. (Students could of course have done their work on paper, and uploaded PDF scans, but this was seldom done.) So students were typing ASCII characters, and not much more. When asked for a graph, a common response was "Sorry, I don't know how to make a graph.", and so on.

## RESULTS

Office of Institutional Research created the following tables from raw data submitted by the Math assessment raters (see caveats under III above).

<b>Effort</b>		
	<b>N</b>	<b>%</b>
Blank	5	5%
Relevant & Adequate	90	95%
Total	95	100%

How many students met learning outcome		
	N	%
Meets	21	23%
Does not meet	69	77%
Total	90	100%

Rubric for Math	Meets		Does not meet	
	N	%	N	%
Interpret and draw inferences from mathematical models	36	40%	54	60%
Represent mathematical information symbolically, visually, numerically, and verbally	38	42%	52	58%
Employ quantitative methods such as arithmetic, algebra, geometry, or statistics to solve problems	26	29%	64	71%
Estimate and check mathematical results for reasonableness	29	32%	61	68%
Recognize the limits of mathematical and statistical methods	30	33%	60	67%

Whether student learning outcomes were met by where GE course was taken:

Rubric for Math	At New Paltz	Elsewhere	Not taken
	N	N	N
Meets	13	8	0
Does not meet	36	31	2
Total	49	39	2
	%	%	%
Meets	27%	21%	0%
Does not meet	73%	79%	100%
Total	100%	100%	100%

## RESULTS – ASSESSMENT RATERS’ SUMMARY

Of the 95 students who were given the assessments, the breakdown by subjects was as follows:

Statistics 38%

Algebra 47%

Graph Theory 9%

Geometry 6%

Logic 4%

No response 5% (Some students did questions from multiple subjects, so the sum is not 100%.)

Given the small numbers doing Graph Theory, Geometry, and Logic, it would not be useful to analyze student performance in those subjects. Rather than comparing percentages that meet the standards by subject, it is

more useful to compare mean percentage scores since a score of 60% was required to meet the SLOs, regardless of subject.

We obtained the following mean percentage scores by subject:

Statistics 37%

Algebra 27% (60% needed to meet the SLOs)

This is not a statistically significant difference ( $p = .32$ ), so we conclude that questions in different subjects were roughly equal in difficulty.

We also analyzed average scores by questions, and found the following:

Subject	SLO 1	SLO 2	SLO 3	SLO 4	SLO 5
Statistics	49%	45%	21%	38%	31%
Algebra	34%	36%	22%	12%	29%
All combined	45%	40%	26%	30%	32%

The larger differences between combined average scores on different questions are statistically significant. But we do not know the causes of these differences. One possible explanation is that students are not taught enough about SLO 3, for example. Another possibility is that relatively more difficult questions were chosen to assess SLO 3.

## DISCUSSION

While there was some difference between questions, most students scored below the 60% cutoff on average. While the percentage meeting the SLOs could have been made higher by moving the cutoff lower, we did not want to do this. It seemed better to have a consistent assessment instrument than to start with a particular percentage meeting the Mathematics SLOs. After all, the most important use of the assessment is to see how it changes from year to year. We want the percentage meeting the SLOs to increase, regardless of its starting value.

Student motivation varied, but was probably also a factor. Several students answered the first couple of questions and then gave up. One possible explanation is that they were not sufficiently motivated to do a large number of questions, and that they would do more of a shorter assessment. With this in mind, it is helpful that GE 5 will remove SLOs 4 and 5.

As previously pointed out, the assessment needs to be given to students on paper. While students should be free to submit their answers and supporting work electronically, not all of them seem able to do so. Supporting students who want to submit their responses on paper is important. This would hopefully reduce the number of students who submitted blank responses; this should not happen 5% of the time.

## SUGGESTED ACTIONS

We feel the same cutoff score of 60% should be used in future assessments. It is important that procedures stay the same so that the numbers can be compared between years.

We include revised questions with clearer instructions and wording. We suggest that these same questions be used at the next assessment, although dropping questions that correspond to deleted SLOs would make for a shorter assessment and improve student motivation to finish it.

The implementation of the assessment should be improved, with everybody involved realizing that both the questions and answers will not just be text. We feel that the entire Math assessment should be distributed to all students in the sample on paper. The expense of doing this is minor compared to the other costs associated with the assessment.

## C. FOREIGN LANGUAGE

### ASSESSMENT RATERS

Adolfo Bejar Lara (Team Leader), Victoria St. George, Mary Stevens, Patricia Fitzpatrick, and César Barros Arteaga

### OVERVIEW

Participation in the Foreign Language assessment was higher than expected. Of the 250 students who were asked to participate, 177 (71%) completed the assessment. One hundred percent (100%) of the 177 students completed the multiple-choice section of the assessment (SLO 1). However, only 106 (60%) of the students submitted essays deemed assessable (SLO 2).

*Information about General Education classes:*

- 102 (60%) of the students took their GE course at New Paltz, 59 (35%) elsewhere, and 9 (5%) were not sure where they had taken their GE courses. Seven students left this question blank.
- 102 (61%) of the students completed the majority of their GE courses at New Paltz, 54 (32%) completed the majority of their GE courses elsewhere, and 12 (7%) were unsure of where they had taken their GE courses. 9 students left this question blank.

The results for the 177 student essays are as follows:

Effort:

- 106 (60%) of the essay responses were relevant and long enough to evaluate using the rubric.
- 20 (11%) of the essay responses were left blank.
- 18 (10%) of the essay responses were irrelevant. Some students wrote about what they liked about the Foreign Language course they took. Some students wrote essays about how to improve the Foreign Language courses they took. A few students wrote essays arguing that learning a Foreign Language should not be a GE requirement.
- 33 (19%) of the essay responses were too short to evaluate.

Student Learning Outcomes for Foreign Language:

Students will demonstrate:

- basic proficiency in the understanding and use of a foreign language
- knowledge of the distinctive features of culture(s) associated with the language they are studying

The group of faculty volunteers who generated the prompt for the GE Foreign Language assessment decided to create a two-part assessment. The first part of the assessment, which addresses SLO 1, asked students to complete a multiple-choice questionnaire in the target language. The second part of the assessment, which addresses SLO 2, asked students to write an essay about how learning a foreign language transformed their ways of knowing, thinking, and engaging with other cultures—specifically the cultures and communities that speak the language they studied.

## **Part 1 of Foreign Language assessment**

The rubric for evaluating the multiple-choice questionnaire has two criteria:

1. Identifies both multiple-choice questions in target language
2. Identifies one or none of the multiple-choice questions in target language

If the student identifies both multiple-choice questions in the target language correctly: The student meets the first SLO for Foreign Language.

If the student identifies correctly one or none of the multiple-choice questions in the target language: The student does not meet the first SLO for Foreign Language.

Based on the evaluation of the multiple-choice questionnaire:

- 143 (81%) of the students correctly identified both multiple-choice questions in the target language.
- 34 (19%) of the students correctly identified one or none of the multiple-choice questions in the target language.

## **Part 2 of the Foreign Language Assessment**

The rubric for evaluating the essay has three criteria:

1. Identifies at least one implication or effect of how learning a foreign language helped them to expand their worldviews.
2. Describes how learning a foreign language helped them to critically understand and approach other cultures/communities that speak that language.
3. Provides brief evidence/example about how their worldview was affected/changed by learning a foreign language.

If the essay achieves 2-3 of these elements: It meets SLO 2 for Foreign Language

If the essay achieves 0-1 of these elements: It does not meet SLO 2 for Foreign Language

Based on the analysis of the essays:

- 100 (94%) of the students identified at least one implication or effect of how learning a foreign language expanded their worldviews.
- 87 (82%) of the students described how learning a foreign language helped them to critically understand and approach other cultures/communities that speak that language.
- 76 (72%) of the students provided brief evidence/example about how their worldviews were affected/changed by learning a foreign language

## **RESULTS**

Office of Institutional Research created the following tables from raw data submitted by the assessment raters for Foreign Language (see caveats under III above).

<b>Effort</b>		
	<b>N</b>	<b>%</b>
Blank	20	11%
Irrelevant	18	10%
Too short	33	19%
Relevant & Adequate	106	60%
Total	177	100%

<b>How many students met learning outcome</b>		
	<b>N</b>	<b>%</b>
Meets	90	85%
Does not meet	16	15%
Total	106	100%

<b>Rubric for Foreign Language</b>	<b>Meets</b>		<b>Does not meet</b>	
	<b>N</b>	<b>%</b>	<b>N</b>	<b>%</b>
Identifies both multiple-choice questions in target language	141	80%	36	20%
Identifies at least one implication or effect of how learning a foreign language expanded their worldviews	100	94%	6	6%
Describes how learning a foreign language helped them to critically understand and approach other cultures/communities that speak that language	87	82%	19	18%
Provides brief evidence/example about how their worldviews were affected/changed by learning a foreign language	75	71%	31	29%

Whether student learning outcomes were met by where GE course was taken:

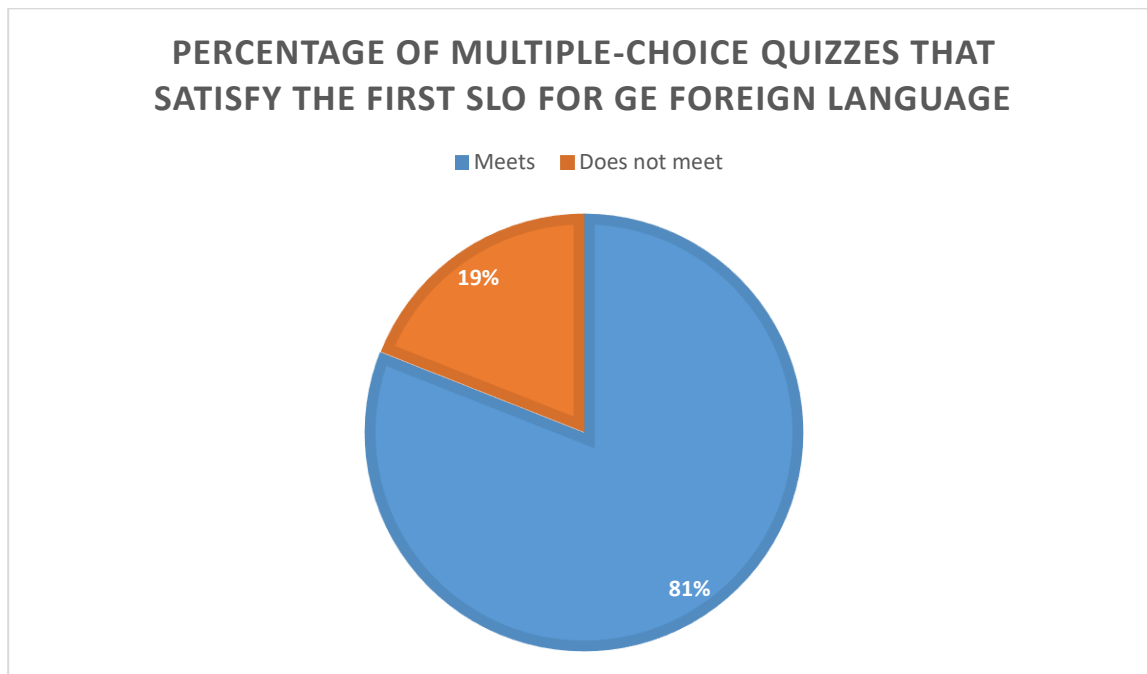
<b>Rubric for Foreign Language</b>	<b>At New Paltz</b>	<b>Elsewhere</b>	<b>Not Sure</b>	<b>Blank</b>
	<b>N</b>	<b>N</b>	<b>N</b>	<b>N</b>
Meets	55	31	3	1
Does not meet	8	6	1	1
Total	63	37	4	2
	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
Meets	87%	84%	75%	50%
Does not meet	13%	16%	25%	50%
Total	100%	100%	100%	100%



## RESULTS – ASSESSMENT RATERS' SUMMARY

### Part 1

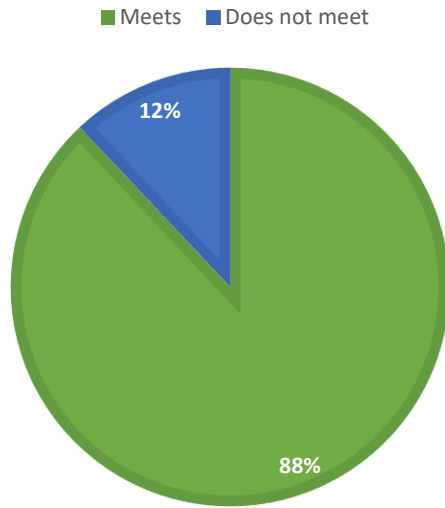
Of the 177 students who completed the multiple-choice questionnaire, 143 (81%) met SLO 1. They were able to demonstrate basic proficiency in the understanding and use of a foreign language. However, 34 (19%) students did not meet the SLO. See chart below:



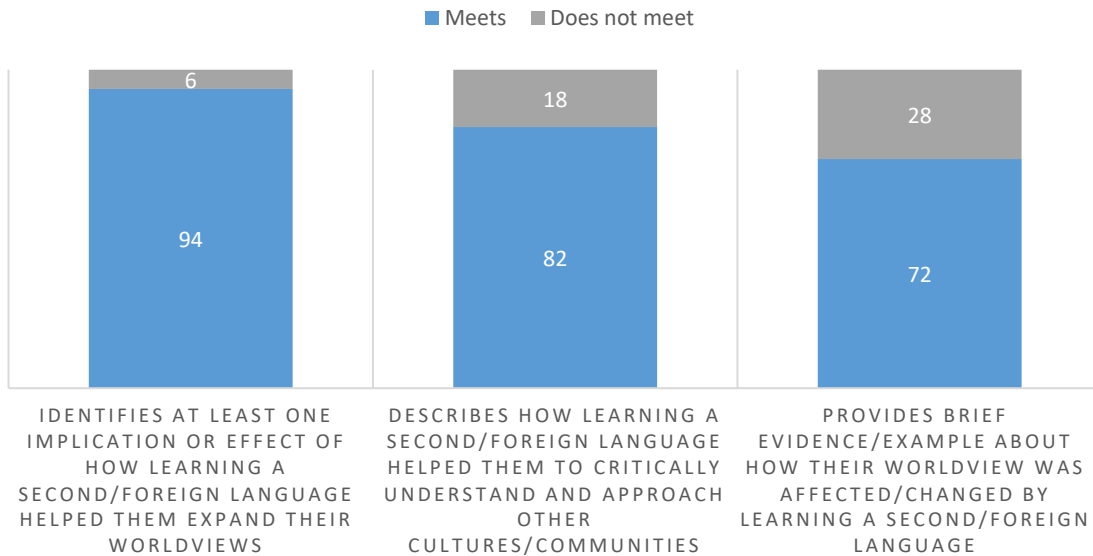
### Part 2

Of the 106 essays evaluated, 93 (88%) met SLO 2. They were able to demonstrate knowledge of the distinctive features of culture(s) associated with the language they are studying. Thirteen (12%) of the students did not meet the SLO. See charts below:

## PERCENTAGE OF ESSAYS THAT SATISFY THE SECOND SLO FOR GE FOREIGN LANGUAGE



## PERCENTAGE OF ESSAYS



Most students discussed in detail some of the implications and effects learning a foreign language had in their worldviews. In addition, a majority of students described how learning a foreign language helped them understand other cultures/communities. Fewer students provided concrete examples of how their worldviews changed by learning a foreign language.

These results show that, through their studies at SUNY New Paltz, many students have a broader understanding of communities and cultural practices beyond their own. They can communicate and

understand simple ideas in the target language. They can identify and describe how learning a foreign language helped them reevaluate their position in the world in relation to other cultures and communities.

### Assessment Prompt

The assessment prompt used for GE FLNG this year was:

Assessment multiple-choice:

Chinese

1. Which of the following options best captures the expression “you are kind”?

- a. 你真好。
- b. 我说英文。
- c. 给我打电话

2. Which of the following options best describes the image?



- a. 她在玩。
- b. 她在唱歌。
- c. 她在吃饭。

Each of the target languages – i.e., American Sign Language, Arabic, Chinese, French, German, Hebrew, Italian, Japanese, Kiswahili, Spanish, and Portuguese – had their own version of the multiple-choice questions presented above.

1. Assessment essay prompt:

How did learning a foreign/second language help you better understand the cultures and communities that speak/use that language? How did learning a foreign/second language transform your ways of knowing, thinking, and engaging with other cultures, communities, and ways of living? Please provide a concrete example.

Faculty from different departments and programs (Languages, Literatures & Cultures, Deaf Studies program, and the Latin American and Caribbean Studies program) developed the assessment prompt. In addition to questions that would demonstrate basic proficiency in the target language (SLO 1), the volunteer faculty believed it was important to ask students to be self-reflective when discussing their knowledge of the distinctive features of the cultures associated with the language they studied (SLO 2). The reason behind this was, in part, because the volunteer faculty wanted to prevent students from reproducing negative/unproductive stereotypes about other cultures in their essays. In asking students to be self-reflective, the volunteer faculty were hoping students would discuss how their worldviews were changed/affected by having the opportunity to understand/know other cultures and communities through their GE Foreign Language courses.

#### *Limitations of the Prompt*

While 177 (100%) students completed the multiple-choice questionnaire part of the assessment, it is very difficult to assess students' level of proficiency in a foreign language based on two questions. This part of the assessment was particularly difficult to conceptualize and produce. There are 11 different foreign languages taught at SUNY New Paltz and creating an assessment that would allow us to get more meaningful data about the levels of proficiency would require the involvement of at least 11 faculty members (one per each language taught).

Regarding the essay, many students did not provide concrete examples of how learning a foreign language helped them better understand other cultures and communities. It could be helpful in the future to rephrase the essay prompt to emphasize how important it is for students to go into as much detail as they can when providing an example. In the future, perhaps we could include a brief description of how their essays will be evaluated to provide students with more context.

## D. BASIC COMMUNICATION – WRITTEN

### ASSESSMENT RATERS

Nikki Wilson Clasby (Team Lead), Mercedes Rooney, Peggy Hach & Joan Perisse

### OVERVIEW

The GE student learning outcomes (SLOs) for Basic Communication – Written (B-Comm) are as follows:

- Students will produce coherent texts within common college-level written forms
- Students will demonstrate the ability to revise and improve such texts
- Students will research a topic, develop an argument, and organize supporting details

The B-Comm Assessment Team addressed one major challenge in designing this year’s materials to assess these three learning outcomes and that was time. This challenge significantly impacted how we perceived the concept of writing within the assessment context because these learning outcomes demand sequential processes, which typically require a significant amount of time to complete. For example, during the course of a researched argument project in ENG 170: Writing & Rhetoric, students are usually given at least two weeks to go through the complete cycle of the academic writing process to satisfy these SLOs. However, students were allocated only 45 minutes to complete this assessment at the capstone level. To address this challenge, the assessment team had to critically address the rhetorical situation of the assessment and rethink the following:

- What constitutes research, argument development and support details for a 45 minute assessment “project”
- How to define common college-level forms of writing for this assessment
- How to define what revision and improvement mean for this assessment

The third SLO posed the biggest challenge in terms of time. Requiring students to demonstrate they could research a topic, develop an argument, and organize supporting details within a 45-minute period is difficult. Requiring students to write an actual research/argument essay is just not feasible or useful under the constraints. Having students reflect on a research project they had written in the past would not get to the SLOs we needed to assess. The assessment team, therefore, decided to create an active writing prompt, designed to get students curious about ideas for a potential research-based argument essay/project where pre-writing would form the focus of the assessment activity, and provide an opportunity for the three SLOs to be clearly identified and evaluated.

### RATIONALE

#### SLO 1: Common College-level Forms of Writing

The assessment team identified three common college-level forms of writing within the beginning stages of the academic writing process (pre-writing), which could be easily accomplished in a 45 minute assessment. These pre-writing forms are part of the standard writing processes taught in ENG 170: Writing & Rhetoric:

##### 1. Focused Free Write

Defined as: an opportunity to explore thoughts and ideas around a topic freely and quickly, without paying attention to structured writing conventions

##### 2. Working Thesis Statement

Defined as: a flexible thesis allowing for refinement as the research progresses. A typical working thesis statement contains a topic, an arguable statement (comment or claim, ranging anywhere from the tentative to the extreme) and some sort of reason or rationale for that arguable statement

3. Bibliography for all sources referenced using a style guide relevant to any discipline

#### SLO 2: Revision & Improvement

As students engage with these three pre-writing genres, we would expect to see revision and improvement naturally occur in several places:

- Usually students begin a focused free write with a rudimentary hypothesis on their chosen topic, which takes shape as they write, culminating in a more clarified version by the end of the free write session
- The working thesis statement, as the driving force of the project, should typically reflect a revised and improved development of that hypothesis leading to an arguable claim.
- Students typically demonstrate revision as they formulate the bibliography if they understand the genre conventions

#### SLO 3: Researching a Topic, Developing an Argument, & Organizing Supporting Details

The Focused Free Write, Working Thesis Statement, and Bibliography are three pre-writing forms that drive the development of any researched-based college project; however, the challenge is how to prompt this pre-writing so that:

- Students can accomplish the tasks in 45 minutes
- Students do not waste all that time just thinking of an idea
- Students cannot copy and paste past work into the assessment
- Students do not get overwhelmed, bored or frustrated
- Students can get curious about a potential topic
- Students have the opportunity to connect to their major area of study

To address these challenges, the assessment team drew from previously tried and tested idea generation exercises used in the ENG 170 curriculum. The assessment team created a series of 32 carefully selected images, reflective of multiple topics, and when researched on a rudimentary level provide many interesting connections to one another. The basic idea is for students to select three images they are drawn to, conduct some rudimentary Google searches to help investigate the connections between the images, and from those connections develop ideas for an interesting research project. From this starting point the three pre-writing forms should develop fairly easily.

#### **HYPOTHESIS**

As instructors of writing and rhetoric, students who take our classes are trained in various types of pre-writing activities to generate ideas for projects, and they are also trained to understand writing as an iterative process involving attention to different writing genres. Students cannot pass ENG 170 unless they have satisfied the SLOs for that course. This means students must show proficiency in conducting research, creating thesis statements and bibliographies/works cited, and conducting various levels of revision. These are transferable skills, and because these pre-writing genres form the foundation of academic writing, we expect students to build on those skills throughout their college career, or at the very least, transfer them to other courses. From a technical perspective, we expect students at the capstone level to be familiar with these writing genres.

However, as writing instructors we know students struggle with curiosity, and making the effort to get interested in a topic. Lack of curiosity tends to have a snowball effect resulting in generic perspectives on a topic and ultimately very weak arguments. Because we work hard to combat these issues in ENG 170, we were interested to see if there would be any improvement or at least retention at the capstone level, given that students have had the opportunity to immerse themselves in their majors. We were also hoping the nature of the assessment prompt would help trigger that sense of curiosity and help students get excited about a potential research project (without actually having to write a research paper). In this sense, we would not only be evaluating whether students could satisfy the three SLOs but also how well students generate interesting ideas through the pre-writing process.

## **METHODS**

Students were provided the following information before the assessment prompt:

What is assessment?

Assessment is not a test or graded assignment. The purpose of assessment is to gather information about the skills and knowledge students gain throughout their education at SUNY New Paltz. We want a bigger picture of your education than a single class or assignment, so assessment is designed to give you an opportunity to reflect on and share what you have learned.

Introduction

This prompt is designed to assess the beginning stages of the research and writing process, where you write your way into an idea, explore that idea through basic preliminary research, then refine that idea into a working thesis statement for a future research-based project of your choice in any genre based on your discipline or area of interest.

**Note:** you are **not** being asked to write a research-based project, you are just being asked to propose one.

\*\*\*You will need a laptop (or tablet) and access to the Internet

*Suggested Time Allocation: 45 minutes*

The “common college-level written forms” required for this assessment are:

Focused Free Write

Definition: A Focused Free Write is an opportunity to explore your own thoughts and ideas around a topic freely and quickly, without paying attention to structured writing conventions. (Please do not cut and paste information directly from your sources into your free write as this defies the genre of the focused free write and is also an act of plagiarism, which is not acceptable at the university.)

Working Thesis Statement

Definition: A Working Thesis Statement is a flexible thesis allowing for refinement as the research progresses. A typical working thesis statement contains a topic, an arguable statement (comment or claim, ranging anywhere from the tentative to the extreme) and some sort of reason or rationale for that arguable statement.

Bibliography

Definition: A list of relevant sources consulted for the project. Required are full citations (not just URLs) using the citation style you are most comfortable with (MLA, APA, Chicago etc.).

Example (in MLA):

Sulloway, Frank J. "The Evolution of Charles Darwin." *Smithsonian.com*, Smithsonian Institution, 1 Dec. 2005, <https://www.smithsonianmag.com/science-nature/the-evolution-of-charles-darwin-110234034/>

Assessment Prompt: B-Comm Written

Preparation

*Suggested time allocation: 15 minutes*

Choose any **three** images that interest you from the **IMAGE BANK** provided in this link\*. These images are designed to help you quickly generate ideas for a future research-based project of your choice. Copy and paste these images into the **Assessment Response Document** below. Then, using simple Google searches:

- Find out more general information about your three selected images
- Research the connections between the three images. These connections could be based on themes, for example: beauty, poverty, scientific discovery, or environmental crisis etc. Write some basic notes on your research. Document the sources you have used in your Google searches in preparation for the Bibliography

*\*A separate Ppt of the Image Bank is provided along with the assessment prompt in case of technical issues with the link*

Task 1: Focused Free Write

*Suggested time allocation: 15 minutes*

From this basic research, choose **one** connection between your chosen three images that you find particularly interesting: Free Write about this connection exploring your ideas (aim for at least 300 words).

Task 2: Working Thesis Statement

*Suggested time allocation: 10 minutes*

Preparation: Based on ideas generated in your Focused Free Write, think about how you might transform them into a research-based project you would like to work on in the future. This project should reflect your own interests &/or your major area of study.

Task: Refine your idea into a Working Thesis Statement for your future project.

**Note:** Your Working Thesis Statement may be written in more than one sentence and should provide enough information for your reader to clearly understand the scope of your idea.

Task 3: Bibliography

*Suggested time allocation: 5 minutes*

Using the citation style you are most comfortable with (MLA, APA, Chicago etc.) create a Bibliography of the most relevant sources you have consulted to create this proposal &/or may use to develop your project.

Assessment Response Document

Selected Images



Copy and paste your three selected images here:

Task 1: Focused Free Write

Task 2: Working Thesis Statement

Task 3: Bibliography

#### ASSESSMENT INSTRUMENT

Effort

0 = Blank/Irrelevant

1 = No Research/Sources

2 = Relevant & Adequate

SLO 1: Students will produce coherent texts within common college-level written forms

Criteria (Genre):

- Focused Free Write (FWW). Focused Free Write follows genre by using research + prior knowledge to explore & develop a hypothesis
- Working Thesis Statement (WTS). Working Thesis Statement follows genre: (topic + arguable statement + reason/rationale/so what factor?) Students must have an arguable statement and a topic or rationale to meet this criteria
- Bibliography (B). Bibliography follows genre with a recognizable style guide

0-1 = Does not Meet

2-3 = Meets

SLO 2: Students will demonstrate the ability to revise and improve such texts

Criteria (Revision):

- The Focused Free Write demonstrates a clear progression from initial hypothesis to a more clarified one as a segue to the thesis
- Working Thesis Statement demonstrates further revision to the developed hypothesis
- Bibliography follows recognized style guide with a high degree of accuracy

0-2 = Does not Meet

3-4 = Meets

SLO 3: Students will research a topic, develop an argument, and organize supporting details

- Criteria (Research, Hypothesis, Argument & Details Research (R): Connections. In the Focused Free Write & the Bibliography there is evidence of individual research on images & on connections, themes or concepts
- Research (R): Exploration. In the Focused Free Write, the research explores & informs the development of hypothesis
- Research (R): Reference. In the Focused Free Write, the images are referenced
- Hypothesis (H): Initial. The Focused Free Write begins with an initial hypothesis
- Hypothesis (H): Clarified. The Focused Free Write concludes with a more clarified hypothesis as a segue to the thesis statement
- Argument. The Working Thesis Statement evidences an arguable statement
- Details. Bibliography satisfies supporting details with a minimum of 3 relevant & appropriate sources

0-3 = Does not Meet

5-7 = Meets

#### Norming Session

Four responses were randomly chosen for the norming session. Team members were given the *Assessment Instrument* and assessed each of the four student responses privately, without any prior discussion, then we met to discuss our findings.

# 10: This student chose three interesting images with no obvious connections. However, instead of conducting research this student responded to the images on an emotional level, identifying their appeal to pathos as a connecting theme. After identifying the emotional connection, the student failed to formulate a hypothesis. Their Working Thesis Statement took the form of two questions vaguely addressing the role of photography in cases of injustice, which had some interesting potential but needed much more development. This student then apologized for not having any sources. The assessment team determined unanimously that the student failed all three learning outcomes.

#26: This student selected two images with obvious connections to the environment, and one concerning ideal body standards. The student used the Focused Free Write to describe each image and relied on interpretations to inspire different topics. This student did not use any research, could not connect any of the ideas together, formulate, or develop a hypothesis. In the section dedicated for the Working Thesis statement, this student used the opportunity to clarify a theme for each image, identifying a unifying concept of “a call for change.” This idea did not develop into a thesis, and it was clear this student did not know how to formulate one. In the bibliography, the student referenced the image bank provided, but no other sources—again, clearly not understanding the genre of the bibliography. We all agreed this student failed all three learning outcomes.

#78: This student’s free write was extremely short. Again, they did not demonstrate any reference to the one source they selected, instead relying on interpretations of the images. However, this student was able to distill an interesting connection between the images which although was not developed in the free write, did lead to a thesis, and although fairly vague did demonstrate a basic understanding of the thesis genre. We all agreed the student satisfied LO1 but due to lack of research and development, this student did not meet LO2 or 3.

#108: This student was very interesting. They began with a generic hypothesis on unrealistic beauty standards, but after researching the selected images, discovered a much more nuanced approach to the topic, which had a profound impact on the development of their thesis statement. This student clearly understood how to write their way into an idea, and actually incorporated the images into the thesis to create a unique perspective. We were impressed with this student’s work and agreed they met all three LOs.

Our assessment tool proved to be extremely clear, easy to use and very effective and we did not have to make any adjustments.

## RESULTS

Office of Institutional Research created the tables below from raw data submitted by the assessment raters for Basic Communication – Written (see caveats under III above).

<b>Effort</b>		
	<b>N</b>	<b>%</b>
Blank	4	4%
No research/sources	13	12%
Relevant & Adequate	93	85%
Total	110	100%

### SLO 1 Common College-level Forms of Writing

<b>How many students met learning outcome</b>		
	<b>N</b>	<b>%</b>
Meets	69	65%
Does not meet	37	35%
Total	106	100%

<b>Rubric for SLO 1</b>	<b>Meets</b>		<b>Does not meet</b>	
	<b>N</b>	<b>%</b>	<b>N</b>	<b>%</b>
Focused Free Write	60	57%	46	43%
Working Thesis Statement	55	52%	51	48%
Bibliography for all sources referenced using a style guide relevant to any discipline	88	83%	18	17%

Whether student learning outcomes were met by where GE course was taken:

<b>SLO 1</b>	<b>At New Paltz</b>	<b>Elsewhere</b>	<b>Not Sure</b>	<b>Blank</b>
	<b>N</b>	<b>N</b>	<b>N</b>	<b>N</b>
Meets	50	16	2	1
Does not meet	22	13	1	1
Total	72	29	3	2
	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
Meets	69%	55%	67%	50%
Does not meet	31%	45%	33%	50%
Total	100%	100%	100%	100%

**SLO 2 Revision & Improvement**

How many students met learning outcome		
	<b>N</b>	<b>%</b>
Meets	58	65%
Does not meet	48	35%
Total	106	100%

Rubric for SLO 2	Meets		Does not meet	
	<b>N</b>	<b>%</b>	<b>N</b>	<b>%</b>
Focused Free Write	60	57%	46	43%
Working Thesis Statement	59	56%	47	44%
Bibliography	81	76%	25	24%
Sources	79	75%	27	25%

Whether student learning outcomes were met by where GE course was taken:

SLO 2	At New Paltz	Elsewhere	Not Sure	Blank
	<b>N</b>	<b>N</b>	<b>N</b>	<b>N</b>
Meets	42	13	2	1
Does not meet	30	16	1	1
Total	72	29	3	2
	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
Meets	58%	45%	67%	50%
Does not meet	42%	55%	33%	50%
Total	100%	100%	100%	100%

**SLO 3 Criteria (Research, Hypothesis, Argument & Details):**

How many students met learning outcome		
	<b>N</b>	<b>%</b>
Meets	46	43%
Does not meet	60	57%
Total	106	100%

Rubric for SLO 3	Meets		Does not meet	
	N	%	N	%
Research (R): Connections	57	54%	49	46%
Research (R): Exploration	51	48%	55	52%
Research (R): Reference	91	86%	15	14%
Hypothesis (H): Initial	82	77%	24	23%
Hypothesis (H): Clarified	57	54%	49	46%
Argument: Working Thesis Statement	55	52%	51	48%
Details: Bibliography	53	50%	53	50%

Whether student learning outcomes were met by where GE course was taken:

SLO 3	At New Paltz	Elsewhere	Not Sure	Blank
	N	N	N	N
Meets	34	10	1	1
Does not meet	38	19	2	1
Total	72	29	3	2
	%	%	%	%
Meets	47%	34%	33%	50%
Does not meet	53%	66%	67%	50%
Total	100%	100%	100%	100%

## RESULTS – ASSESSMENT RATERS’ SUMMARY

### General Overview

We received a total of 110 student responses for the assessment. Two of these responses were protest pieces, one was blank, and one was irrelevant. This left us with a pool of 106 valid responses for evaluation.

The following chart provides an overview of the number of students who met and did not meet the SLOs for B-Comm Written:

**Fig I: Number of Students who Meet or Do Not Meet Learning Outcomes for BComm-Written 2022**

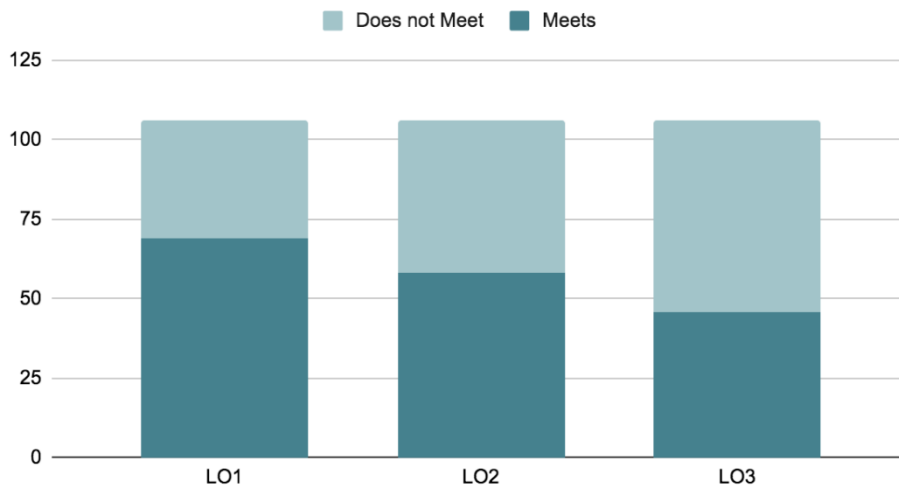
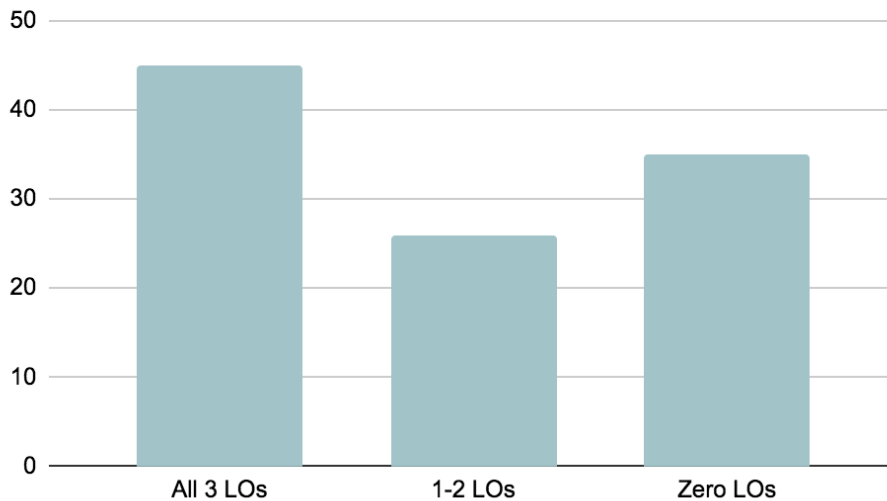


Figure I shows 69 (65.1%) of the students met SLO 1; 58 (54.7%) met SLO 2, and 46 (43.4%) met SLO 3.

Significantly, as shown in Fig. II, 45 (42.5%) of the students met all three SLOs and 35 (33%) of the students did not meet any of the SLOs.

**Fig II: Number of students meeting all, zero or some of the LOs**



**Results for Individual Student Learning Outcomes**

*SLO 1: Students will produce coherent texts within common college-level written forms*

The following graph shows the number of students who understood/did not understand basic genre conventions for college pre-writing. Please Note: in the instructions for the assessment prompt, students were provided definitions of these genres.

**Fig III: LO1: Students will produce coherent texts within common college-level written forms**

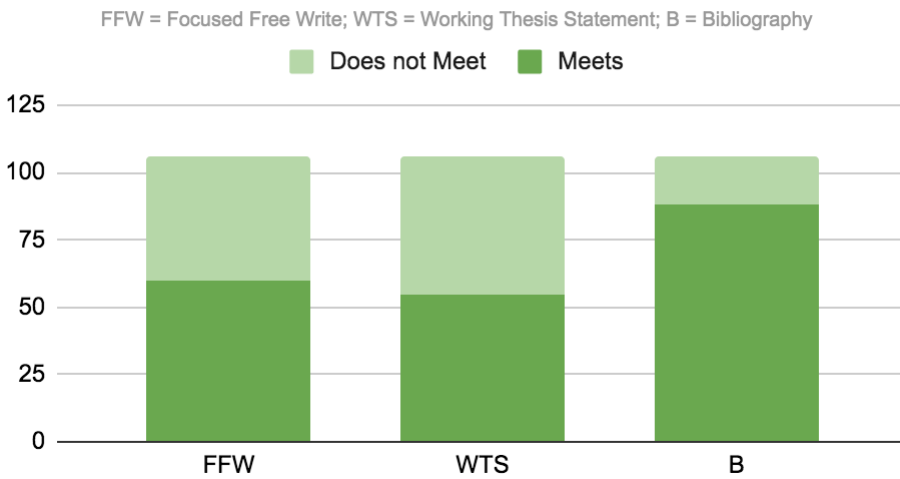


Figure III shows 60 (56.6%) of the students understood the genre conventions of a Focused Free Write; 55 (51.9%) understood how to write a Working Thesis Statement, and 88 (83.0%) how to write a Bibliography.

**SLO 2: Students will demonstrate the ability to revise and improve such texts**

The following graph shows the number of students who demonstrated an understanding of revision practices. Please Note: for this assessment, our definition of revision is not grounded in grammar, spelling, and syntax but on revision of ideas, arguments, and attention to genre conventions.

**Fig IV: LO2: Students will Demonstrate the Ability to Revise and Improve Common College-Level Texts**

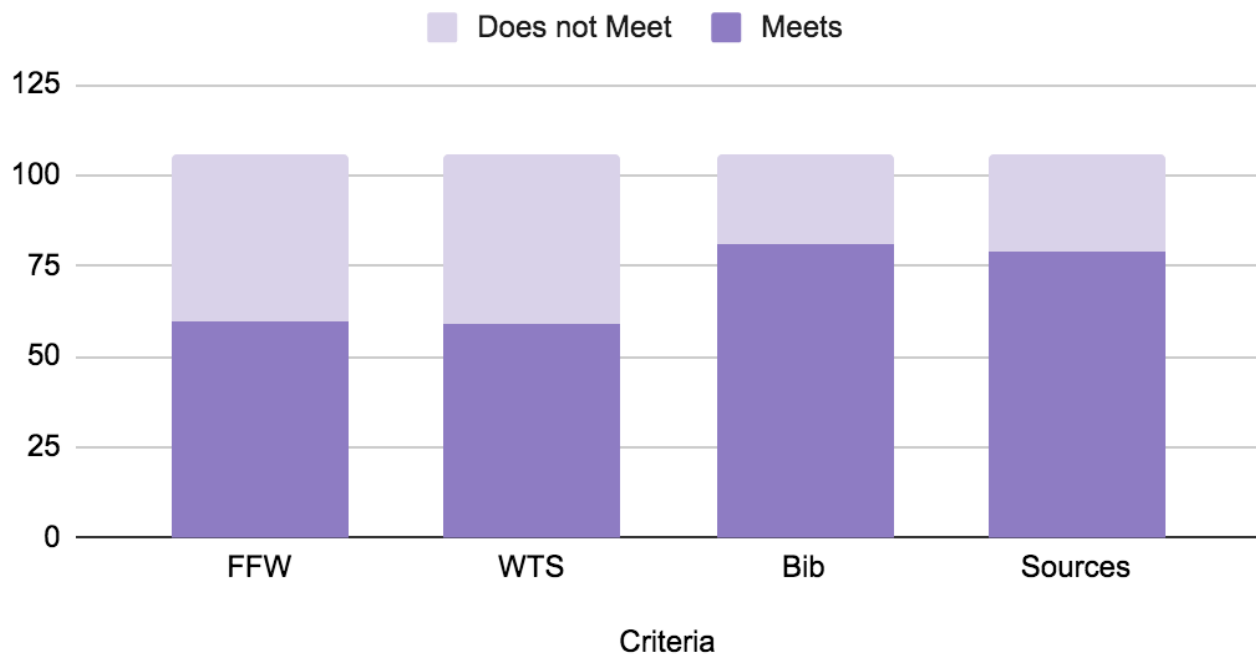


Figure IV shows, in the Focused Free Write, 60 (56.6%) of the students were able to make revisions to their initial hypothesis to create a more clarified version, as a segue to the Working Thesis Statement; 59 (55.7%) of the students demonstrated further revision to that hypothesis as they formulated the Working Thesis Statement; 81 (76.4%) of the students produced a bibliography using a recognizable style with a high degree of accuracy, and 79 (74.5%) selected sources relevant and appropriate to their thesis.

**SLO3: Students will research a topic, develop an argument, and organize supporting details**

The following graph shows the number of students who demonstrated an understanding of the research processes necessary for developing an idea.

**Fig V: LO3: Students will Research a Topic, Develop an Argument & Organize Supporting Details**

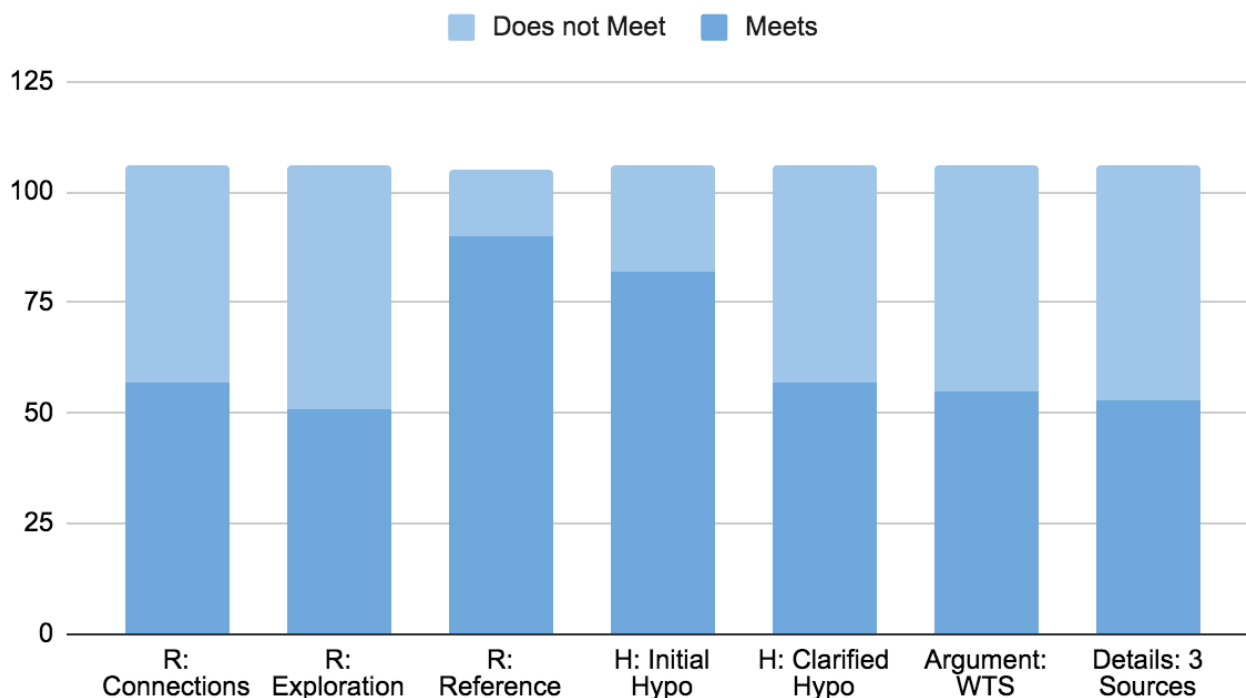


Figure V shows, regarding researching for a topic, in the Focused Free Write, 57 (53.8%) of the students demonstrated an ability to use research in their selected images to make connections to themes or concepts; 51 (48.1%) of the students were able to use research to explore and inform the development of their hypothesis, and 90 (84.9%) of the students referenced their selected images as part of the idea development process.

Regarding the development of the hypothesis, in the Focused Free Write, we can see that 82 (77.4%) of the students began with an initial hypothesis after researching their selected images and 57 (53.8%) of the students demonstrated an ability to write a clear version of their hypothesis as a segue to the thesis. Fifty-five (51.9%) students created an arguable claim for their Working Thesis Statement from that hypothesis.

With regard to organizing supporting details, 53 (50%) of the students showed they could find and document a minimum of three relevant and appropriate sources to support their thesis statement.



## Where Students Took their GE Courses

### 1. Students who met all three learning outcomes:

Of the 45 (42.5%) students who met all 3 LOs, 33 (73.3%) stated that they took their Humanities GE course at New Paltz:

- 16 (35.6%) identified that course as ENG 170
- 2 (4.4%) identified that course as ENG 160
- 2 (4.4%) identified that course as ENG 206
- 28 (62.2%) identified taking the majority of their GE courses at New Paltz

### 2. Students who did not meet any of the learning outcomes:

Of the 35 (33%) students who did not meet any of the three learning outcomes:

- 21 (60%) identified taking their Humanities GE course at New Paltz
- 8 (22.9%) identified that course as ENG 170, and 3 (6.8%) as ENG 160
- 12 (34.3%) identified taking their Humanities GE course elsewhere
- 15 (42.9%) identified taking the majority of their GE courses at New Paltz
- 15 (42.9%) identified taking the majority of their GE courses elsewhere

## DISCUSSION

The team was pleasantly surprised to receive a high number of responses to the assessment this year. We were also pleased that 96.4% of the students positively engaged with the assessment prompt and that 42.3% met all three SLOs. Over 70% (73.3%) of the students reported that they took their humanities course at New Paltz. However, this assessment prompt highlighted some of the key issues we face moving forward in Basic Communication-Written.

SLO 1: Students will produce coherent texts within common college-level written forms

Regarding SLO 1, since most students are familiar with using a citation tool, it was expected that a large number of students (83% to be precise) would understand the genre conventions of a bibliography. We know at the ENG 170 level that students struggle to create a working thesis statement, so we were expecting low numbers. However, we were hoping that at the capstone level, students would have retained and/or improved upon this skill. As only 51.9% of students satisfied the criteria, it is clear more work is necessary to improve students' understanding of this writing genre.

Although 56.6% of the students satisfied the criteria for the Focused Free Write, we observed some confusion about its purpose. Some students clearly did not understand that this was a space to develop ideas, and that there was an expectation of some degree of progression of those ideas leading to the thesis. Many students did not reference any research on their chosen images or allow basic research to form connections and help in the development of ideas, which led us to conclude that students struggle to transfer basic research skills in the writing process.

SLO 2: Students will demonstrate the ability to revise and improve such texts

For this assessment we focused on revision of ideas, arguments, and attention to genre conventions rather than on writing mechanics. Student learning outcome two is difficult to assess under the 45 minute time restriction. However, given the nature of the assessment prompt, we expected to see a natural revision of ideas, concepts, and arguments as students moved from selecting images, to research, to hypothesis development, and then to thesis statement. If students understand the process of idea generation and the

important connection between thinking and writing in the three pre-writing genres, we expect to see some progressive improvements.

However, 43.4% of students failed the criteria for a successful Focused Free Write. We observed one of the key issues for this failure was students' struggle to generate an initial hypothesis because they did not do any (or enough) basic research. Without an initial hypothesis, students lacked direction in their free write leading to issues formulating a working thesis. In other words, these students did not provide themselves any opportunity for revision of ideas. Indeed, due to the iterative process of idea generation and development, failure to engage in any one part of the process seems to create a snowball effect.

SLO 3: Students will research a topic, develop an argument, and organize supporting details

The assessment team found only 43.3% of students demonstrated they could meet the criteria for SLO 3. Based on observations we conclude the main reason students did not satisfy these criteria is due to lack of intellectual curiosity.

This lack of curiosity is evidenced, first, in the students' choice of images, where images seemed to be selected for their obvious connections or for their reference to popular topics. Some students began their Focused Free Write with a description of the images and/or reasons why they were selected; without any (or enough) research. These students struggled to develop even an initial hypothesis, leading to problems developing the Working Thesis Statement.

Second, many students "interpreted" their selected images superficially, based on assumptions and/or prior knowledge. Fifty-one percent of the students relied only or mainly on inspiration from the images to help steer them toward a topic/idea. Third, the lack of even the most basic research on these images was a key factor in students' struggle to develop an interesting idea for a research topic. Only 53.8% of students demonstrated an ability to use some sort of research on their selected images to make connections to themes or concepts, and only 48.1% demonstrated an ability to use research to explore and inform the creation and subsequent development of their hypothesis in the Focused Free Write. Out of all responses, 59.4% of students used three or more sources to support their ideas and 12.3% used no sources. Some students who included sources in their bibliography showed no evidence of having referenced them in their Focused Free Write.

We are encouraged that 85.9% of the students made some reference to their selected images in their Focused Free Write. However, most students failed to use these references to develop their hypothesis. Based on our observations of underdeveloped hypotheses, it seems that lack of curiosity and reliance on assumptions and prior knowledge in the absence of sufficient research triggered "safe" generic topics. We identified 63.2% of all Working Thesis Statements as "canned" topics, the most popular of which were unrealistic beauty standards for women or ideals of beauty/body image; climate change; or environmental issues. For students who resorted to a canned topic during their Focused Free Write, we observed a distinct disconnect between the canned topic and the resulting Working Thesis Statement. This observed disconnect suggests students are not invested in their topic because:

- they have not conducted enough basic research to form some sort of personal interest or personal perspective.
- they don't know how (or don't want) to get interested in something that requires a little effort.
- they do not have the confidence to trust their ideas.
- they do not understand (or have forgotten) that idea generation is part of an iterative process where pre-writing plays an important role.
- forty-five minutes is not enough time to cycle through an idea generation process.

This disconnect is supported by the observation that 48.1% of students did not know how to formulate a Working Thesis Statement (even though students were provided with a definition and basic formula in the assessment prompt). The biggest issue was failure to create an arguable claim. Arguable claims demand knowledge and perspective on a topic, and development of a hypothesis, so it is not surprising that students who struggle with curiosity and research also struggle to develop a thesis. We are concerned that this issue is still a problem at the capstone level.

By contrast, the assessment team observed that the students who selected less popular images (and/or images with less obvious connections), used these images to connect to their area of expertise or their discipline. These students showed clear evidence of research on their images and seemed to write with more conviction and knowledge than other students. In their Focused Free Writes, these students clearly demonstrated the arc of their thinking leading to more original ideas, insightful thesis, and less canned responses. These students had more success creating arguable claims.

## **CONCLUSION**

The assessment team was very satisfied with the nature of the prompt as a tool for identifying students' weak areas in the research process. Although students cannot pass ENG 170 without demonstrating they understand the basic writing conventions for developing an argument-based research project, it is clear these skills are not being sufficiently retained or transferred at the capstone level (within the context of the GE assessment environment). The key concerning issues are:

- Failure to begin with a recognizable initial hypothesis
- Interpretation of images based on assumptions or prior knowledge
- No (or not enough) research or research does not inform development
- No recognizable revision or development of ideas
- Failure to create an arguable claim

The most significant issue uncovered by the assessment prompt is the failure to use research competently. When students noted relevant and appropriate sources, the development of arguments was hardly ever informed by the research from those sources. Where sources were used appropriately to investigate the topic, they were not always referenced or cited. Some students appeared confused by or unfamiliar with the writing genre (despite clear instructions). Some struggled to produce a clear initial hypothesis that was not a general statement, or a series of statements, based on prior knowledge and assumptions.

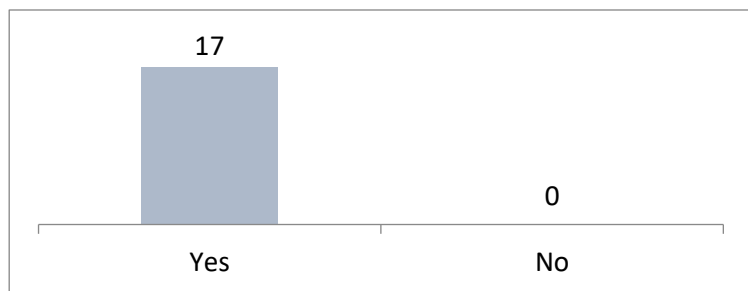
For future assessments, our team sees great value in making revisions to the image bank by removing images with obvious connections to the most popular topics revolving around standardized body ideals, climate change, and environmental issues. We need to find a balance between making students think more critically about those images through research, without being too obscure. This year, because of the pandemic and the obvious fatigue students experienced as a result, we chose images we thought would appeal to a wide audience, without adding extra stress to the students. We are sure this selection played a role in the number of "canned" thesis statements we received. Because some students demonstrated an ability to successfully connect images to their major area of study, develop an interesting hypothesis and arguable thesis, it would be helpful to include an extra question in the survey to ask students to identify their major.

## SECTION IV: SURVEYS

### A. RESPONSES TO SURVEY OF FACULTY TEACHING CAPSTONE COURSES

Faculty teaching capstone courses in the GE knowledge and skills areas (i.e., Basic Communication – Written, Math, Foreign Language and The Arts) in which the assessments were administered were sent a survey asking them to reflect on the assessment process. The survey was sent to 66 faculty on March 31 through April 12, 2022, and we received 17 survey responses, for a response rate of 26%.

Q1 – Did you participate in the assessment?



Q 2 - Did you or your students experience any technical issues?

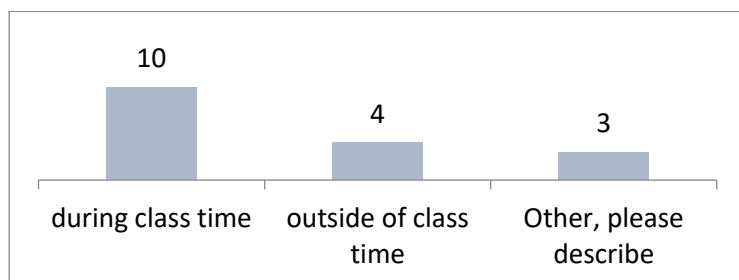
No (13 Responses)

Yes (1 Response)

Comments

- It was set up awkwardly. I think it would make more sense to either be done like the teaching evaluations are done or to have paper copies we distribute in class because the time I set aside to do it in class, several students didn't have a laptop.
- Originally my students were given the math assessment and it would have required them to print it and then rescan it. Since I teach an asynchronous fieldwork course this was not a good fit and it was changed to Art instead.
- Some students had difficulty finding the video questions for the sign language assessment.

Q 3 - Did students complete the assessment during or outside of class time?



Comments

- Asynchronous fieldwork class
- Most during class time but some outside of it.
- This is a hybrid class and I had students complete the assessment as part of their assignments for the asynchronous class session.

Q 4 - What questions, if any, did students have about the assessment?

Comments

- They had no questions.
- They completed the art portion. Several contacted me because they have not viewed any art and could not think of something to write about. I reminded them that they prompt includes film.
- None other than curiosity about doing a GE Art assessment in a science course.
- None - they were surprisingly serious about the assessment!
- Math questions are not easy to complete. They studied years ago and cannot easily recall how to solve the problems.
- Why are we doing this? Is this going to be graded? How long should the essay be? Pretty standard stuff, easily answered.
- They didn't understand why they needed to do it and wondered why (the writing one in particular) was so long.
- Why do we have to do this if we did our GE in community college?
- A lot of the stuff you already have answered on the FAQ, which was helpful for me.
- Whether, if they took more than one of the GE math classes, they had to do assessments for each.

Q 5 - What feedback, if any, did students have about the assessment?

Comments

- They seemed to think it was clear and understood the value of completing it.
- All the students who participated in the assessment had negative comments about it.
- They didn't say anything to me. They took it in stride.
- Math assessment should be done right after they take the class.
- I did take time to explain the objectives of the assessment at the beginning of the semester, and before it was due. No student reported difficulties or had any comments to share on the completion of the assessment.
- At first they were nervous but most completed it to the best of their ability.

Q 6 - What feedback, if any, do you have about improving this process in the future?

Comments

- I thought it worked well, though it does take a significant amount of class time. I had several students absent on the day we completed the assignment. I asked them to do it on their own time but got no responses, so I think having them compete it in class is working!
- If it is possible to have the capstone for the students in early childhood and childhood education be a different course like EED379 or EED376, I would suggest that. The two courses I mentioned are seated courses that students take the same semester as the fieldwork experience. We made it work this semester but the fieldwork course is not really set up for this kind of task.
- I think this is an ok process but it does weigh a little on the instructors to use class time.

- Student interviews should be conducted as opposed to a random exercise.
- I found downloading a sheet, having the students fill it out and then uploading it rather cumbersome. I'd recommend using an online fillable form in the future.
- Maybe a standardized video instructors could show their classes with the instructions. This would ensure the same information is given to students when completing the assessment.
- I would recommend providing printed copies of the assessment. I printed out the assessment myself so that everyone in the class could complete it during class time, whether or not they had laptops with them. I think providing printed copies and recommending that instructors set aside time so that students complete the assessment during class time would improve response rates if this were an issue. We could be given instructions about where to return the completed tools.
- It was a little confusing at first that different instructors in the same department were assessing different learning goals. I'm not sure how that could be made clearer. Regardless, it was a masterful plan!
- I think the assessment itself was a huge improvement over the one last year. Much clearer and more straightforward! And Anne's instructions and communication were extremely helpful throughout the process. Thank you for your hard work and commitment to a challenging process!
- Math assessment might need to use a different type of instrument.
- Seems to work best if done during class time. My sense is that if I had asked them to do it on their own time, they would not have done it.
- Not sure right now. It definitely stressed them out, which I was a little surprised about, but not sure what can be done about that, and it feels like more how I present it than anything else.
- It was a major imposition on class time and very disruptive to the flow of the course. I would not do it during class time again and would discourage others from using their class time for it.
- It will be better to use an actual online survey.

## B. RESPONSES TO SURVEY OF FACULTY TEACHING GENERAL EDUCATION COURSES

Faculty teaching GE courses in the knowledge and skills areas assessed (i.e., Basic Communication – Written, Math, Foreign Language and The Arts) were sent a survey asking them to reflect on their teaching of the GE course(s) and on their expectations of students' performance on the GE assessments. The survey was administered May 11, 2022 through June 14, 2022 and was sent to 104 faculty. We received 18 responses, for a response rate of 17%.

Q 1 - How do you help students understand your course within the broader context of the General Education (GE) Program?

Comments

- By incorporating plenty of cultural material (in English) and reminding them of the importance of both language and cultural competence in our world
- By providing them both low stakes writing assignments in each class session as well as scaffolding larger research assignments. In addition to practicing their writing skills across genres, students read texts from across the disciplines. They learn to communicate in a wide variety of ways.
- By stressing that foreign languages are essential for life in today's globalized world. And that beyond developing the "4 skills" (reading, writing, speaking, and listening), students expand their understanding of the French-speaking cultures worldwide. This beginner's course helps reach communication goals of GE, providing basic proficiency in French, and the ability to communicate at the American Council on the Teaching of Foreign Languages' (ACTFL) Novice-Mid level.
- I connect interdisciplinary issues of identity with the arts through self-portraiture.
- I encourage the students to think broadly about the GE Program and to understand these classes as the foundation for a strong undergraduate education.
- I stress that it is not just plugging numbers into formulas. The important point is to understand why we do what we do.
- Statement at the beginning of the course regarding the importance of General Education in a Democracy.
- This course is an asynchronous class. I post video tutorials and presentations weekly in addition to their digital textbook. I also, use Remind (texting App) to remind students to complete their assignments in addition to their weekly emails.
- We discuss broader cultural and societal issues, and how artists make meaningful contributions and act as change agents.
- We read academic essays and learn proper research strategies. We also have debates and presentations.
- We talk about how statistics relates to numeracy literacy beyond just the discipline they are in and why it's often necessary in order to understand and evaluate a lot of news that they consume.

Q 2 - What work do your students complete that aligns with the GE student learning outcomes for the content area assigned to your course?

- All of the work (weekly homework, class exercises, exams) is designed to help them understand and retain how quantitative methods are used and how results are interpreted.
- Campus support for struggling students is so non-existent, most of my class was not engaged, did not show up, or turn in work this semester. This is highly atypical. But the students are beyond unengaged, anxious, or burned out - they are so checked out they are not functioning as humans or students. They didn't complete work that aligns with GE learning outcomes. Faculty needs the campus to provide more support to struggling

students (which is most of them) so they can academically succeed. We can't be therapists, social workers, and work twice as hard teaching by offering assignment re-dos, teaching time management skills, etc. - and still meet "learning outcomes". This is impossible.

- Everything we do aligns with the SLOs. It is a basic language course - reading, writing, listening, speaking and cultural skills are built.
- I assign a variety of writing assignments, from short reflections to synopses, annotated bibliographies, research projects, and multi-media assignments, to name only a few. Students experiment with writing for different audiences and for different purposes. Frankly, the Writing and Rhetoric program does a great job of scaffolding assignments and encouraging instructors to be creative with cross-disciplinary assignments. We aren't just reading and writing about literature!
- In Elementary French I, students actively practice the four skills of speaking, listening, reading, and writing, and also learn about the culture of French-speaking countries.
- Library skills, presentations, research, peer review, essay writing, and problem solving
- Project 2 focuses on the artistic processes, which the students research and write a number of different texts based on that research.
- The writing intensive designation is addressed through having the students write responses to virtually everything they read.
- Computer literacy competencies are addressed throughout the course as they research and write about images within different conceptual framings throughout the course.
- Students communicate in French within its different cultural contexts by participating in unrehearsed conversations to exchange information, ideas, opinions, and feelings in classroom group activities and in online homework assignments. They reflect on, investigate, and explain the relationships among the perspectives, practices, and products of the francophone cultures studied in classroom activities, homework assignments and later on tests.
- Students create hands-on assignments building skills in representational and imaginative drawing, painting, and sculpture.

The faculty were also asked to estimate the number of students they believe would meet or not meet the SLOs. Their responses are summarized in the tables that follows.

<b>Basic Communication Written</b> – estimate of the number of students meeting or not meeting the learning objective	Meets # of Students (% of Students)	Meet # of Students (% of Students)	Total
Students will produce coherent texts within common college-level written forms	46 (87%)	7 (13%)	53
Students will demonstrate the ability to revise and improve such texts	46 (87%)	7 (13%)	53
Students will research a topic, develop an argument, and organize supporting details	46 (87%)	7 (13%)	53

<b>Mathematics</b> – estimate of the number of students meeting or not meeting the learning objective	Meets # of Students (% of Students)	Meet # of Students (% of Students)	Total



Students will demonstrate the ability to interpret and draw inferences from mathematical models such as formulas, graphs, tables and schematics	70 (70%)	30 (30%)	100
Students will demonstrate the ability to represent mathematical information symbolically, visually, numerically and verbally	70 (70%)	30 (30%)	100
Students will demonstrate the ability to employ quantitative methods such as arithmetic, algebra, geometry or statistics to solve problems	70 (70%)	30 (30%)	100
Students will demonstrate the ability to estimate and check mathematical results for reasonableness	50 (50%)	50 (50%)	100
Students will demonstrate the ability to recognize the limits of mathematical and statistical methods	40 (40%)	60 (60%)	100

<b>Foreign Language</b> – estimate of the number of students meeting or not meeting the learning objective	Meets # of Students (% of Students)	Meet # of Students (% of Students)	Total
Student will demonstrate basic proficiency in the understanding and use of a foreign language	138 (87%)	20 (13%)	158
Student will demonstrate knowledge of the distinctive features of culture(s) associated with the language they are studying	145 (91%)	14 (9%)	159

<b>The Arts</b> – estimate of the number of students meeting or not meeting the learning objective	Meets # of Students (% of Students)	Meet # of Students (% of Students)	Total
Students will demonstrate understanding of at least one principal form of artistic expression and the creative process inherent therein	64 (75%)	21 (25%)	85

## V. PROPOSED ACTIONS TO BE TAKEN ON THE ASSESSMENTS

The associate provost will disseminate the GE assessment summary report to the campus via the Strategic Planning and Assessment website and directly to the chairs, associate deans, deans, interim provost, and to relevant faculty. Keeping in mind that the assessment is only as good as the action we take on them, recipients will be urged to read the report and to engage in loop-closing activities. The reports above proposed actions that should be taken to improving the assessment process such as improving the participation rate, using the data to improve student learning, changing the way the math assessment is administered, and refining rubrics and assessment prompts.

The GE Board, associate deans, and associate provost will support departments to carry out 'close the loop' activities regarding these assessments. For example, the GE Board has already announced that the board has set-aside this academic year for loop-closing activities.

Consistent with past practice, departments will be required to submit annual assessment reports to their associate deans. The reports will include information about activities they implemented to address the findings from this year's assessments. Upon receipt of the reports, each associate dean will provide feedback to departments draft a brief summary of key issue from the reports for the associate provost.



Submitted by: Laurel M. Garrick Duhaney Date: 7/29/2022

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## Appendix 1: Revised Assessment Questions

### General Education Mathematics Assessment 202X

#### What is assessment?

Assessment is not a graded assignment. The purpose of assessment is to gather information about the skills and knowledge students gain throughout their education at SUNY New Paltz. We want a bigger picture of your education than a single class or assignment, so assessment is designed to give you an opportunity demonstrate what you have learned.

#### Survey:

1. I took my MATH category GE course at A) SUNY New Paltz \_\_\_\_ or B) elsewhere \_\_\_\_ or C) not sure \_\_\_\_
2. The (approximate) name of the course I took to fulfill my MATH GE requirement was (fill in the blank) A) \_\_\_\_\_ or B) not sure \_\_\_\_
3. I completed the majority of my GE requirements at A) SUNY New Paltz \_\_\_\_ or B) elsewhere \_\_\_\_ or C) not sure \_\_\_\_

#### Instructions:

Please write your answers directly on this paper and return it to your professor.

There are a lot of different kinds of GE Math courses, so we have different sets of 5 questions depending on what kind of course you had. You don't have to do the 5 questions that match your course, you could look through the sets of questions until you found a block of 5 that you liked. But you should only complete one set of questions.

In case you want to jump straight to questions for your GE Math course, they're organized as follows.

STATISTICS (for Intro Stat, Psych Stat, Soc Stat, Stats and Public Policy, Stat for Bus and Econ, ...)

ALGEBRA, page 5 (for College Algebra, Math Methods for Business, Precalculus, Calculus 1, ...)

GRAPH THEORY, page 6 (for Math in the Modern World, ...)

GEOMETRY, page 8 (for Math for Elementary Teachers 2, ...)

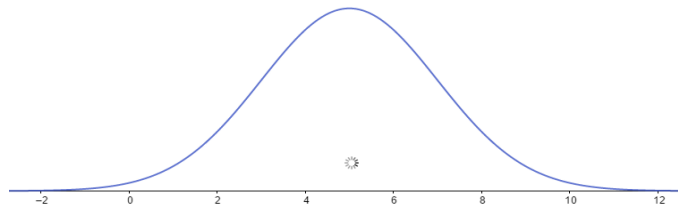
LOGIC, page 10 (for Symbolic Logic, ...)

## STATISTICS

### Question 1:

For each of the following distributions, state whether it is skewed to the left, unskewed, or skewed to the right. In each case, briefly explain your reasoning.

a) The distribution with this graph:



b) A distribution with median of 10 and mean of 11.

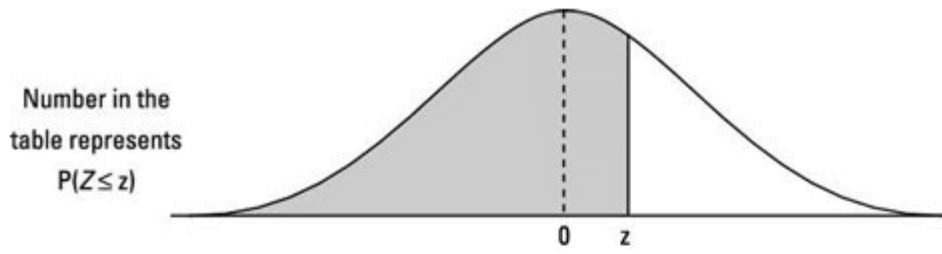
c) The distribution of 16 measurements, as follows:

1,3,6,8,8,9,11,12,12,12,13,13,14,14,15,17

**Question 2:** Ten students were asked how many classes they missed last semester yielding the following results 2,5,5,6,6,6,6,7,7, and 10. Draw a histogram to represent this data. Describe the shape of the distribution in words.

### Question 3:

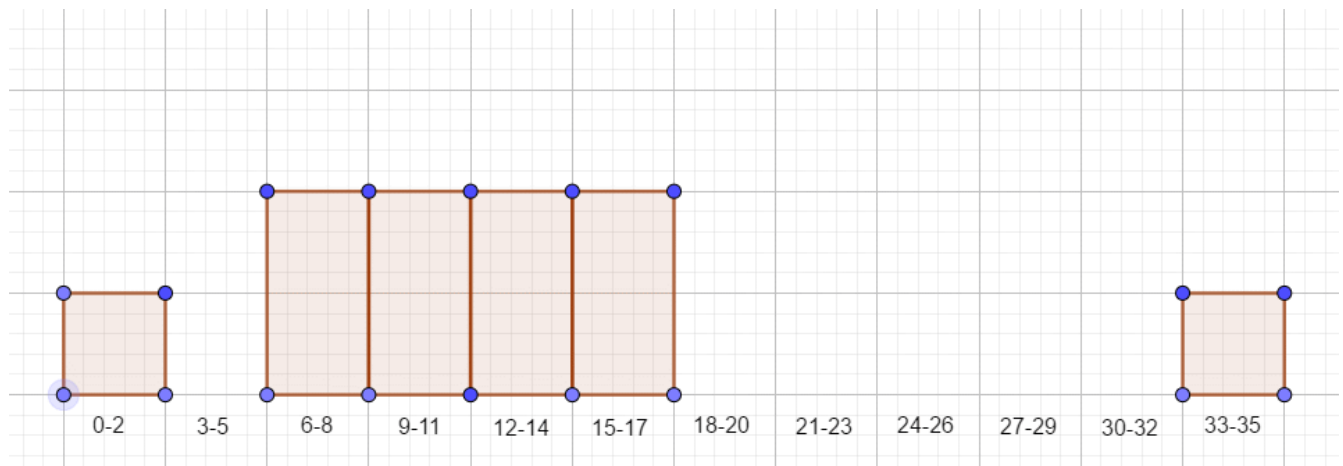
The weight of ears of corn is normally distributed, with mean of  $\mu = 300$  grams and standard deviation of  $\sigma = 50$  grams. Showing your work, find the probability that a given ear of corn weighs 330 grams or more.



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890

**Question 4:**

Consider the distribution shown in the histogram below:



- a) Estimate the mean of the distribution.
- b) Estimate the standard deviation of the distribution. (Doing this by eye is fine.)

**Question 5:**

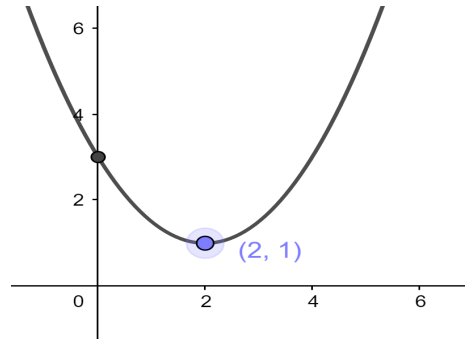
A music professor wants to know if students in the United States prefer rock music to classical music. He decides to use the students in his music class as a sample. He finds that 62% of his students prefer classical music. He does a statistical analysis on his sample data and finds that his result is statistically significant at the .05 level. He then claims that common perceptions about the musical preferences of students are mistaken and that he has demonstrated beyond doubt that the majority of students actually prefer classical music to rock. Describe several things that are wrong with the music professor's claim.

## ALGEBRA

### Question 1:

Here is the graph of a quadratic function.

- Writing the equation as  $y = ax^2 + bx + c$ , would  $a$  be positive or negative?
- We see  $(2,1)$  is the low point (vertex) of this graph. Showing appropriate work, give an equation of the form  $y = ax^2 + bx + c$  that has  $(2,1)$  as its low point.
- Showing appropriate work, give an equation of the form  $y = ax^2 + bx + c$  that has  $(2,1)$  as its low point, **and** has  $y$ -intercept 3.



### Question 2:

- Showing your work, find the equation for a circle with center at  $(-3,2)$  and radius of 7.
- Sketch the graph of your equation from part (a).

### Question 3:

Abe leaves Pleasantville at noon, driving north on Route 1 at a constant speed of 37 mph.

Brenda follows him, leaving Pleasantville at 2:00 p.m. and driving at a constant speed of 45 mph.

When does Brenda catch up with Abe? (Use algebra, showing your work.)

### Question 4:

A student was solving a system of equations in the following forms. She finds 4 solutions. Is this possible? Explain why or why not.

$$(1) x^2 + y^2 = a^2$$

$$(2) y = mx + b$$

### Question 5:

Solve for  $x$ :  $\sqrt{2x} + 6 = x + 2$ .

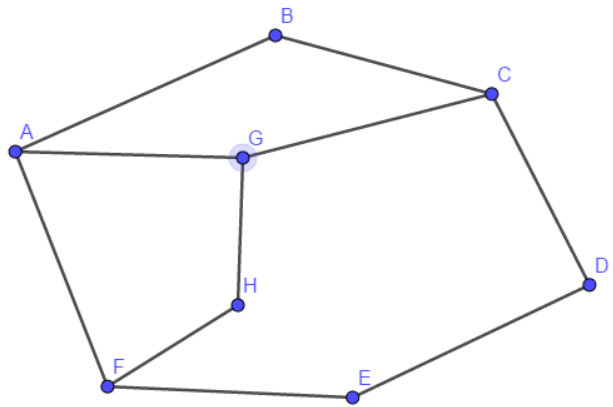
(In words, the equation is “the square root of  $2x$ , plus 6, is equal to  $x$  plus 2”.)



**GRAPH THEORY**

**Question 1:**

List all the different paths from A to D in the graph at right. (A path cannot have a repeated vertex.)



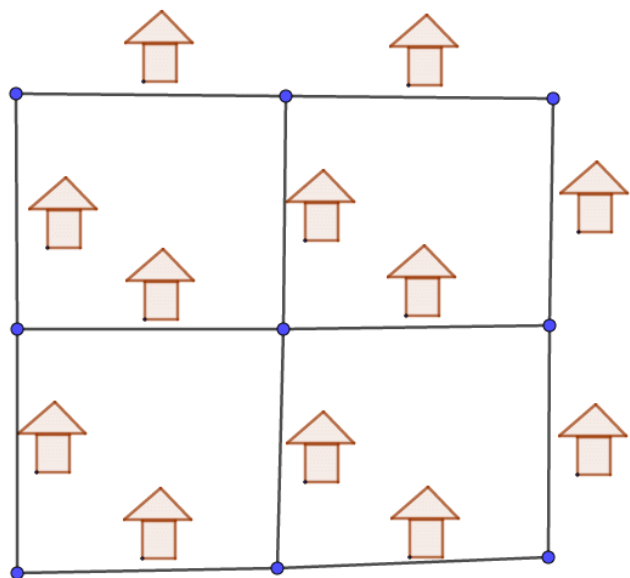
**Question 2:**

- a. Draw a graph with six vertices  $\{2, 3, 5, 7, 11, 13\}$  with an edge between vertices  $x$  and  $y$  if and only if the (absolute value of the) difference of  $x$  and  $y$  is 3 or less.
- b. Staying inside the set of numbers  $\{2, 3, 5, 7, 11, 13\}$ , is it possible to go from 2 to 13 by taking steps between numbers that are 3 or less apart? Explain your answer in words, referring to the graph you made in part (a).

**Question 3:**

Here is a map of Riverton, showing intersections, streets and houses. A delivery driver wants a route for their truck that goes past each house, never driving past a house twice or turning around in the middle of a street. (All turns must be made in intersections.)

Is it possible to make such a route?  
Explain, briefly.



**Question 4:**

Is it possible to have a graph that is not connected, but that has a circuit which visits all its vertices?

Explain, briefly.

**Question 5:**

You are given the following driving distances:

New York to Atlanta, 884 miles,

Atlanta to Dallas, 781 miles,

Dallas to Chicago, 967 miles,

Chicago to New York, 796 miles.

There are two paths from New York to Dallas, the length of the New York – Atlanta – Dallas path is  $884+781 = 1665$ , and the length of the New York – Chicago – Dallas path is  $796+967 = 1763$ .

Is it reasonable to conclude that the driving distance from New York to Dallas is 1665 miles?

Explain how this could be inaccurate.

## GEOMETRY

### Question 1:

In the diagram at right:

Line  $f$  goes through points  $A$ ,  $B$  and  $C$ .

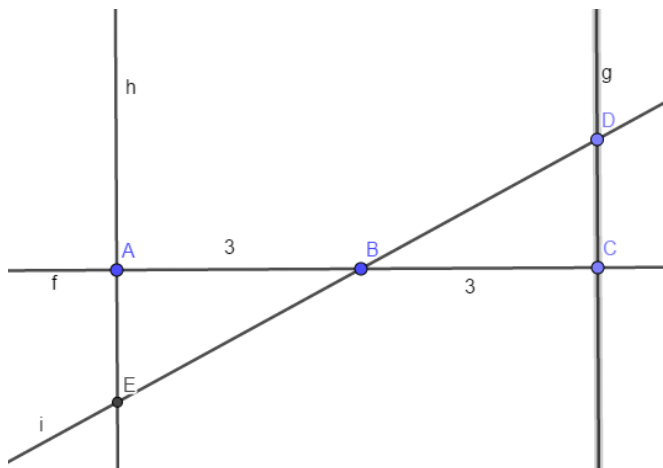
Line  $i$  goes through points  $F$ ,  $B$  and  $D$ .

Lines  $g$  and  $h$  are perpendicular to  $f$ .

Segments  $AB$  and  $BC$  both have length 3.

Are triangles  $\triangle ABE$  and  $\triangle CBD$  congruent?

Explain your reasoning.



### Question 2:

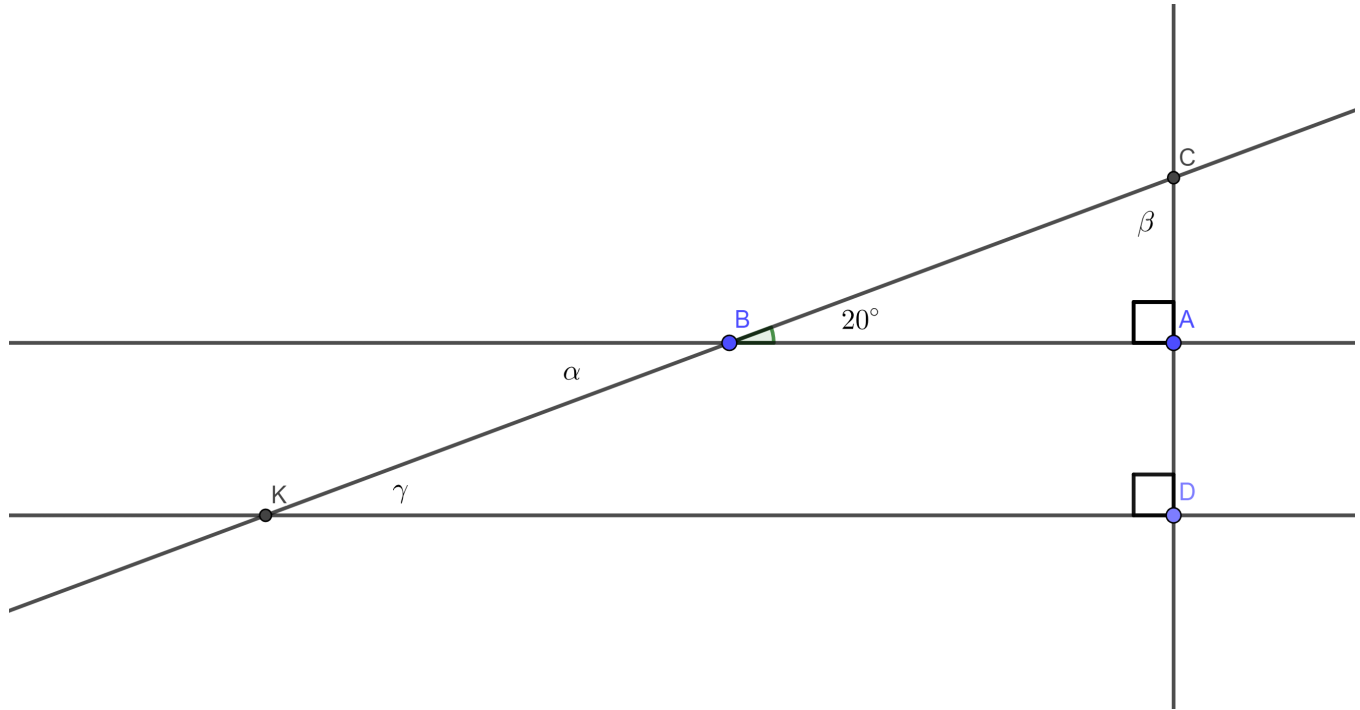
You are given that (the measures of) angles  $\alpha$  and  $\beta$  add to 90 degrees.

- Draw and label an accurate diagram, showing angles  $\alpha$  and  $\beta$  where the sum is 90 degrees.
- Complete the sentence: "Angles  $\alpha$  and  $\beta$  are \_\_\_\_\_ of each other."
- Give three different pairs of values for (the measures of) Math placement coordination, math lab coordination, and  $\beta$  so that their sum is 90 degrees:

" $\alpha$  and  $\beta$  could be \_\_\_\_ and \_\_\_\_, or \_\_\_\_ and \_\_\_\_, or \_\_\_\_ and \_\_\_\_."

**Question 3:**

In the diagram below, K is on line BC, D is on line AC, line AC is perpendicular to lines AB and DK, and angle  $\angle CBA$  measures 20 degrees. Briefly explaining your reasoning, find the measures of angles  $\alpha$ ,  $\beta$  and  $\gamma$ .



**Question 4:**

You are told that a triangle has sides that measure 1, 3 and 5 units. Is this possible? Explain your reasoning.

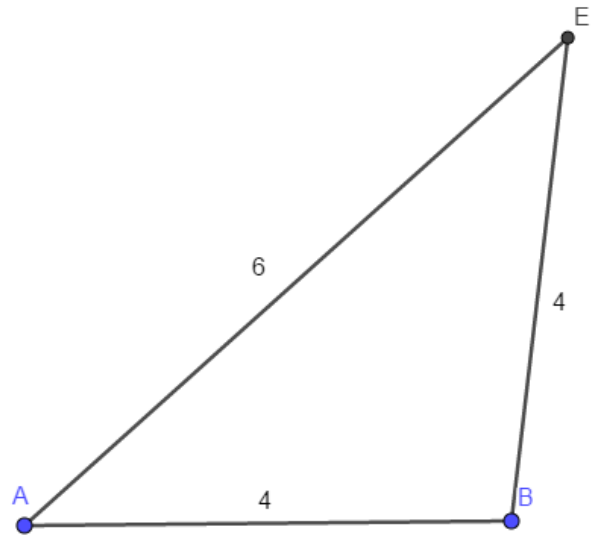
**Question 5:**

In triangle  $\triangle ABE$ , sides  $AB$  and  $BE$  have length 4 and side  $AE$  has length 6.

Consider the following calculation of the area of  $\triangle ABE$ :

“We know Area is  $\frac{1}{2}$  Base times Height. Since  $AB$  is the base and  $BE$  is the height, the area of  $\triangle ABE$  is  $\frac{1}{2} \cdot 4 \cdot 4 = 8$  square units.”

Is this calculation valid? Explain, briefly.



**LOGIC**

**Question 1:**

Since language and notation varies, this question is written two ways. They really are the same question, and you should do the one that sounds more familiar to you.

**First way of writing it:**

P and Q are sentence letters, and  $\sim(P \leftrightarrow Q)$  is a premise and  $P \rightarrow Q$  is the conclusion. Their truth-values are determined by the truth table at right.

P	Q	$\sim(P \leftrightarrow Q)$	$P \rightarrow Q$
T	T	F	T
T	F	T	F
F	T	T	T
F	F	F	T

- a. What values should P and Q have to make both  $\sim(P \leftrightarrow Q)$  and  $P \rightarrow Q$  true?
- b. Is the argument  $\sim(P \leftrightarrow Q) \vdash P \rightarrow Q$  valid? Explain briefly, indicating which row of the table shows an invalidating assignment, if any.

**Second way of writing it:**

X and Y are Boolean variables, and F(X,Y) and G(X,Y) are determined by the truth table at right.

X	Y	F(X,Y)	G(X,Y)
T	T	F	T
T	F	T	F
F	T	T	T
F	F	F	T

- a. What values should X and Y have to make both F(X,Y) and G(X,Y) true?
- b. Is the implication  $F(X,Y) \rightarrow G(X,Y)$  always true? Explain, briefly.

**Question 2:**

Let P, Q and R be sentence letters (Boolean variables) and let  $\Phi$  be a compound sentence (Boolean expression) that is true if and only if at least one of P, Q or R is true.

- a. Make a truth table for  $\Phi$ .
- b. Write a compound sentence (Boolean expression) that has the same truth table as the one you made in part (a). You may use any of the sentential connectives (Boolean operations)  $\&$ ,  $\vee$  and  $\sim$  (AND, inclusive OR and NOT).

**Question 3:**

Consider the proposed rule of logic that says  $X \rightarrow (Y \rightarrow Z)$  is equivalent to  $Y \rightarrow (X \rightarrow Z)$ .

Is this a valid rule? Support your answer, either using truth tables or by proving the theorem

$$\vdash (X \rightarrow (Y \rightarrow Z)) \leftrightarrow (Y \rightarrow (X \rightarrow Z)).$$

**Question 4:**

P and Q are sentence letters (Boolean variables). Are  $\sim (P \& Q)$  and  $(\sim P \& \sim Q)$  logically equivalent?

Explain, briefly.

**Question 5:**

a. Giving a translation scheme, symbolize the following argument in Sentential Logic (also called Propositional Logic):

All students are intelligent, Maria is a student, therefore Maria is intelligent.

b. Now symbolize the same argument in Predicate Logic with a new translation scheme.

c. Explain why the validity of this argument cannot be shown in Sentential Logic and why the language of Predicate Logic is better at showing the relevant logical form of the argument.

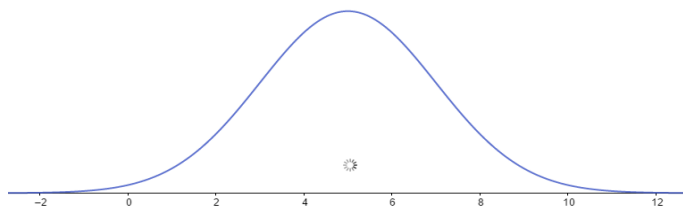
## Appendix 2: Scoring keys, by subject

### STATISTICS

**Question 1:** (SLO is: “Students will be able to interpret and draw inferences from mathematical models such as formulas, graphs, tables and schematics.”)

For each of the following distributions, state whether it is skewed to the left, unskewed, or skewed to the right. In each case, briefly explain your reasoning.

a) The distribution with this graph:



**4pts for (a): “Unskewed” (2pts), “Graph is symmetric” (2pts)**

**(Give the full 4 points for “I don't see a graph.”)**

b) A distribution with median of 10 and mean of 11.

**3pts for (b): “Skewed right” (1pt), explanations (2pts)**

**A drawing of a distribution with median roughly 10 and mean roughly 11. (Optional, but 1pt if present.)**

**“To have the mean greater than the median, there needs to be a long tail to the right” (2pts, and sufficient explanation.)**

**Skewed right. (1pt for answer with no explanation. (The direction of skew is the direction of the long tail.))**

c) The distribution of 16 measurements, as follows:

1,3,6,8,8,9,11,12,12,12,13,13,14,14,15,17

**3pts for (c): “Skewed left” (1pt), explanations (2pts)**

**“Median = mode = 12, mean = 10.5” (1pt)**

**“Since mean is below median, long tail is to the left.” (1pt)**



**Question 2:** (SLO is: "Students will be able to represent mathematical information symbolically, visually, numerically and verbally.")

Ten students were asked how many classes they missed last semester yielding the following results 2,5,5,6,6,6,6,7,7, and 10. Draw a histogram to represent this data. Describe the shape of the distribution in words.

**Histogram is 5pts:**

Answers may vary. Nine bins each of width 1 is fine. Bins of width 2 or 3 are also fine. (Some books say "number of bins should be around square root of n".) Bins of width 4 or more are lazy, and a point is lost.

**Features of graph:**

Labeled horizontal axis, including 2 through 10. (1pt)

Marked vertical axis. (1pt) (An unlabeled axis is OK. If present, label would be "number" or "quantity".)

Bar heights accurately represent quantities in each bin. (3pts)

**Description in words is 5pts:**

Score indicated points for each phrase, but maximum possible is 5.

"Mode is 6" (2pts)

"Median is 6" (2pts)

"Mean is 6" (2pts)

"10 may be an outlier" (2pts) (Using the "1.5 IQR" rule, 10 is on the cusp between being an outlier or not. Depending on the exact variant of the rule used, one could say 10 is either an outlier or not. And there are other rules for when something is an outlier. Any attempt to investigate if 10 may be an outlier is worth 2pts.)

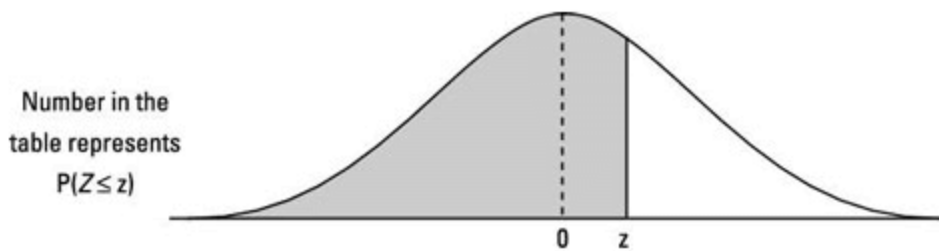
"Almost completely symmetrical" or "unskewed" (2pts)

"Range is 8" (2pts)

"Normally distributed," with nothing else written (1pt) (It's not normal, but looks similar.)

**Question 3:** (SLO is: "Students will be able to employ quantitative methods such as, arithmetic, algebra, geometry, or statistics to solve problems.")

The weight of ears of corn is normally distributed, with mean of  $\mu = 300$  grams and standard deviation of  $\sigma = 50$  grams. What is the probability that a given ear of corn weighs 330 grams or more?



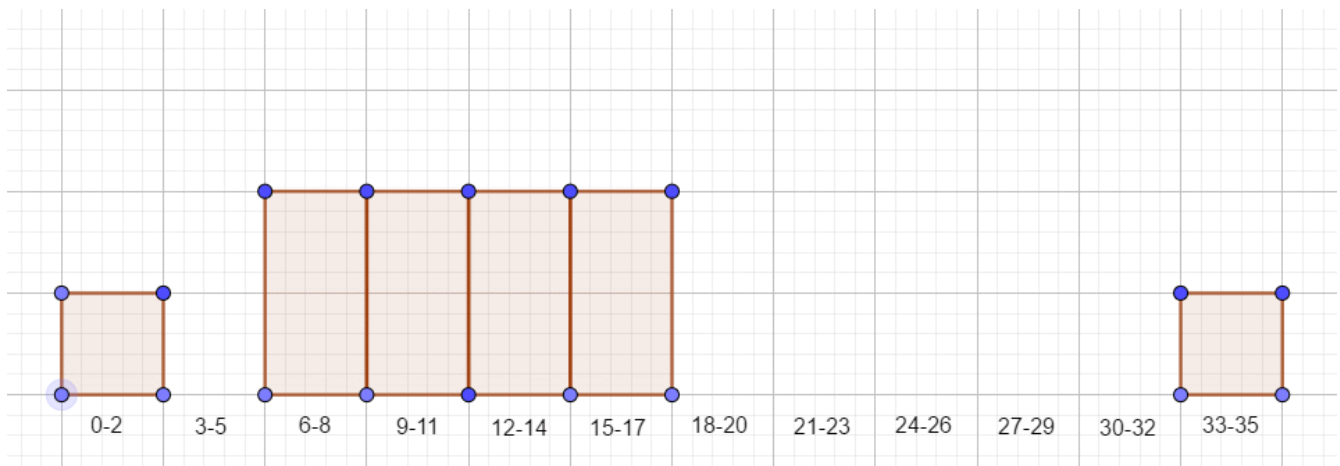
z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890

The question failed to ask for work to be shown, so full credit is given for just the answer.

Work for partial credit:  $z = (330-300)/50 = .6$  (5pts). Table gives .7257 for  $z = .6$ . (3pts) Actual probability is  $1 - .7257 = .2743$ . (2pts)

**Question 4:** (SLO is: "Students will be able to estimate and check mathematical results for reasonableness.")

Consider the distribution shown in the histogram below:



- a) Estimate the mean of the distribution.
- b) Estimate the standard deviation of the distribution. (Doing this by eye is fine.)

**Explanations were not asked for, so doing it all by eye is OK.**

**(As is picking a distribution that would give the histogram and calculating the mean etc for it.)**

**(a) Estimate the mean. (6pts)**

**Intuitively, the mean is “where it balances,” and 11.5 (a border between bins) is too low.**

**So, 11.5 gets 5 pts.**

**16 looks too high for the mean, and gets 5 pts.**

**Numbers in the open interval (11.5,16) get 6pts.**

**Numbers much outside it, like 10 and 17 only get 2pts, with more fewer points for wilder guesses.**

**(b) Estimate the standard deviation. (4pts)**

**Work could be given for partial credit. A mean of 12 or 13 is expected for (a), and additional points won't be given for it in (a). Since standard deviation is roughly “the mean distance from the mean”, marking around 7 and 21 to find these points would be worth 1pt for each side.**

**Then calculating  $|7-12| = 5$ , or  $|21-12| = 9$  would be worth 1 more point.**

**Any estimate between 5 and 9 gets the full 4pts, 4 or 11 gets 2pts, etc.**

**Question 5: (SLO is: “Students will be able to recognize the limits of mathematical and statistical methods.”)**

A music professor wants to know if students in the United States prefer rock music to classical music. He decides to use the students in his music class as a sample. He finds that 62% of his students prefer classical music. He does a statistical analysis on his sample data and finds that his result is statistically significant at the .05 level. He then claims that common perceptions about the musical preferences of students is mistaken and that he has demonstrated beyond doubt that students actually prefer classical music to rock. Describe what is wrong with the music professor's claim.

**There are many possible flaws, each worth some points. A maximum of 10 points is possible. Responses need not use statistical terminology for full credit, but should be clear.**

**"The students in the class are not a representative sample." (4pts)**

**"The students in the class are not a random sample." (4pts)**

**("Is a convenience sample." combines features of the two answers above. If it is given instead of them, that's worth 4 points.)**

**"The class is probably too small a sample." (This is actually irrelevant, but probably true. 3pts)**

**"Students may not be answering honestly to curry favor with their professor." (4pts)**

**"Statistically significant at  $p = .05$  is not 'beyond doubt'." (A bit of a quibble. 2pts)**

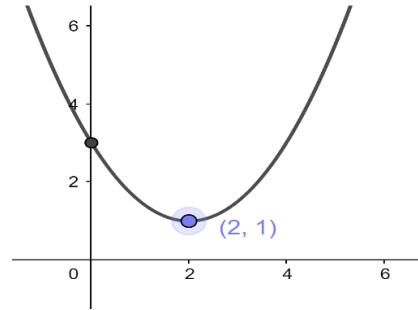
## Algebra

**Question 1:** (SLO is: "Students will be able to interpret and draw inferences from mathematical models such as formulas, graphs, tables and schematics.")

### Question 1:

Here is the graph of a quadratic function.

- Writing the equation as  $y = ax^2 + bx + c$ , would  $a$  be positive or negative?
- We see  $(2,1)$  is the low point (vertex) of this graph. Give an equation of the form  $y = ax^2 + bx + c$  that has  $(2,1)$  as its low point.
- Give an equation of the form  $y = ax^2 + bx + c$  that has  $(2,1)$  as its low point, **and** has  $y$ -intercept 3.



**2pts for (a)**

**4pts for (b):**

Students must show evidence of substituting in both values (1 point for  $x = 2$  and 1 point for  $y = 1$ ) and putting the equation in general form (2). If correct final equation given, full credit.

**4pts for (c)**

Students must show evidence of substituting in all values (1 point for  $x = 2$  and 1 point for  $y = 1$  and 1 point for using the point  $(0, 3)$  and putting the equation in general form (1). If correct final equation, full credit.

**Question 2:** (SLO is: "Students will be able to represent mathematical information symbolically, visually, numerically and verbally.")

**Question 2:**

- a) Showing your work, find the equation for a circle with center at  $(-3,2)$  and radius of 7.
- b) Sketch the graph of your equation from part (a).

**7pts for (a):**

Student must show evidence of using the center (2 points) and radius (2 points) in the correct equation for a circle (3 points).

**3pts for (b): [may be omitted if technical issues?]**

Student correctly graphs circle (1 point) with center (1 point) and radius (1 point).

**No points if left blank.**

**If mention of technical difficulties, full points.**

**Question 3:** (SLO is: "Students will be able to employ quantitative methods such as, arithmetic, algebra, geometry, or statistics to solve problems.")

**Question 3:**

Abe leaves Pleasantville at noon, driving north on Route 1 at a constant speed of 30 mph.  
Brenda follows him, leaving Pleasantville at 2:00 p.m. and driving at a constant speed of 45 mph.  
When does Brenda catch up with Abe ? (Use algebra, showing your work.)

**10pts:**

Students shows evidence of algebra, a formula, a table, or some other method to solve the problem.

Abe speed times a value (2)

Brenda speed times a value (2)

Gives some expression of total distance after x hours (2)

Sets equations equal (2)

Answers question with a time or number of hours after started (2)

Correct answer with no work (6)

**Question 4:** (SLO is: "Students will be able to estimate and check mathematical results for reasonableness.")

**Question 4:**

A student was solving a system of equations in the following forms. She finds 4 solutions. Is this possible? Explain why or why not.

(1)  $x^2 + y^2 = a^2$

(2)  $y = mx + b$

**10pts:**

Student shows evidence of understanding of the two types of equations given, earning points if mentioning circle (3) or line (3) with correct number of solutions (4).

Recognize pos and neg values . . . . 2pt

Not possible w/ no explanation (2)

**Question 5:** (SLO is: "Students will be able to recognize the limits of mathematical and statistical methods.")

**Question 5:**

Solve for x:  $\sqrt{2x} + 6 = x + 2$ .

(In words, the equation is "the square root of 2x, plus 6, is equal to x plus 2".)

**10pts:**

Partial credit based on algebra and potential solutions. Full credit for  $x = 8$  alone. If students mention both  $x = 8$  and  $x = 2$  as solutions without verifying will only earn 6 points.

Movement of terms (2)

Square both sides (2)

Expand square of binomial (2)

Solve (2)

Check (2)

Question 1 [10 points]

- 1 point for “ABCD”
- 2 points for “ABCGHFED”
- 2 points for “AGCD”
- 2 points for “AGHFED”
- 2 points for “AFHGCD”
- 1 point for “AFED”

[ One-half point for any path listed if letters are omitted in its name.  
One-half point for each path that is not listed but is drawn on the  
graph with numbered arrows. ]



Question 2 [10 points]

7 points for (a)

Answers may vary. The six vertices can be placed in a straight line format, or as vertices of an undrawn hexagon, or in rows, etc.

Features of graph

Six discrete dots representing vertices that are labeled with an identifying number. [ 2 points ]

One edge connecting each of these vertex pairs in the graph: 2 – 3, 2 – 5, 3 – 5, 5 – 7, 11 – 13 [5 points: 1 point each]

3 points for (b)

Formal answer: The graph is not connected and therefore includes two components. 2 and 13 are on different components, so it is not possible to go from 2 to 13.

If the graph illustrated “disconnectedness”, then an informal explanation without technical language earns the credit.

Question 3 [10 points]

Discussion includes reference to an Euler circuit, formally or informally [visiting each edge only once] [ 8 points ]; and valence, or degree, of a vertex [ 2 points ].

A route that goes past each of the houses in this graph only once is an euler circuit, a circuit that visits each edge of a graph once and only once.

An euler circuit, which by definition has vertices that are only even-valent, is required for the specified route [because of the location of the houses]. This graph has vertices that are not even-valent, so there is no euler circuit in the graph, and it is not possible to make such a route.

An euler path is not an option for this graph because there are more than two odd-valent vertices.

[One-half point for each edge that is visited by a route that is drawn that does not revisit any edge on the graph.]

Question 4 [10 points]

Content of explanation includes “connectedness” or informal reference to “connectedness” [6 points]; and “circuit” or a non-technical reference [4 points].

“If a graph is not connected, then there is at least one pair of vertices not joined by a path; but if a circuit visits all the vertices of a graph, then every pair of vertices would be joined by a path. This contradiction makes the situation impossible.”

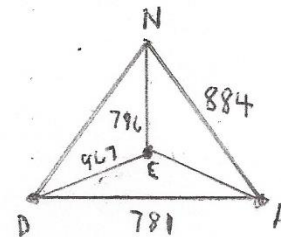
A drawing of the graph attempting to show the conditions [optional, but 2 points (available) if present]

Question 5 [10 points]

A technical discussion includes “complete graph” with vertices N, A, C, D [2 points], path NAD [2 points], path NCD [2 points], edge ND [2 points], and “the third side of a triangle” information [2 points].

“In a complete graph showing the four cities and the distances, the ND edge is not weighted. ND is the “third side” in the two triangles formed by paths NAD and NCD. Since ND is the third side, it is less than the sum of the other two sides in triangle NAD [ $884 + 781 = 1665$ ] and in triangle NCD [ $796 + 967 = 1763$ ]. Therefore, the driving distance from New York to Dallas is less than 1665 miles and the suggested conclusion is not reasonable.”

A drawing of the complete graph showing labeled vertices and driving distances [optional, but 2 points if present.]



An informal discussion suggesting that a shorter route from New York to Dallas might exist, making the driving distance between the two cities less than, or the same as, 1665 miles. [10 points]

## GEOMETRY

(SLO is: "Students will be able to interpret and draw inferences from mathematical models such as formulas, graphs, tables and schematics.")

### Question 1:

In the diagram at right:

Line  $f$  goes through points  $A$ ,  $B$  and  $C$ . Line

$i$  goes through points  $F$ ,  $B$  and  $D$ . Lines  $g$  and  $h$  are perpendicular to  $f$ .

Segments  $AB$  and  $BC$  both have length 3.

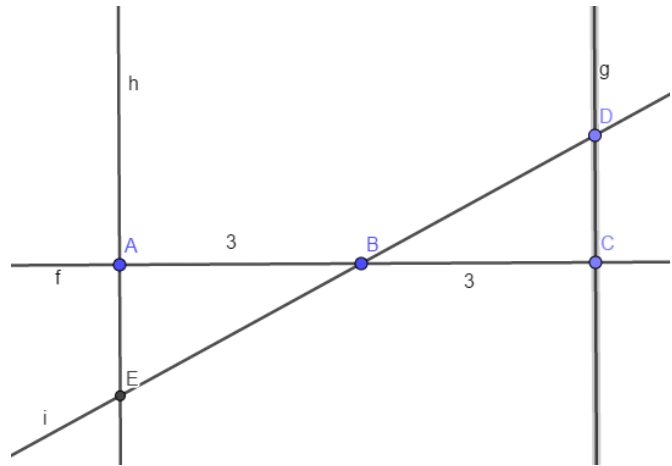
4 pts Are triangles  $\triangle ABE$  and  $\triangle CBD$  congruent? 6 pts Explain your reasoning.

Reasoning: These triangles are congruent by ASA (or AAS).

2pts. For each justification of the angles

1 pt for recognition that  $AB$  is congruent to  $BC$

1 pt for the ASA recognition.



(SLO is: "Students will be able to represent mathematical information symbolically, visually, numerically and verbally.")

### Question 2:

You are given that (the measures of) angles  $\alpha$  and  $\beta$  add to 90 degrees.

a. 5 pts Draw and label an accurate diagram, showing angles  $\alpha$  and  $\beta$  where the sum is 90 degrees.

b. 2 pts Complete the sentence: "Angles  $\alpha$  and  $\beta$  are complementary \_\_\_\_\_ of each other."

c. 3 pts Give three different pairs of values for (the measures of)  $\alpha$  and  $\beta$  so that their sum is 90 degrees:

" $\alpha$  and  $\beta$  could be \_\_\_\_\_ and \_\_\_\_\_, or \_\_\_\_\_ and \_\_\_\_\_, or \_\_\_\_\_ and \_\_\_\_\_."

More points are given here to the visual and numerical portions of the question. Some students could draw this visually and provide different pairs, but did not know the correct term for part b.

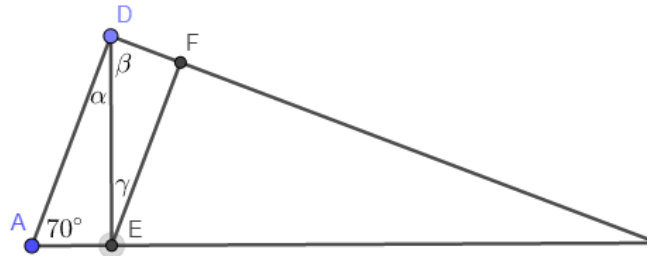
It was not given that the angles must share a vertex or an adjacent side, thus \* was also considered an acceptable answer if the right angle was shown.

Part b. supplementary is often confused with complementary, so the student would get one point for this answer. Depending on the drawing, the student may have drawn  $\alpha$  and  $\beta$  as the same angle measure, so congruent would also be an accurate description according to their drawing, so one point will be awarded.

(SLO is: “Students will be able to employ quantitative methods such as, arithmetic, algebra, geometry, or statistics to solve problems.”)

Question 3:

In the diagram at right:  
E is on segment AB, and F is on segment BD. Angles  
AED, ADB, DEB and EFB are right. Angle DAB  
measures 70 degrees.  
What are the angle measures  $\alpha$ ,  $\beta$  and  $\gamma$ ?



$\alpha =$

20

$\beta =$

70

$\gamma =$

20

It was not required that work must be shown, so only answers were considered.

$\beta$  and  $\gamma$  rely on the answer for  $\alpha$ , thus the correct  $\alpha$  choice will be awarded 4 points, while 3 points will be awarded for each of the correctly identified remaining angle measures.

If  $\alpha$  was chosen incorrectly but an appropriate  $\beta$  or  $\gamma$  was chosen respective to the choice of  $\alpha$ , then 3 points are awarded for each appropriately chosen  $\beta$  and/or  $\gamma$ .

(SLO is: “Students will be able to estimate and check mathematical results for reasonableness.”)

Question 4:

You are told that a triangle has sides that measure 1, 3 and 5 units. Is this possible? 5 points Explain your reasoning. 5 points [3 mentions the smaller sides in relation to the larger, 2 if the relation recognizes that the sum of the two smaller must be greater than the larger side.]

Not possible, the two smaller sides must be greater than the larger side.

(SLO is: “Students will be able to recognize the limits of mathematical and statistical methods.”)

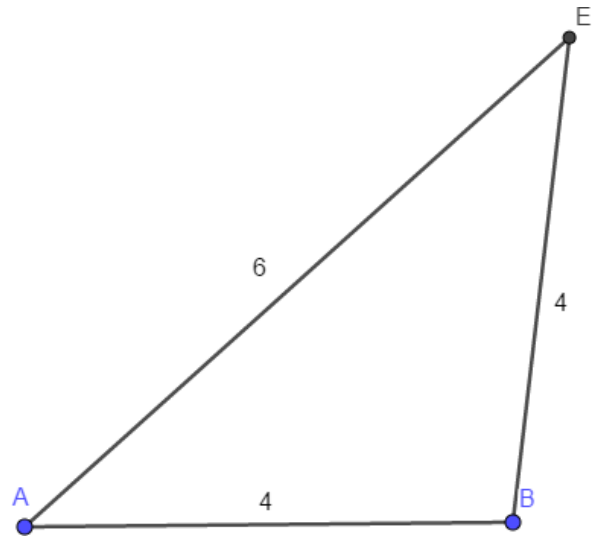
**Question 5:**

In triangle  $\triangle ABE$ , sides AB and BE have length 4 and side AE has length 6.

Consider the following calculation of the area of  $\triangle ABE$ :

“We know Area is  $\frac{1}{2}$  Base times Height. Since AB is the base and BE is the height, the area of  $\triangle ABE$  is  $\frac{1}{2} \cdot 4 \cdot 4 = 8$  square units.”

Is this calculation valid? 5 points Explain, briefly. 5 points [2 points for recognition of height issue, 3 points for recognition that the height must be perpendicular to the base; -1 if idea is there but incorrect term (e.g., “straight”)]



This is not a valid calculation since BE is not perpendicular to AB. Thus, BE cannot be considered the height of the triangle with a base of AB. Since this is a brief explanation, it isn't necessary to show why AB and BE are not perpendicular.

**LOGIC \*ANSWER KEY and \*GRADING RUBRIC**

**SLO #1: interpret and draw inference from model (e.g., table)**

**Question 1, version 1:**

Since language and notation varies, this question is written two ways. They really are the same question, and you should do the one that sounds more familiar to you.

**First way of writing it:**

P and Q are sentence letters, and  $\sim(P \leftrightarrow Q)$  is a premise and

$P \rightarrow Q$  is the conclusion. Their truth-values are determined by the truth table at right.

- a. What values should P and Q have to make both  $\sim(P \leftrightarrow Q)$  and  $P \rightarrow Q$  true?
  
- b. Is the argument  $\sim(P \leftrightarrow Q) \vdash P \rightarrow Q$  valid? Explain briefly, indicating which row of the table shows an invalidating assignment, if any.

**Answer to Question 1, version 1**

1a. P: F Q: T

1b. The argument is not valid. The second row of the truth table (where P:T and Q:F) shows the possibility of the premise being true while the conclusion is false.

**Point value and standards for Answers to Question 1, version 1**

Value: worth 5 points **each** for parts a and b. Both parts a and b are measuring the student's ability to interpret the information contained in the table and to infer from it the conditions required for both sentences to be true and to infer whether the argument is valid.

Standards for assigning values:

For 1a: 5 full points for 1a for a correct identification of the required truth values for the sentence letters (the value F for P and the value T for Q). 2.5 points if the required truth value for only one of the sentence letters is identified. Range of 1 point to 2.5 points if some explanation showing that the student is thinking of how the truth value of the whole is a function of the value of the parts is given even if the answer is incorrect/incomplete. 0 points for not answering or for a non-responsive answer.



For 1b: 2 points for correctly answering whether the argument is valid. 1 point for an incorrect answer. 0 points for no answer or for a non-responsive answer. Additionally, 3 points for an explanation that correctly identifies any invalidating truth value assignments. Range of 1 to 2 points for explanations that show an understanding of (in)validity but misidentify the relevant invalidating assignment, or that identify the relevant invalidating assignment but for which the explanation shows a misunderstanding about (in)validity. 0 points for not answering or for a non-responsive answer.

**Second way of writing it:**

---

X and Y are Boolean variables, and  $F(X,Y)$  and  $G(X,Y)$  are determined by the truth table at right.

- a. What values should X and Y have to make both  $F(X,Y)$  and  $G(X,Y)$  true?
- b. Is the implication  $F(X,Y) \rightarrow G(X,Y)$  always true? Explain, briefly.

**Answer to Question 1, version 2**

1a. X: F Y: T

1b. The implication is not always true. The second row of the truth table (where X:T and Y:F) shows the possibility of  $F(X,Y)$  being true while  $G(X,Y)$  is false. Therefore,  $F(X,Y)$  does not always imply  $G(X,Y)$ .

**Point value and standards for Answers to Question 1, version 2**

Value: worth 5 points **each** for parts a and b. Both parts a and b are measuring the student's ability to interpret the information contained in the table and to infer from it the conditions required for both functions to yield the value true and to infer whether the implication always holds.

Standards for assigning values:

For 1a: 5 full points for 1a for a correct identification of the required truth values for the Boolean variables (the value F for variable X and the value T for variable Y). 2.5 points if the required truth value for only one of the variables is identified. Range of 1 point to 2.5 points if the explanation given shows that the student is thinking of how the value yielded by the function is determined by the value of the variables, even if the answer is incorrect/incomplete. 0 points for not answering or for a non-responsive answer.

For 1b: 2 points for correctly answering whether the implication is always true. 1 point for an incorrect answer. 0 points for no answer or for a non-responsive answer. Additionally, 3 points

for an explanation that correctly identifies any truth value assignments showing a failure of implication. Range of 1 to 2 points for explanations that show an understanding of implication but misidentify the relevant invalidating assignment, or that identify the relevant invalidating assignment but for which the explanation shows a misunderstanding about implication. 0 points for not answering or for a non-responsive answer.

SLO#2: represent information symbolically

### Question 2:

Let P, Q and R be sentence letters (Boolean variables), and let  $\Phi$  be a compound sentence (Boolean expression) that is true if and only if at least one of P, Q or R is true.

- Make a truth table for  $\Phi$ .
- Write a compound sentence (Boolean expression) that has the same truth table as the one you made in part (a). You may use any of the sentential connectives (Boolean operations)  $\&$ ,  $\vee$  and  $\sim$  (AND, inclusive OR and NOT).

### Answer to Question 2

Table for 2a:

P	Q	R	$\Phi$
T	T	T	T
T	T	F	T
T	F	T	T
T	F	F	T
F	T	T	T
F	T	F	T
F	F	T	T
F	F	F	F

For 2b, there are multiple possible correct answers. The most natural answer is likely to be  $P \vee Q \vee R$ , as the wedge is the operator that yields true when at least one of the sentence letters (variables) is true.

### Point value and standards for Answers to Question 2

Part a worth 7 points, part b worth 3 points.

For the table in part a, for the full 7 points, the table should include reference columns capturing all the truth-value assignments given the number of letters/variables, and should indicate the correct value for  $\Phi$ . A score in the range of 4-6 if the answer contains a table with a few errors of calculation, or one missing some possible truth-value assignments for the letters/variables. A score in the range of 1-3 for some attempt at a truth-table or otherwise showing some description of what it takes for an expression to be true as long as one of its elements is true. 0 points for not answering or for a non-responsive answer.

For part b, a full 3 points if an equivalent formula has been provided. A range of 1-2 points if some formula containing relevant letters/variables and connectives. 0 points for not answering or for a non-responsive answer.

**SLO#3: employ quantitative method to solve problem**

**Question 3:**

Consider the proposed rule of logic that says  $X \rightarrow (Y \rightarrow Z)$  is equivalent to  $Y \rightarrow (X \rightarrow Z)$ . Is this a valid rule? Support your answer, either using truth tables or by proving the theorem  $\vdash (X \rightarrow (Y \rightarrow Z)) \leftrightarrow (Y \rightarrow (X \rightarrow Z))$ .

**Answer to Question 3:**

Yes, the two formula are equivalent to each other. Given the same truth values for the variables X, Y, and Z, each formula yields the same truth value. This is shown in the table below:

X	Y	Z	$X \rightarrow (Y \rightarrow Z)$	$Y \rightarrow (X \rightarrow Z)$
T	T	T	T	T
T	T	F	F	F
T	F	T	T	T
T	F	F	T	T

F	T	T	T	T
F	T	F	T	T
F	F	T	T	T
F	F	F	T	T

The equivalence is also shown in a proof for the theorem, such as:

1	(1) $X \rightarrow (Y \rightarrow Z)$	Assumption
2	(2) $Y$	A
3	(3) $X$	A
1,3	(4) $Y \rightarrow Z$	1,3 $\rightarrow$ Elim
1,2,3	(5) $Z$	2,4 $\rightarrow$ Elim
1,2	(6) $X \rightarrow Z$	5 $\rightarrow$ Intro (3)
1	(7) $Y \rightarrow (X \rightarrow Z)$	6 $\rightarrow$ Intro (2)
	(8) $(X \rightarrow (Y \rightarrow Z)) \rightarrow (Y \rightarrow (X \rightarrow Z))$	7 $\rightarrow$ Intro (1)
9	(9) $Y \rightarrow (X \rightarrow Z)$	A
10	(10) $X$	A
11	(11) $Y$	A
9,11	(12) $X \rightarrow Z$	9,11 $\rightarrow$ Elim
9, 10,11(13)	$Z$	10, 12 $\rightarrow$ Elim
9,10	(14) $Y \rightarrow Z$	13 $\rightarrow$ Intro (11)
9	(15) $X \rightarrow (Y \rightarrow Z)$	14 $\rightarrow$ Intro (10)
	(16) $(Y \rightarrow (X \rightarrow Z)) \rightarrow (X \rightarrow (Y \rightarrow Z))$	15 $\rightarrow$ Intro (9)
	(17) $(X \rightarrow (Y \rightarrow Z)) \leftrightarrow (Y \rightarrow (X \rightarrow Z))$	8, 16 $\leftrightarrow$ Intro

**Point value and standards for Answers to Question 3**

7 points possible for the table or proof, 3 points possible for the correct yes/no answer.

For the table option, for the full 7 points, the table should include reference columns capturing all the truth-value assignments given the number of letters/variables, and should indicate the correct values for the two sentences being compared (alternatively, a value for a biconditional of the two sentences would also work). A score in the range of 4-6 if the answer contains a table with a few errors of calculation, or one missing some possible truth-value assignments for the letters/variables. A score in the range of 1-3 for some attempt at a truth-table or otherwise showing some description of what it takes for expressions to be equivalent to each other. 0 points for not answering or for a non-responsive answer.

For the proof option, for the full 7 points, the proof should include valid steps of inference from one formula to the other and vice versa. Full points could still be possible with minor errors in the format of the proof. A score in the range of 3-6 if the proof shows only the entailment in one direction, or contains a few errors or otherwise skips steps of inference. A score in the range of 1-3 for some attempt at a proof or otherwise showing some description of what it takes for expressions to be equivalent to each other. 0 points for not answering or for a non-responsive answer.

A full 3 points if the correct answer about the equivalence is given, even if only 'yes' is stated. A range of 1-2 points if the answer does not clearly assert the equivalence, or otherwise provides an explanation that shows a misunderstanding about equivalence or validity. 0 points for not answering or for a non-responsive answer.

#### **SLO#4: estimate and check results for reasonableness**

##### **Question 4:**

P and Q are sentence letters (Boolean variables). Are  $\sim(P \& Q)$  and  $(\sim P \& \sim Q)$  logically equivalent?

Explain, briefly.

##### **Answer to Question 4:**

No, the two formula are not logically equivalent because they can have different truth values on the same truth value assignment to the letters (variables). For example, if P is true and Q is false, the first formula will be true and the second will be false.

##### **Point value and standards for Answers to Question 4**

7 points possible for the explanation, 3 points possible for the correct 'no' answer.

A full 3 points if the correct answer about the equivalence is given, even if only 'no' is stated. A range of 1-2 points if the answer does not clearly deny the equivalence, or otherwise provides an explanation that shows a misunderstanding about equivalence or of the connectives involved. 0 points for not answering or for a non-responsive answer.

A full 7 points for an informal explanation that clearly identifies relevant factors in support of the answer, including the scope of the negation and that a denial of a conjunction does not entail the denial of both conjuncts. A formal device such as a truth table could be used but is not required. An informal discussion of how the two expressions can have different truth values is sufficient. A range of 4 to 6 points for explanations that show an understanding of the relevant differences but that are otherwise unclear, incomplete, or contain some error. A range of 1 to 3 points for an attempted explanation that contains significant error or misunderstanding. 0 points for not answering or for a non-responsive answer.

#### **SLO#5: recognize limits of method**

##### **Question 5:**

- a. Giving a translation scheme, symbolize the following argument in Sentential Logic (also called Propositional Logic):

All students are intelligent, Maria is a student, therefore Maria is intelligent.

- b. Now symbolize the same argument in Predicate Logic with a new translation scheme.

- c. Explain why the validity of this argument cannot be shown in Sentential Logic and why the language of Predicate Logic is better at showing the relevant logical form of the argument.

##### **Answer to Question 5:**

###### **Answer to 5a**

Different sentence letters could be chosen, but a sample translation scheme for the argument could be: A=All students are intelligent, S=Maria is a student, and I=Maria is intelligent. Using this scheme, symbolizing the argument would be:  $A, S \vdash I$  (where the turnstile  $\vdash$  is a conclusion/implication indicator).

### Answer to 5b

Again, different predicate and name letters could be chosen, but a sample PL translation scheme for the argument could be:  $S\alpha = \alpha$  is a student,  $I\alpha = \alpha$  is intelligent,  $m = \text{Maria}$ . Using this scheme, symbolizing the argument would be:  $\forall x(Sx \rightarrow Ix), Sm \vdash Im$

### Answer to 5c

The argument is valid: if the premises are true, the conclusion must be true too. The validity of the reasoning depends on Maria's being a member of a category for which all the members are also a member of another category. SL is not expressive enough to represent the form of this reasoning. Since SL's basic represented unit is the sentence, it cannot represent the relation between the categories and how all the members of one will be members of the other. Indeed, a truth table would suggest that the SL argument is invalid:  $A = \text{true}, S = \text{true}, I = \text{false}$ .

PL is better at representing the relevant relation between the categories since it contains predicate letters for each of the categories, and it contains quantifier symbols to express how all the members of one category are members of the other. A proof of  $\forall x(Sx \rightarrow Ix), Sm \vdash Im$  could be given to show how the conclusion follows from those premises.

### Point value and standards for Answers to Question 5

Parts a and b are worth 3 points each, while Part c is worth 4 points.

Full 3 points for Part a for an answer giving a translation scheme that assigns a letter for each of the sentences, without ambiguity, and which shows the argument as consisting of three sentence letters. A range of 1-2 points for an answer that attempts to give a symbolization but which is either incomplete or attempts to symbolize a unit that is a proper part of the sentence. 0 points for not answering or for a non-responsive answer.

Full 3 points for Parts b for an answer giving a translation scheme that assigns letters to the relevant parts of the sentences (predicates, names). The translation scheme may use Greek metavariables or some kind of placeholder to indicate that these are one-place predicates, but this is not necessary for the full 3 points. The full 3 points should also require a correct symbolization of the argument, including a quantifier symbol. A range of 1-2 points for an answer that attempts to give a scheme and symbolization but which is either incomplete or contains significant errors. 0 points for not answering or for a non-responsive answer.

A full 4 points for an explanation in part c that addresses how the validity of the argument depends on the form/structure of the reasoning and how the expressive power of SL is too limited to represent that form/structure. A range of 1-3 points for attempted explanation that

identifies some relevant factor but which is either incomplete or contains significant errors. 0 points for not answering or for a non-responsive answer.