Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2020 – Summer 2021

Program or Department Mission:
The Department of Mathematics/Engineering/Physical Sciences offers a broad range of courses that service the career programs of the college and that will transfer to baccalaureate degree granting institutions. The department also offers developmental mathematics courses to prepare students for college level mathematics.

Instructional Program Outcomes & Assessment Plan – AST 220

Department Outcomes

- Provide freshman and sophomore-level courses in Chemistry, Mathematics, Physics, Physical Sciences, and Astronomy, with emphasis on critical thinking and analytical ability, that are transferable to public institutions of higher learning.
- Offer an appropriate remedial mathematics program accommodating various skill levels.
- Develop and provide courses relevant to the career and professional degree programs of the college.

Astronomy Course Level Outcomes Assessment Rubric

Level 3: Attempted Problem and Solved Correctly
Level 2: Attempted Problem and Did Not Solve Correctly
Level 1: Did Not Attempt Problem

Evaluated Course Objectives

The General Education Objective is met through the course objectives that require the use of analogy and scientific concepts to understand fundamental elements of astronomy. Student mastery of the specific course objectives to follow will be evaluated by analyzing answers to appropriate questions from the comprehensive final exam. The astronomy final will be a comprehensive multiple-choice exam.

The student will demonstrate knowledge of astronomy by his/her ability to:

1. Use analogy to describe size and distance scales between planets in the solar system, distance between star systems in galaxies, and distance between galaxies or galaxy clusters within the universe.
2. Be to describe the time scales for major cosmic events such as the age of the universe, when galaxies began to form, or when our solar system formed.
3. Demonstrate knowledge of basic scientific principles used by astronomers to understand the composition and the dynamics of the universe.

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
AST 220 Objective 1 Use analogy to describe size and distance scales between planets in the solar system, distance between star systems in galaxies, and distance between galaxies or galaxy clusters within the universe.	Rubric based assessment of a related final exam question that fits the description given in objective 1	70% of students learning at a rubric level of 3	Internet Campus Level 3 359/425 84% Level 2 56/425 14% Level 1 10/425 2%	**Observations/Changes:** 84% (359/425) performed at Level 3 or higher. Down from 86% last year. The overall percentage of students that scored at level 3 decreased slightly this academic year. Our recommendation is to add discussion questions on the relative sizes of objects in our universe in lab exercises. See Addendum A.

AST 220 Objective 2 Describe the time scales for major cosmic events such as the age of the universe, when galaxies began to form, or when our solar system formed.	Rubric based assessment of a related final exam problem that fits the description given in objective 2	70% of students learning at a rubric level of 3	Internet Campus Level 3 353/425 83% Level 2 62/425 15% Level 1 10/425 2%	**Observations/Changes:** 83% (353/425) performed at Level 3 or higher. Up from 80% last year. The overall percentage of students that scored at level 3 increased this academic year. Our recommendation is to continue adding discussion questions the timing of events since the Big Bang in the chapter review. See Addendum B.
AST 220 Objective 3 Demonstrate knowledge of basic scientific principles used by astronomers to understand the composition and the dynamics of the universe.	Rubric based assessment of a related final exam question that fits the description given in objective 3	70% of students learning at a rubric level of 3	I Internet Campus Level 3 343/425 81% Level 2 72/425 17% Level 1 10/425 2%	81% (343/425) performed at Level 3 or higher. No change from last year. The overall percentage of students that scored at level 3 remained the same this academic year. Our recommendation is to continue to add additional discussion questions of the basic scientific principles in lab exercises to help further increase understanding. Addendum C.

Addendum A

We might include a question similar to the following in the lab documents or in the lab discussion: How do the following distance compare: the distance between the earth and the moon, the distance between the earth and the sun, between the earth and the outer planets, and our sun and the nearest star system of Alpha Centauri?

Addendum B

We might include a question similar to the following in the chapter review document or in the test chapter review discussion: How do the following events compare on the cosmic calendar: the time between the Big-Bang and the emergence of our galaxy, the time between the emergence of galaxy of the emergence of our solar system, the emergence of our solar system and the emergence of intelligent life on earth?

Addendum C

We might include a question similar to the following in the lab documents or in the lab discussion: Why does the rotation axis of the earth remain generally fixed in one direction and what effect does this have on our seasons and climate?

Evaluated Course Objectives and Related Example Questions

The General Education Objective is met through the course objectives that require the use of analogy and scientific concepts to understand fundamental elements of astronomy. Student mastery of the specific course objectives to follow will be evaluated by analyzing answers to appropriate questions from the comprehensive final exam. The astronomy final will be a comprehensive multiple-choice exam.

The student will demonstrate knowledge of astronomy by his/her ability to:

1. Use analogy to describe size and distance scales between planets in the solar system, distance between star systems in galaxies, and distance between galaxies or galaxy clusters within the universe.

Example question 1

Suppose we imagine the Sun to be about the size of a grapefruit. What sort of area would the portion of our Solar System that includes the orbits of the eight major planets and the dwarf planet Pluto cover?

2. Be to describe the time scales for major cosmic events such as the age of the universe, when galaxies began to form, or when our solar system formed.

Example question 2

What is approximate age of the universe?

3. Demonstrate knowledge of basic scientific principles used by astronomers to understand the composition and the dynamics of the universe.

Example question 3

What does Kepler's first law say about how the planets orbit our sun?

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2020 – Summer 2021

Program or Department Mission:
The Department of Mathematics/Engineering/Physical Sciences offers a broad range of courses that service the career programs of the college and that will transfer to baccalaureate degree granting institutions. The department also offers developmental mathematics courses to prepare students for college level mathematics.

Instructional Program Outcomes & Assessment Plan – CHM 105

Chemistry Course Level Outcomes Assessment Rubric

Level 4: Student provides a complete and correct solution process that is well organized, with no errors.

Level 3: Student provides a complete solution process that is well organized but contains minor errors.

Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.

Level 1: Student attempts a solution but demonstrates little understanding of methods required to produce a correct solution with expected organization.

Level 0: Student does not attempt a solution.

Departmental Objectives:

. Provide freshman and sophomore level courses in Chemistry, Mathematics, Physics, Physical Sciences and Astronomy with emphasis on critical thinking and analytical ability, that are transferable to public institutions of higher learning.
. Offer an appropriate remedial mathematics program accommodating various skill levels.
. Develop and provide courses relevant to the career and professional degree programs of the college.

Evaluated Course Objectives

The student will demonstrate his/her understanding of chemistry by being able to:

1. Using structural formulas, draw and name three isomers when given the molecular formula.
2. Given a Fischer structure of a monosaccharide, draw both α – and β- Haworth structures
3. Show how α-amino acids form peptide linkages.

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results

SLO 1: Using structural formulas, draw and name three isomers when given the molecular formula.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**Annual Campus-wide total at rubric level 2 or higher: 14/16=87.5%** **Data collected during SU21** **All 20-21 Classes were taught online.** **Online Campus** Level 4 13/16 81% Level 3 1/16 6% Level 2 0/16 0% Level 1 2/16 13% Level 0 0/16 0% *	**Observations/Changes:** CHM 105 instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice to improve performance drawing and naming isomers. Summer 2021 saw a decrease in student success in the class. Because this is a very small population, it is hard to draw valid statistical conclusions from the data. Students attended and participated in the live discussion sessions for this objective. This objective is reinforced by assigned homework problems (see addendum A)

SLO 2: Given a Fischer structure of a monosaccharide, draw both **α** – and **β**-Haworth structures.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**Annual Campus-wide total at rubric level 2 or higher: 14/16=87.5%** **Data collected during SU21** **All 20-21 Classes were taught online.** **Online Campus** Level 4 11/16 69% Level 3 2/16 13% Level 2 1/16 6% Level 1 2/16 13% Level 0 0/16 0%	**Observations/Changes:** CHM 105 instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice to improve performance drawing Hayworth structures

SLO 3: Show how α- amino acids form peptide linkages.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**Annual Campus-wide total at rubric level 2 or higher: 14/16=87.5%** ***Data collected during SPR21 and SU21** **All 20-21 Classes were taught online.** **Online Campus** Level 4 12/16 75% Level 3 2/16 13% Level 2 0/16 0% Level 1 2/16 13% Level 0 0/16 0%	**Observations/Changes:** CHM 105 instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice to improve performance drawing peptide linkages.

Plan submission date: September 21st, 2021	**Submitted by: Lisa Nagy**

References

CHM 105 SLO Rubric:

Level 4: Student provides a complete and correct solution process that is well organized, with no errors. Level 3: Student provides a complete solution process that is well organized but contains minor errors. Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant. Level 1: Student attempts a solution but demonstrates little understanding of methods required to produce a correct solution with expected organization. Level 0: Student does not attempt a solution.

CHM 105 SLO Common Final Exam Problems:

(Data in **bold** are parameterized).

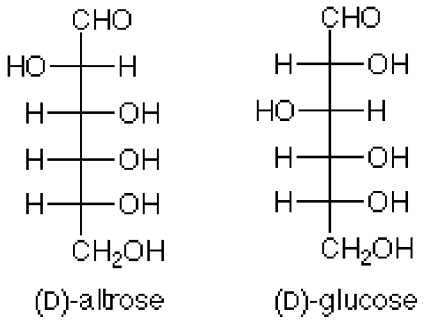
CHM 105 SLO 1

1. Draw the structural formulas of the four possible isomers of C_4H_9Cl. Hint: Start with the carbon skeletons and be systematic

2. Write the IUPAC names of the compounds you drew.

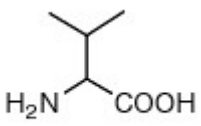
CHM 105 SLO 2

Draw Haworth projection structures for the α- anomer for these Fischer projections

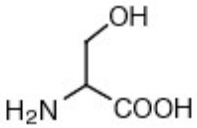


CHM 105 SLO 3

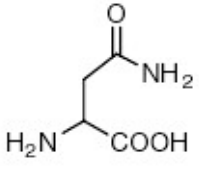
Draw the structure of the tri-peptide Val-Ser-Asn that forms from the following three amino acids



Valine (Val, V)



Serine (Ser, S)



Asparagine (Asn, N)

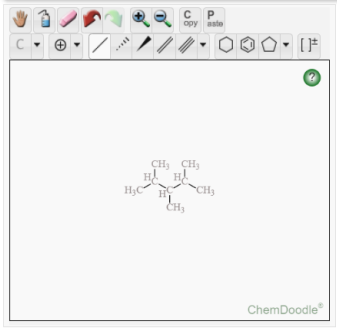
Examples of Corresponding Homework Problems

SLO 1 Isomers

Use the References to access important values if needed for this question.

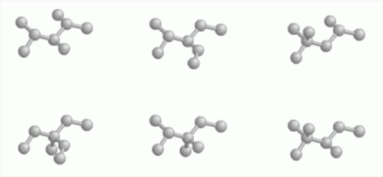
Draw a structural formula for one of the 6 constitutional isomers of the unbranched alkane C_8H_{18} in which the longest carbon chain has **5** atoms.

- You do not have to consider stereochemistry.
- You do not have to explicitly draw H atoms.
- In cases where there is more than one answer, just draw one.



Correct

The molecular formula given is C_8H_{18}. Any isomer must have the same molecular formula. Representations of the possible answers are shown below.



Use the References to access important values if needed for this question.

What is the IUPAC name for the following alkane?

2-methylpropane

Correct

The structural formula for the alkane given in the line drawing is:

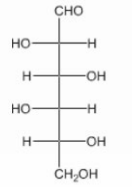
Because the longest carbon chain has **3** atoms, the substance is named as a **propane**. The position of substituents on the chain are indicated by numbering the chain C atoms so that the substituents will have the lowest numbers possible.

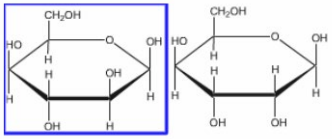
Submit Answer | Retry Entire Group | 9 more group attempts remaining

SLO 2 Haworth Drawings

EXERCISE Structure of Monosaccharides II

Click on the Haworth projection that depicts the same monosaccharide as that in the Fischer projection shown here.

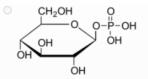


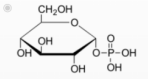


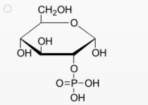
Check Next (2 of 13)

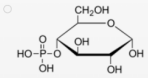
Correct

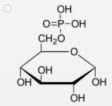
α-D-Glucose-1-phosphate







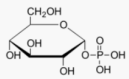




Correct

The hydroxyl groups of a monosaccharide can react with inorganic oxyacids to form inorganic esters. Phosphate esters, formed from phosphoric acid and various monosaccharides, are commonly encountered in biochemical systems. The hemiacetals from which they are formed can exist in both α and β forms: in α configuration both the terminal $-CH_2OH$ and $-OR$ groups point in different directions; in β configuration the groups point in the same direction.

α-D-Glucose-1-phosphate has the structural formula



Previous Next

SLO 3 Peptides

Homework Problems for Discussion:

20-59 Draw a condensed structural representation for just the "backbone" portion of a tripeptide.

20-60 What are the two alternating structure units present in the "backbone" of a peptide?

20-61 Draw a complete condensed structural representation for the tripeptide Val–Ser–Cys.

20-62 Draw a complete condensed structural representation for the tripeptide Gly–Ala–Thr.

20-67 Draw condensed structural formulas for the following peptides.
a. glycylalanine
b. cysteinylalanylglycine

20-68 Draw condensed structural formulas for the following peptides.
a. threonylserine
b. valylglycylcysteine

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2020-Summer 2021

Program or Department Mission:

The Department of Mathematics/Engineering/Physical Sciences offers a broad range of courses that service the career programs of the college and that will transfer to baccalaureate degree granting institutions. The department also offers developmental mathematics courses to prepare students for college level mathematics.

Instructional Program Outcomes & Assessment Plan – MTH 098

Mathematics Course Level Outcomes Assessment Rubric

Level 4: Student provides a complete and correct solution process that is well organized, with no errors.

Level 3: Student provides a complete solution process that is well organized but contains minor errors.

Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.

Level 1: Student attempts a solution but demonstrates little understanding of methods required to produce a correct solution with expected organization.

Level 0: Student does not attempt a solution.

Evaluated Course Objectives

The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations by being able to:

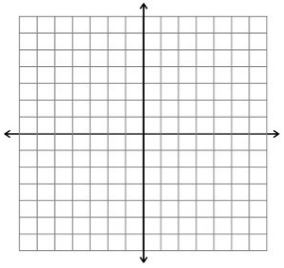
1. Solve linear equations, including literal, by applying the properties of equality.
2. Evaluate algebraic expressions using given numerical values.
3. Graph a linear equation.
4. Write the equation of a line given appropriate information.

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
Assessment of Objective 1 Solve linear equations, including literal, by applying the properties of equality.	Rubric-based assessment of related common final exam problems *Solve linear equations, including literal, by applying the properties of equality.* ***Solve: 2 + 5(x – 5) = 6(x – 1)***	70% of students learning at a rubric level of 2 or higher	**Annual campus-wide total at rubric level 2 or higher: 235/252= 93.3%** ***Data collected during SPR21 and SU 21** **Jefferson Campus** Level 4 5/12 41.7% Level 3 4/12 33.3% Level 2 3/12 25% Level 1 0/12 0% Level 0 0/12 0% **Shelby Campus** Level 4 17/27 63% Level 3 6/27 22.2% Level 2 2/27 7.4% Level 1 2/27 7.4%	**Observations/Changes:** Many of the sections offered were online sections, not face to face classes, due to the pandemic. Most instructors presented solving equations by using the properties of equality. Most students are performing at 70% or better on the objective. For the 2021-2022 year, the department recommends reinforcing student learning of this objective further by using algebra tiles to solve equations. The additional emphasis and use of manipulatives should help any struggling student improve performance. (See Addendum "A") https://youtu.be/G9DA70LjMoA

			Level 0 0/27 0% **<u>Clanton Campus</u>** Level 4 3/8 37.5% Level 3 4/8 50% Level 2 1/8 12.5% Level 1 0/8 0 % Level 0 0/8 0% **<u>Pell City Campus</u>** Level 4 4/7 57.1% Level 3 2/7 28.6% Level 2 1/7 14.3% Level 1 0/7 0% Level 0 0/7 0% **<u>Online</u>** Level 4 132/198 66.7% Level 3 29/198 14.6% Level 2 22/172 11.1% Level 1 10/172 5.1% Level 0 5/172 2.5%	

Assessment of Objective 2 Evaluate algebraic expressions using given numerical values.	Rubric-based assessment of related common final exam problems *Evaluate algebraic expressions using given numerical values.* ***Evaluate the following algebraic expressions, using x = 2, y = -3 and z = 4.*** $\frac{(x+y)^2}{2z}$	70% of students learning at a rubric level of 2 or higher	**Annual campus-wide total at rubric level 2 or higher: 234/252= 92.9%** **Jefferson Campus** Level 4 7/12 58.3% Level 3 5/12 41.7% Level 2 0/12 0% Level 1 0/12 0% Level 0 0/12 0% **Shelby Campus** Level 4 16/27 59.3% Level 3 5/27 18.5% Level 2 5/27 18.5% Level 1 1/27 3.7% Level 0 0/27 0% **Clanton Campus** Level 4 4/8 50% Level 3 1/8 12.5% Level 2 2/8 25% Level 1 0/8 0% Level 0 0/8 0% **Pell City Campus** Level 4 4/7 57.1% Level 3 1/7 14.3% Level 2 1/7 14.3% Level 1 1/7 14.3% Level 0 0/7 0%	**Observations/Changes:** For the 2021-2022 year, the department recommends reinforcing student learning of this objective by assigning problems using DeltaMath, a free online tool. Instructors can generate multiple assignments using this tool to individualize instruction as needed. (See Addendum "B")

			<u>Online</u> Level 4 115/198 58.1% Level 3 36/198 18.2% Level 2 32/198 16.2% Level 1 8/198 4% Level 0 7/198 3.5%	

Assessment of Objective 3 Graph a linear equation.	Rubric-based assessment of related common final exam problems *Graph the following linear equation:* ***Problem:*** *Graph the following linear equation: y = 12 x - 4* 	70% of students learning at a rubric level of 2 or higher	**Annual campus-wide total at rubric level 2 or higher: 227/252= 90.1%** **Jefferson Campus** Level 4 5/12 41.7% Level 3 2/12 16.7% Level 2 2/12 16.6% Level 1 3/12 25% Level 0 0/12 0% **Shelby Campus** Level 4 19/27 70.4% Level 3 0/27 0% Level 2 3/27 11.1% Level 1 5/27 18.5% Level 0 0/27 0% **Clanton Campus** Level 4 4/8 50% Level 3 2/8 25% Level 2 2/8 25% Level 1 0/8 0% Level 0 0/8 0% **Pell City Campus** Level 4 5/7 71.4% Level 3 0/7 0% Level 2 0/7 0%	**Observations/Changes:** There was an increase in the rate of success of 7.6% compared to 2019-2020. The increase in success could be due to the fact that more students are taking the course online where instructors are using videos to present the content and students can access those videos an unlimited number of times. For the 2021-2022 year, the department recommends reinforcing student learning of this objective by introducing students to "Desmos", an online graphing calculator. The program helps graphing come to life for students by aiding in their understanding of slope, intercepts, and ordered pairs. (See Addendum "C") https://www.desmos.com/calculator/actu6rn2ry

			Level 1 2/7 28.6% Level 0 0/7 0% **<u>Online</u>** Level 4 112/198 56.6% Level 3 41/198 20.7% Level 2 30/198 15.2% Level 1 8/198 4% Level 0 7/198 3.5%	

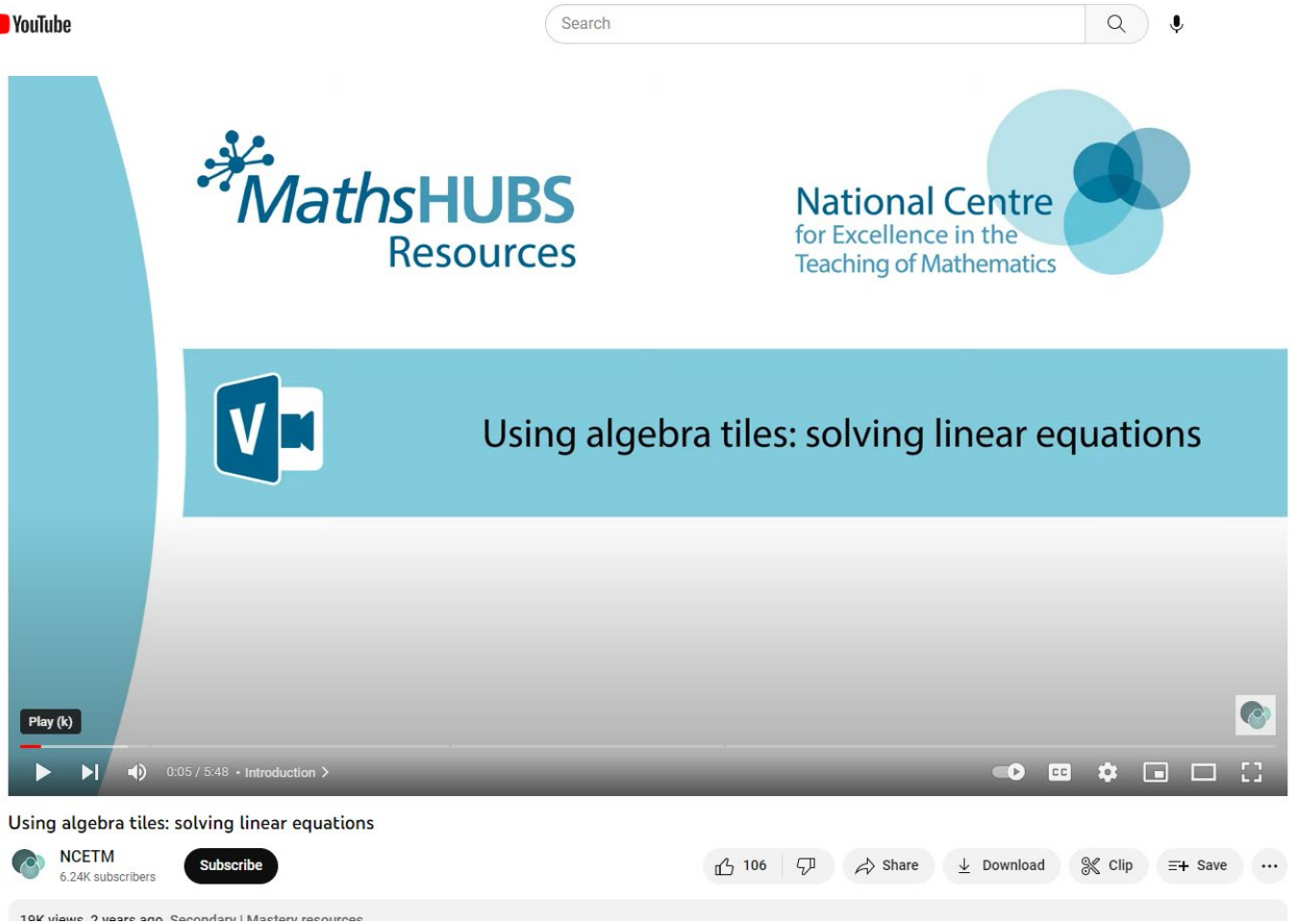
Assessment of Objective 4 Write the equation of a line given appropriate information.	Rubric-based assessment of related common final exam problems *Find the equation of a line given appropriate information.* ***Problem:*** *Write the equation of the line passing through the point* $6, 0$ *with slope* $-5/9$. *Write the answer in slope-intercept form.*	70% of students learning at a rubric level of 2 or higher	**Annual campus-wide total at rubric level 2 or higher: 214/252= 84.9%** **Jefferson Campus** Level 4 5/12 41.7% Level 3 0/12 0% Level 2 3/12 25% Level 1 3/12 25% Level 0 1/12 8.3% **Shelby Campus** Level 4 4/27 14.8% Level 3 4/27 14.8% Level 2 7/27 26% Level 1 12/27 44.4% Level 0 0/27 0% **Clanton Campus** Level 4 1/8 12.5% Level 3 0/8 0% Level 2 6/8 75% Level 1 1/8 12.5% Level 0 0/8 0% **Pell City Campus** Level 4 1/7 14.3% Level 3 3/7 42.9% Level 2 3/7 42.8%	**Observations/Changes:** For the 2021-2022 year, the department recommends providing a detailed handout with all formulas needed to work this type of problem and examples of how to use the formulas. Additional focus on this topic should lead to an increase in success rates for this objective.

			Level 1 0/7 0% Level 0 0/7 0 % **<u>Online</u>** Level 4 93/198 47% Level 3 40/198 20.2% Level 2 44/198 22.2% Level 1 12/198 6.1% Level 0 9/198 4.5% **Nanette Easterling**	

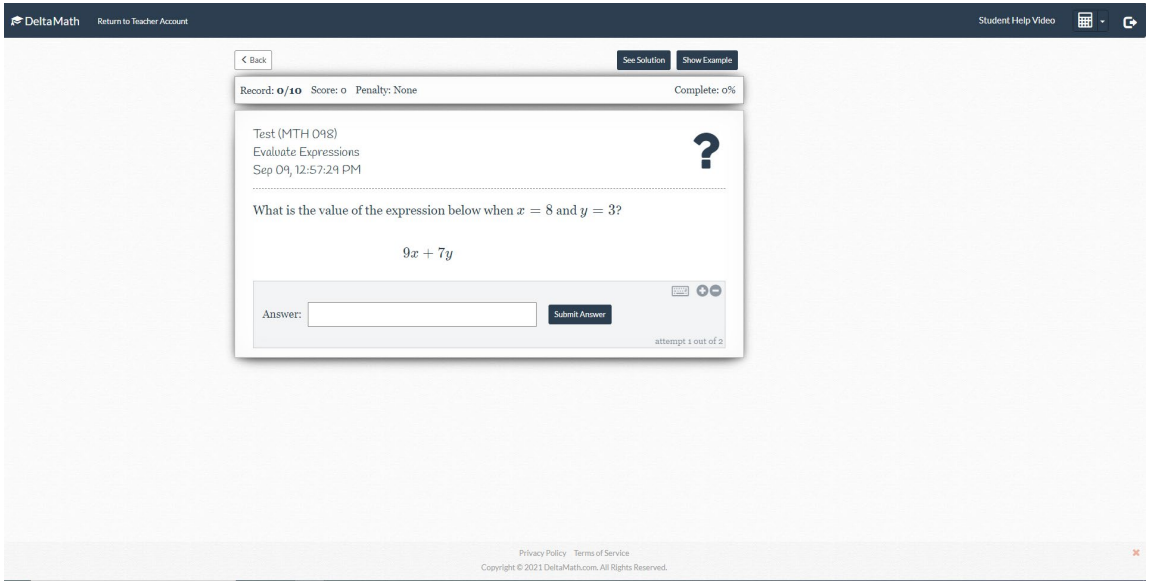
Addendum A:

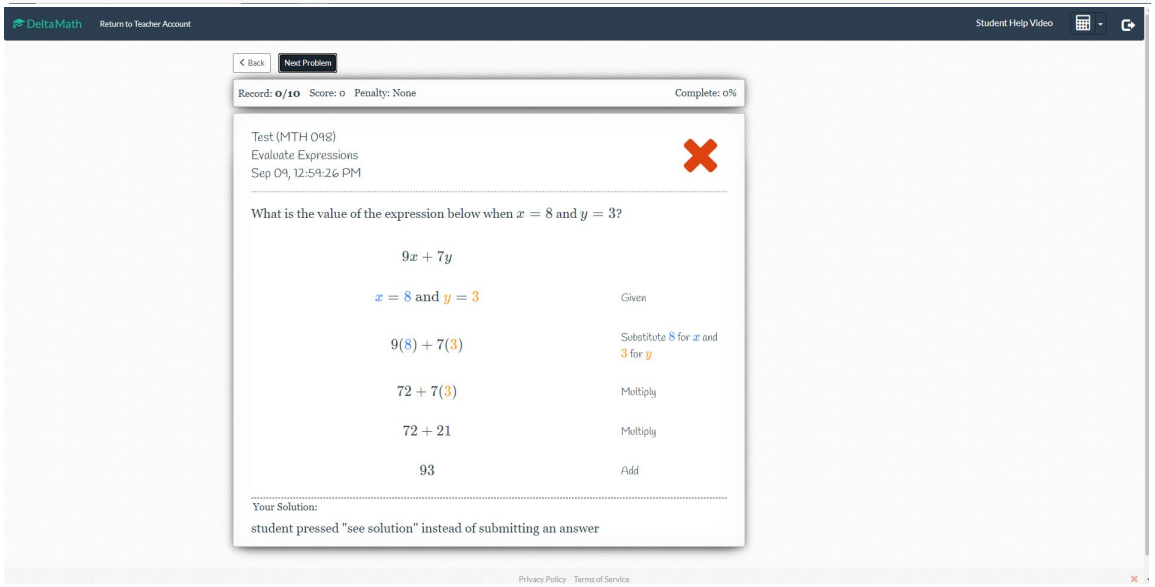
URL for Video explaining how to use algebra tiles to solve an equation:

https://youtu.be/G9DA70LjMoA



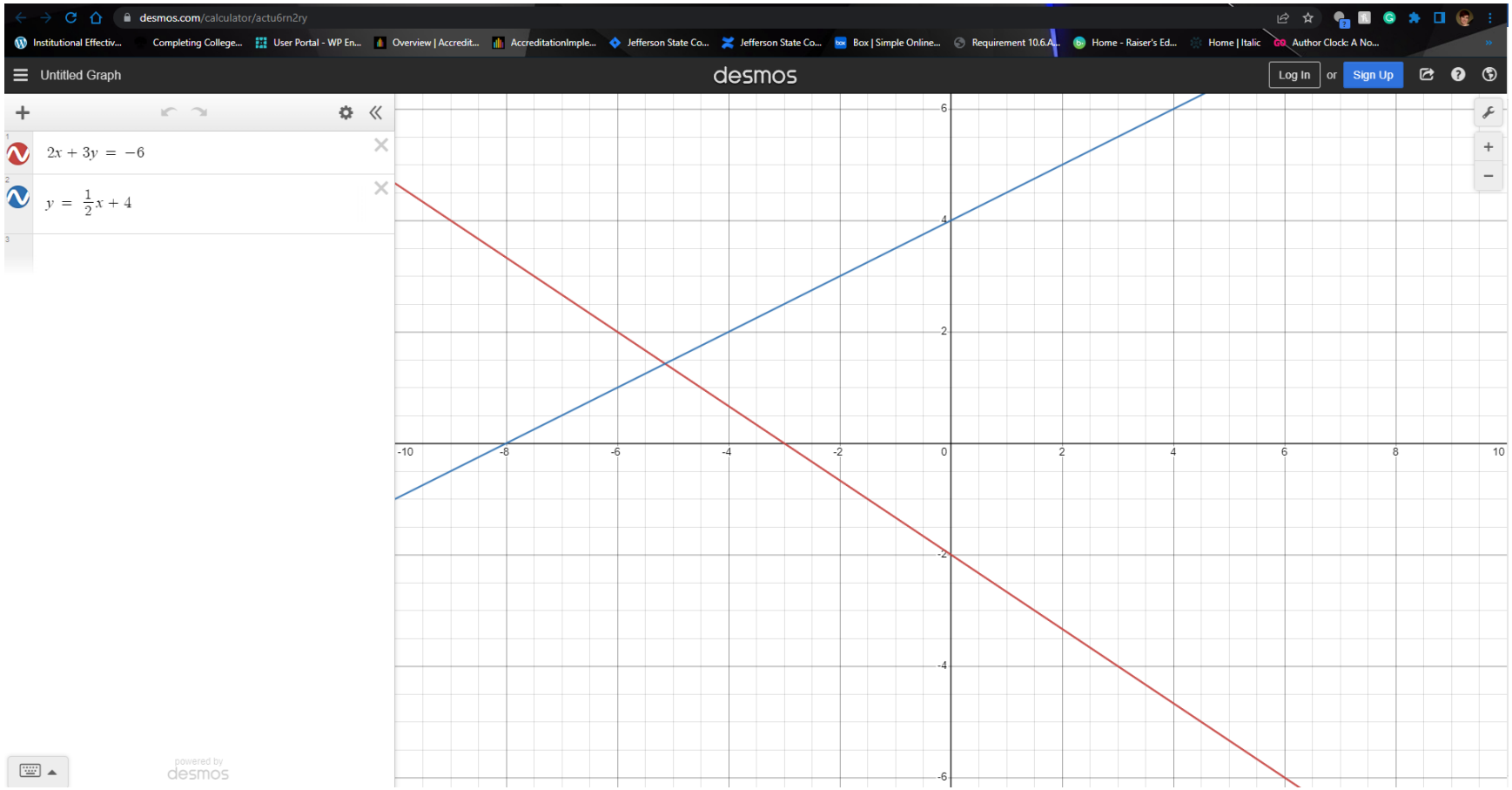
Addendum B:


DeltaMath
Return to Teacher Account
Student Help Video
Back
See Solution
Show Example
Record: 0/10 Score: 0 Penalty: None
Complete: 0%
Test (MTH 098)
Evaluate Expressions
Sep 09, 12:57:29 PM
What is the value of the expression below when $x = 8$ and $y = 3$?
$9x + 7y$
Answer:
Submit Answer
attempt 1 out of 2
Privacy Policy Terms of Service
Copyright © 2021 DeltaMath.com. All Rights Reserved.


DeltaMath
Return to Teacher Account
Student Help Video
Back
Next Problem
Record: 0/10 Score: 0 Penalty: None
Complete: 0%
Test (MTH 098)
Evaluate Expressions
Sep 09, 12:59:26 PM
What is the value of the expression below when $x = 8$ and $y = 3$?
$9x + 7y$
$x = 8$ and $y = 3$ Given
$9(8) + 7(3)$ Substitute 8 for x and 3 for y
$72 + 7(3)$ Multiply
$72 + 21$ Multiply
93 Add
Your Solution:
student pressed "see solution" instead of submitting an answer
Privacy Policy Terms of Service

Addendum C: Link to an example of graphs using Desmos

https://www.desmos.com/calculator/actu6rn2ry



Assessment Record

Program: Math-MTH 100 **Assessment period:** 2020-21

Program or Department Mission:
The Department of Mathematics/Engineering/Physical Sciences offers a broad range of courses that service the career programs of the college and that will transfer to baccalaureate degree granting institutions. The department also offers developmental mathematics courses to prepare students for college level mathematics

Course Student Learning Outcomes & Assessment Plan

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
SLO 1: Simplify radical expressions and perform operations with radical expressions	Rubric based assessment of related common final exam problems. Example common final exam problem: Simplify and add: $5\sqrt{72} + 6\sqrt{162} + 7\sqrt{200}$	70% of students learning at a rubric level of 2 or higher	**Data collected during SPR21 and SU21.** **Shelby Campus** Level 4 13/24 54.2% Level 3 5/24 20.8% Level 2 2/24 8.3% Level 1 1/24 4.2% Level 0 3/24 12.5% **Clanton Campus** Level 4 6/15 40.0% Level 3 3/15 20.0% Level 2 4/15 26.7% Level 1 0/15 0.0% Level 0 2/15 13.3%	**Observations/Changes:** Instructors will reinforce student learning of this objective further by creating video tutorials that emphasize the process of simplifying and performing operations on radical expressions. The additional emphasis and the extra examples should bolster student success and increase performance.

			Pell City Campus Level 4 4/4 100.0% Level 3 0/4 0.0% Level 2 0/4 0.0% Level 1 0/4 0.0% Level 0 0/4 0.0% **Online Campus** Level 4 545/597 91.3% Level 3 1/597 0.2% Level 2 13/597 2.2% Level 1 0/597 0.0% Level 0 38/597 6.4%	
SLO 2: Factor a trinomial.	Rubric based assessment of related common final exam problems. Example common final exam problem: Factor $\mathbf{4x^2 + 5x - 6}$	70% of students learning at a rubric level of 2 or higher	**Data collected during SPR21 and SU21.** **Shelby Campus** Level 4 11/24 45.8% Level 3 3/24 12.5% Level 2 2/24 8.3% Level 1 7/24 29.2% Level 0 1/24 4.2% **Clanton Campus** Level 4 7/15 46.7% Level 3 0/15 0.0% Level 2 7/15 46.7% Level 1 0/15 0.0% Level 0 1/15 6.7% **Pell City Campus** Level 4 4/4 100.0% Level 3 0/4 0.0% Level 2 0/4 0.0% Level 1 0/4 0.0% Level 0 0/4 0.0% **Online Campus** Level 4 551/597 92.3%	**Observations/Changes:** Instructors will reinforce student learning of this objective by assigning a manipulative-based assignment that will assist students in developing a deeper understanding of the concept of factoring and will give the students a visual representation of the factoring process.

			Level 3 3/597 0.5% Level 2 8/597 1.3% Level 1 2/597 0.3% Level 0 33/597 5.5%	
SLO 3: Perform operations with rational expressions	Rubric based assessment of related common final exam problems Example common final exam problem: Perform the operation. Simplify the complex fraction. $\frac{4+\frac{2}{x}}{\frac{x}{3}+\frac{1}{6}}$	70% of students learning at a rubric level of 2 or higher	**Data collected during SPR21 and SU21.** **Shelby Campus** Level 4 4/24 16.7% Level 3 2/24 8.3% Level 2 4/24 16.7% Level 1 8/24 33.3% Level 0 6/24 25.0% **Clanton Campus** Level 4 6/15 40.0% Level 3 2/15 13.3% Level 2 6/15 40.0% Level 1 0/15 0.0% Level 0 1/15 6.7% **Pell City Campus** Level 4 3/4 75.0% Level 3 0/4 0.0% Level 2 1/4 25.0% Level 1 0/4 0.0% Level 0 0/4 0.0% **Online Campus** Level 4 528/597 88.4% Level 3 0/597 0.0% Level 2 30/597 5.0% Level 1 1/597 0.2% Level 0 38/597 6.4%	**Observations/Changes:** To increase the percentage of students performing at level 4, Instructors will reinforce student learning of this objective by creating an instructional video detailing the process for simplifying a complex fraction and performing operations on rational expressions. Additional focus on this topic should lead to an increase in success rates for this objective.
SLO 4: Use the quadratic formula to find solutions to equations	Rubric based assessment of related common final exam problems.	70% of students learning at a rubric level of 2 or higher	**Data collected during SPR21 and SU21.** **Shelby Campus** Level 4 5/24 20.8% Level 3 7/24 29.2%	**Observations/Changes:** The department for 2021-2022 will use a musical application to reinforce student learning for this objective. Music has shown effective in learning

	Example common final exam problem: Solve the equation: $6n^2 = -12n - 4$		Level 2 4/24 16.7% Level 1 824 33.3% Level 0 0/24 0.0% **Clanton Campus** Level 4 5/15 33.3% Level 3 4/15 26.7% Level 2 5/15 33.3% Level 1 0/15 0.0% Level 0 1/15 6.7% **Pell City Campus** Level 4 4/4 100.0% Level 3 0/4 0.0% Level 2 0/4 0.0% Level 1 0/4 0.0% Level 0 0/4 0.0% **Online Campus** Level 4 455/597 76.2% Level 3 14/597 2.3% Level 2 76/597 12.7% Level 1 12/597 2.0% Level 0 40/597 6.7%	because of a process called "chunking". Chunking allows learners to group words and phrases together to a tune. Students will be given an assignment to listen to the "quadratic formula song" as applied to different tunes in hopes that this will aid in the memorization of the formula and increase success rates for this objective. Quadratic Formula Song 1
SLO 5: Apply rules of exponents to quantities involving integer exponents.	Rubric based assessment of related common final exam problems. Example common final exam problem: Simplify. $\frac{5(x^5y)^2}{-15(x^3y)^4}$	70% of students learning at a rubric level of 2 or higher	**Data collected during SPR21 and SU21.** **Shelby Campus** Level 4 14/24 58.3% Level 3 5/24 20.8% Level 2 3/24 12.5% Level 1 2/24 8.3% Level 0 0/24 0.0% **Clanton Campus** Level 4 5/15 33.3% Level 3 3/15 20.0% Level 2 7/15 46.7% Level 1 4/78 0.0% Level 0 0/78 0.0%	**Observations/Changes:** MTH 100 Instructors will reinforce student learning of this objective by assigning a manipulative-based assignment. This project is aimed at getting the students actively involved in the learning process while further solidifying the concept of applying the rules of exponents.

			Pell City Campus Level 4 4/4 100.0% Level 3 0/4 0.0% Level 2 0/4 0.0% Level 1 0/4 0.0% Level 0 0/4 0.0% **Online Campus** Level 4 533/597 89.3% Level 3 9/597 1.5% Level 2 17/597 2.8% Level 1 1/597 0.2% Level 0 37/597 6.2%	
Plan submission date:			**Submitted by:**	

MTH 100 Rubric

Mathematics Course Level Outcomes Assessment Rubric

Level 4: Student provides a complete and correct solution process that is well organized, with no errors.

Level 3: Student provides a complete solution process that is well organized, but contains minor errors.

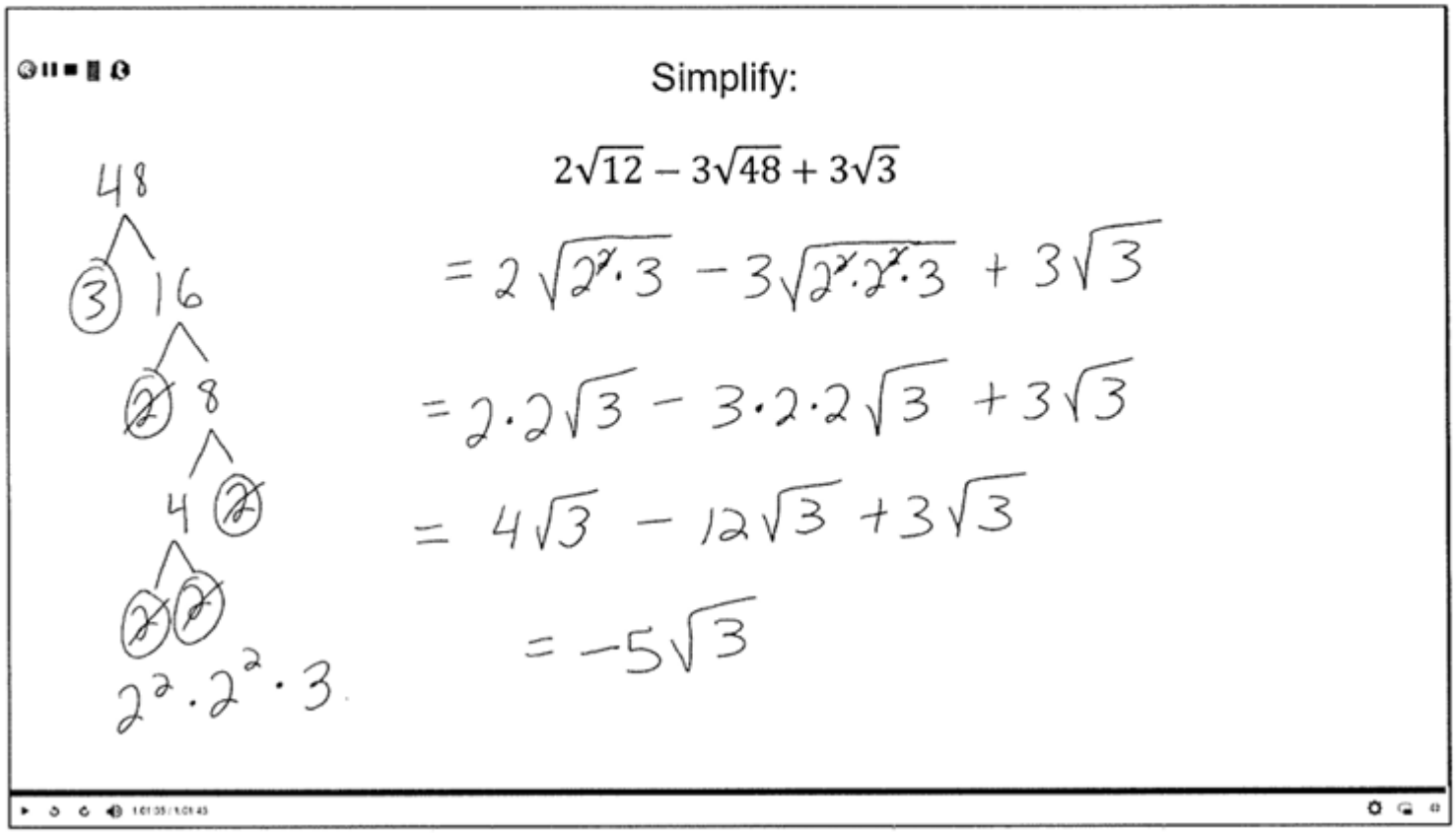
Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.

Level 1: Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.

Level 0: Student does not attempt a solution.

Evidence in support of SLO 1

Addendum "B"



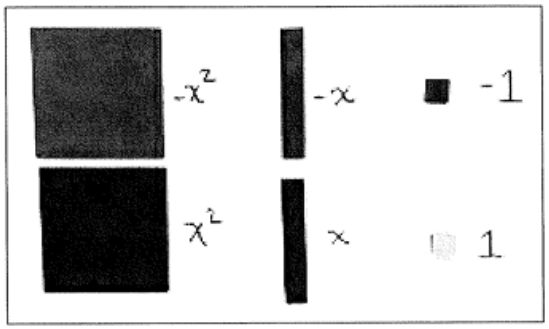
Evidence in support of SLO 2

Addendum "C"

Directions: Please complete the following assignments for partial credit.

Assignment #3: Algebra Tiles
Factor the polynomials by coloring algebra tiles.

$+x^2$: color four blue squares
$-x^2$: color four red squares
$+x$: color two green squares
$-x$: color two red squares
$+1$: color one yellow square
-1: color one red square



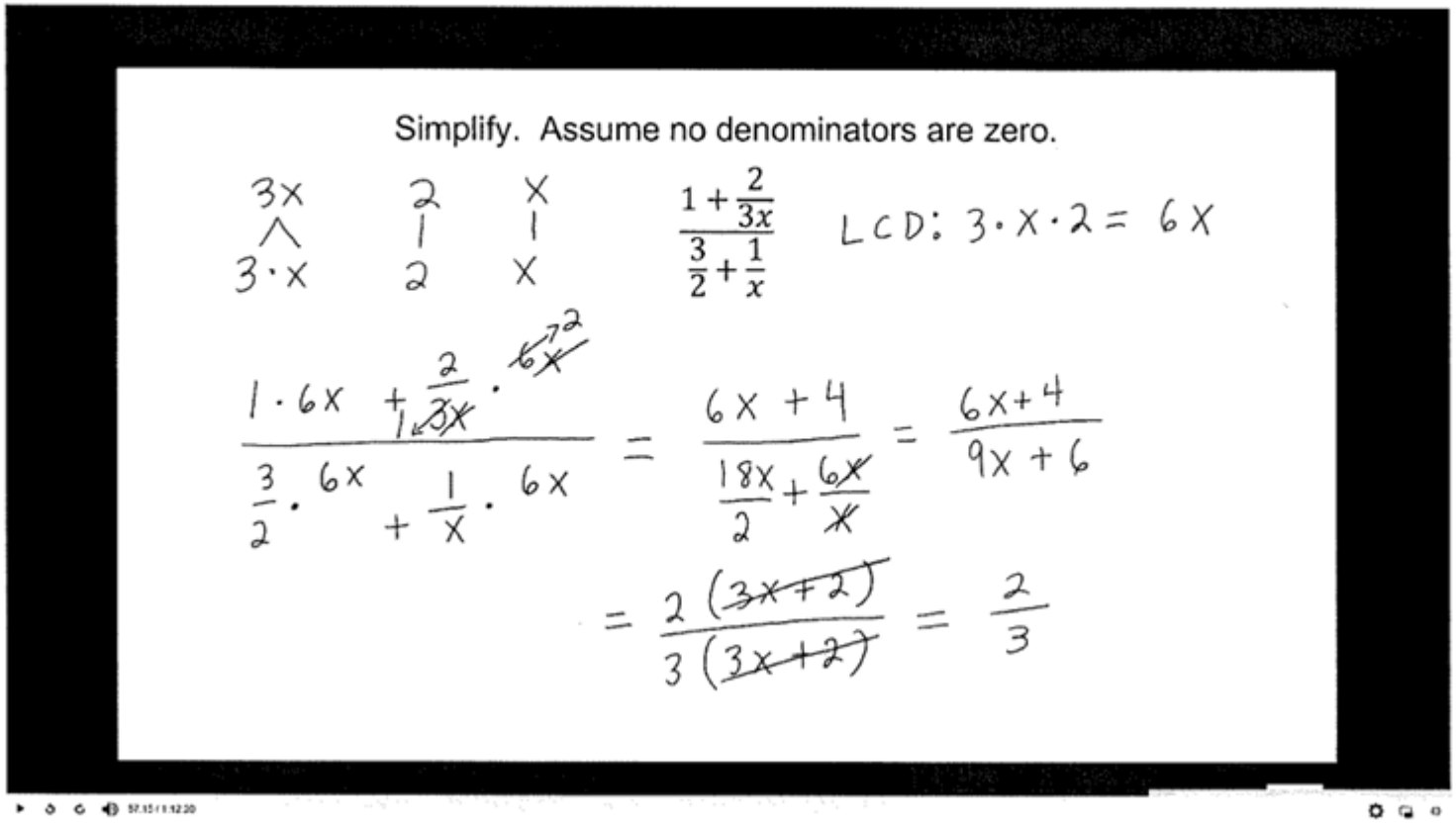
1) Factor. $8x + 4$

x	

Answer: _____

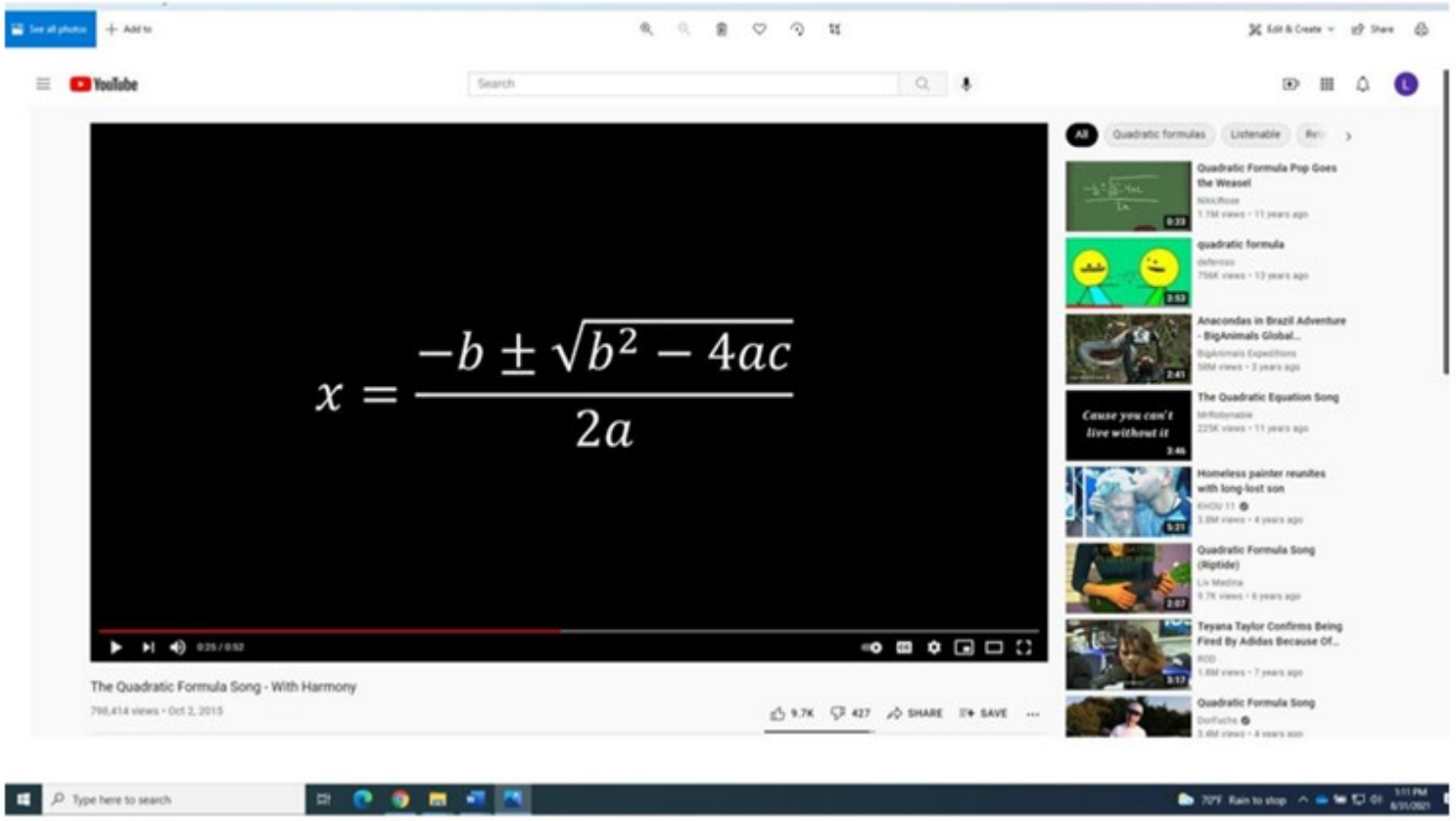
Check your answer using the Block Method.

Addendum "D"


Simplify. Assume no denominators are zero.
3x = 3 · x
2 = 1 · 2
x = 1 · x
LCD: 3 · x · 2 = 6x

Evidence in support of SLO 4

[The Quadratic Formula Song - With Harmony - YouTube]



Addendum "E"

Directions: Please complete the following assignments for partial credit.

Assignment #2: Properties of Exponents

Open your textbook to the following pages and complete the problems using the attached manipulatives. Cut and tape the necessary manipulatives on this worksheet. Cancel out with bingo marker. Handwrite the initial problem and final answer.

Section 4.1, page 238, #99

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2020 – Summer 2021

Program or Department Mission:
The Department of Mathematics/Engineering/Physical Sciences offers a broad range of courses that service the career programs of the college and that will transfer to baccalaureate degree granting institutions. The department also offers developmental mathematics courses to prepare students for college level mathematics.

Instructional Program Outcomes & Assessment Plan – MTH 110

Department Outcomes

- Provide freshman and sophomore-level courses in Chemistry, Mathematics, Physics, Physical Sciences, and Astronomy, with emphasis on critical thinking and analytical ability, that are transferable to public institutions of higher learning.
- Offer an appropriate remedial mathematics program accommodating various skill levels.
- Develop and provide courses relevant to the career and professional degree programs of the college.

Mathematics Course Level Outcomes Assessment Rubric

Level 4: Student provides a complete and correct solution process that is well organized, with no errors.

Level 3: Student provides a complete solution process that is well organized but contains minor errors.

Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.
Level 1: Student attempts a solution but demonstrates little understanding of methods required to produce a correct solution with expected organization.

Level 0: Student does not attempt a solution.

Evaluated Course Objectives

The student will demonstrate understanding of concepts, develop competent skills, and demonstrate applications by his/her ability to

1. Perform basic algebraic operations on matrices
2. Use Venn diagram to solve a problem
3. Use Bayes' Theorem to solve a problem
4. Compute the mean, variance, and standard deviation of a random variable

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
MTH 110 Objective 1 Perform basic algebraic operations on matrices	Rubric based assessment of related common final exam problems Problem: Perform basic algebraic operations on matrices. Perform the indicated operations. [1 4 –1]+[5 0 –1]-[4 6 6]	70% of students learning at a rubric level of 2 or higher	**88.9% of the students assessed performed at Level 2 or higher. (97/109)** Jefferson Campus Level 4 39/53 74% Level 3 3/53 5% Level 2 0/53 0% Level 1 0/53 0% Level 0 11/53 21% Online	**Observations/Changes:** MTH 110 instructors will reinforce student learning by including helpful video tutorials. Example: https://www.youtube.com/watch?v=HKnTgMlWs30

			Level 4 50/56 89% Level 3 0/56 0% Level 2 5/56 9% Level 1 0/56 0% Level 0 1/56 2%	
MTH 110 Objective 2 Use Venn diagram to solve a problem	Rubric based assessment of related common final exam problems Problem: Use Venn diagram to solve a problem. **Problem:** To help plan the number of meals to be prepared in a college cafeteria, a survey was conducted, and the following data were obtained: 131 students ate breakfast 180 students ate lunch 275 students ate dinner 68 students ate breakfast and lunch 111 students ate breakfast and dinner 90 students ate lunch and dinner 57 students ate all three meals How many of the students ate only dinner in the cafeteria?	70% of students learning at a rubric level of 2 or higher	**81.6% of the students assessed performed at Level 2 or higher. (89/109)** Jefferson Campus Level 4 23/53 43% Level 3 18/53 34% Level 2 0/53 0% Level 1 0/53 0% Level 0 12/53 23% Online Level 4 36/56 65% Level 3 0/56 0% Level 2 12/56 21%	**Observations/Changes:** MTH 110 instructors will attempt to reinforce student learning by including specific video tutorials. Example: https://www.youtube.com/watch?v=MassxXy8iko

			Level 1 0/56 0% Level 0 8/56 14%	
MTH 110 Objective 3 Use Bayes' Theorem to solve a problem	Rubric based assessment of related common final exam problems Problem: Use Bayes' Theorem to solve a problem. **Problem:** Urn A contains six white and eight black balls. Urn B contains four white and three blackballs. A ball is drawn from urn A and then transferred to urn B. A ball is then drawn from urn B. What is the probability that the transferred ball was black given that the second ball drawn was white?	70% of students learning at a rubric level of 2 or higher	**61.4% of the students assessed performed at Level 2 or higher. (67/109)** Jefferson Campus Level 4 25/53 47% Level 3 5/53 9% Level 2 3/53 6% Level 1 3/53 6% Level 0 17/53 32% Online Level 4 15/56 27% Level 3 0/56 0%	**Observations/Changes:** Instructors will utilize videos and other recordings to help students. Example: https://www.youtube.com/watch?v=XQoLVl31ZfQ

<table>
<tr>
<td></td>
<td></td>
<td></td>
<td>Level 2 19/56
34%
Level 1 0/56
0%
Level 0 22/56
39%</td>
<td></td>
</tr>
<tr>
<td><u>MTH 110
Objective 4</u>

Compute the mean, variance, and standard deviation of a random variable</td>
<td>Rubric based assessment of related common final exam problems

Problem: Compute the mean, variance, and standard deviation of a random variable.

Problem: The probability distribution of a random variable X is
<table>
<tr><td>x</td><td>250</td><td>360</td><td>510</td><td>545</td><td>570</td></tr>
<tr><td>$P(X=x)$</td><td>0.1</td><td>0.2</td><td>0.4</td><td>0.2</td><td>0.1</td></tr>
</table>
Compute the mean, variance, and standard deviation of X.</td>
<td>70% of students learning at a rubric level of 2 or higher</td>
<td>77.9% of the students assessed performed at Level 2 or higher. (85/109)

Jefferson Campus
Level 4 15/53
28%
Level 3 20/53
38%
Level 2 0/53
0%
Level 1 0/53
0%
Level 0 18/53
34%

Online
Level 4 30/56
53%
Level 3 0/56
0%
Level 2 20/56
36%
Level 1 0/56
0%
Level 0 6/56
11%</td>
<td>Observations/Changes:
MTH 113 instructors will reinforce student learning by including helpful video tutorials. Example: https://www.youtube.com/watch?v=2egl_5c8i-g</td>
</tr>
</table>

Plan submission date: September 10, 2021			**Submitted by: Sam White**	

Mathematics 110 Rubric:

Mathematics Course Level Outcomes Assessment Rubric

Level 4: Student provides a complete and correct solution process that is well organized, with no errors.

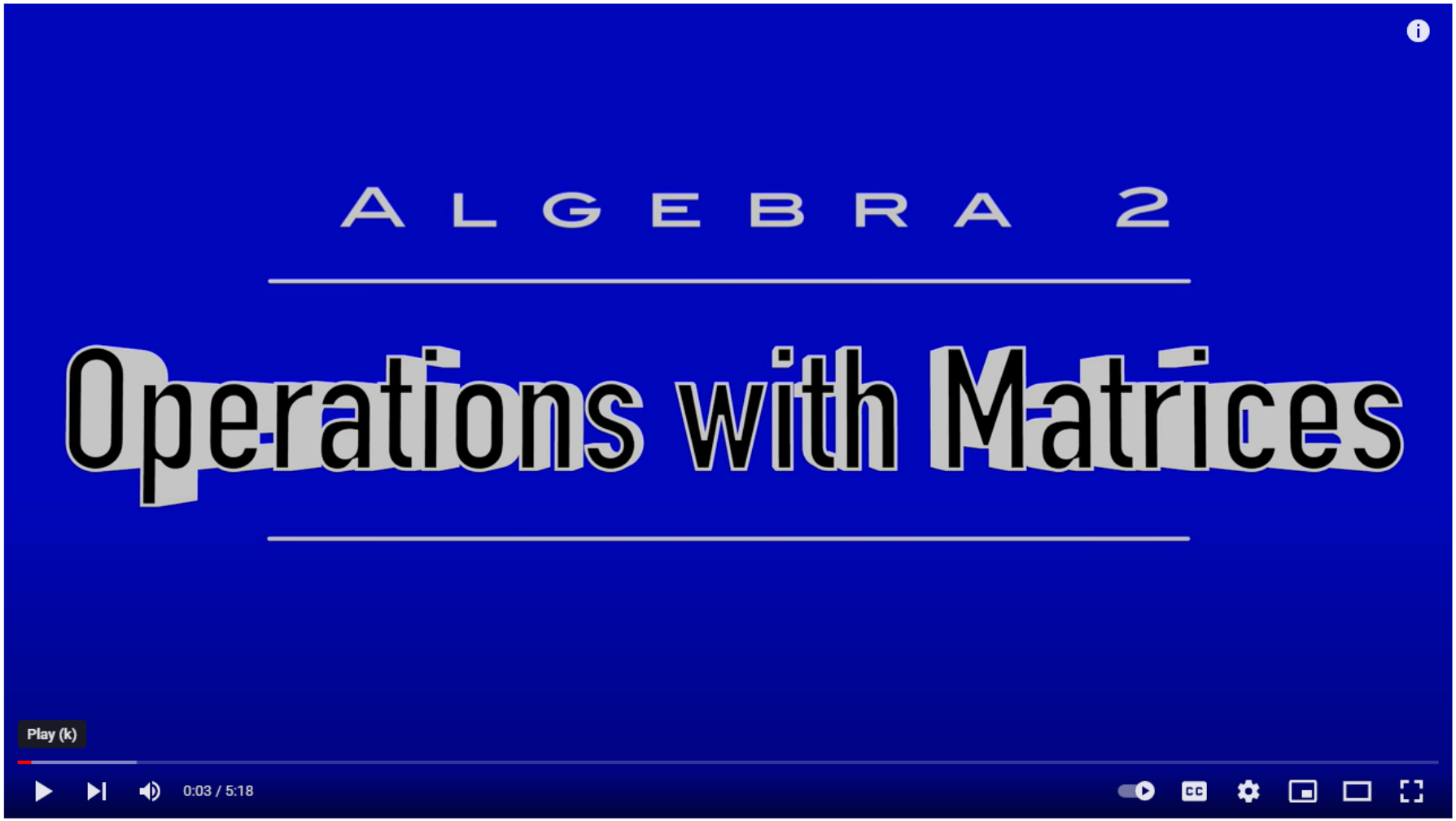
Level 3: Student provides a complete solution process that is well organized but contains minor errors.

Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.

Level 1: Student attempts a solution but demonstrates little understanding of methods required to produce a correct solution with expected organization.

Level 0: Student does not attempt a solution.

Evidence to support SLO 1



Algebra 2 - Operations with Matrices

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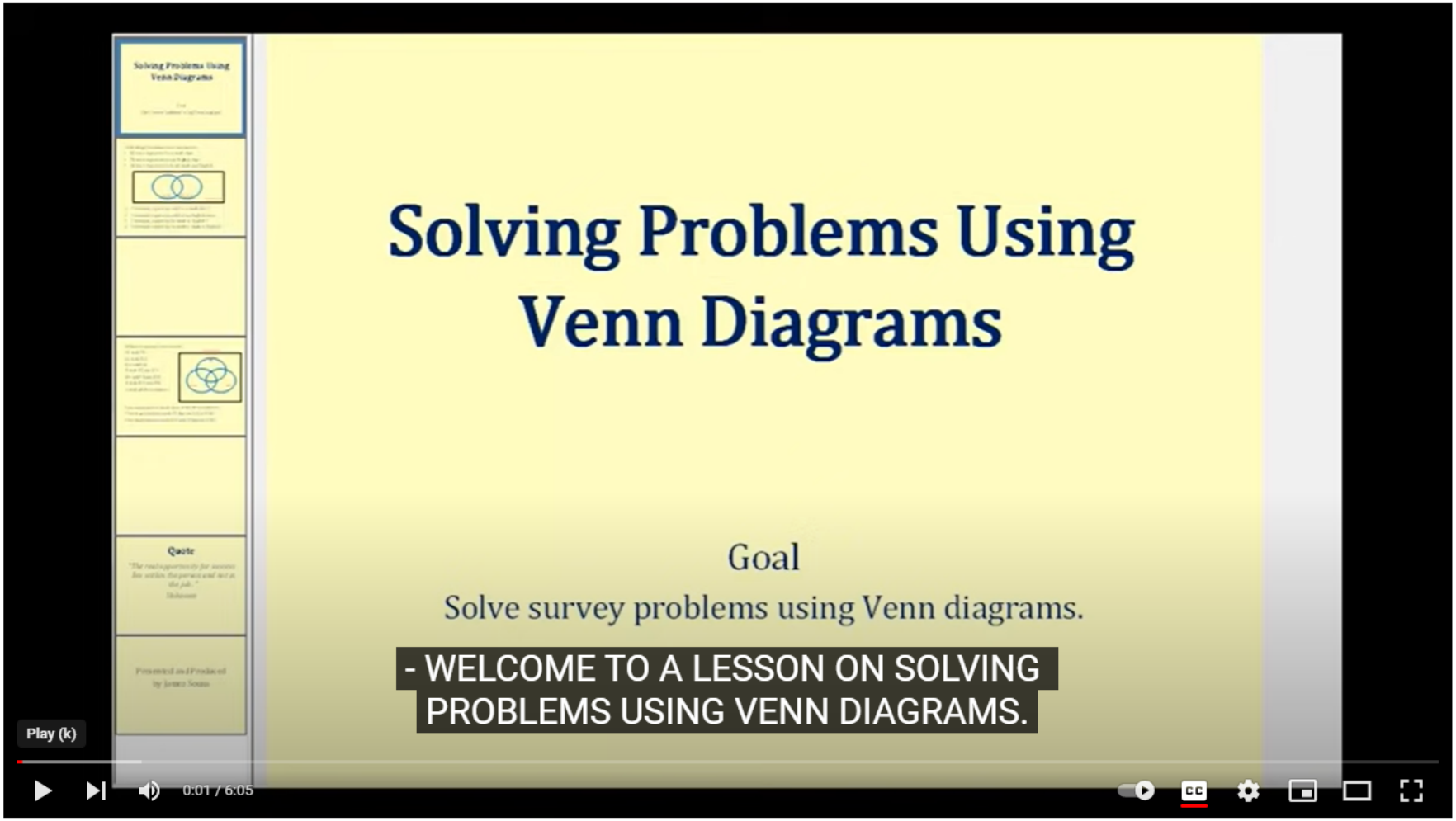
Evidence to support SLO 2



Solving Problems with Venn Diagrams

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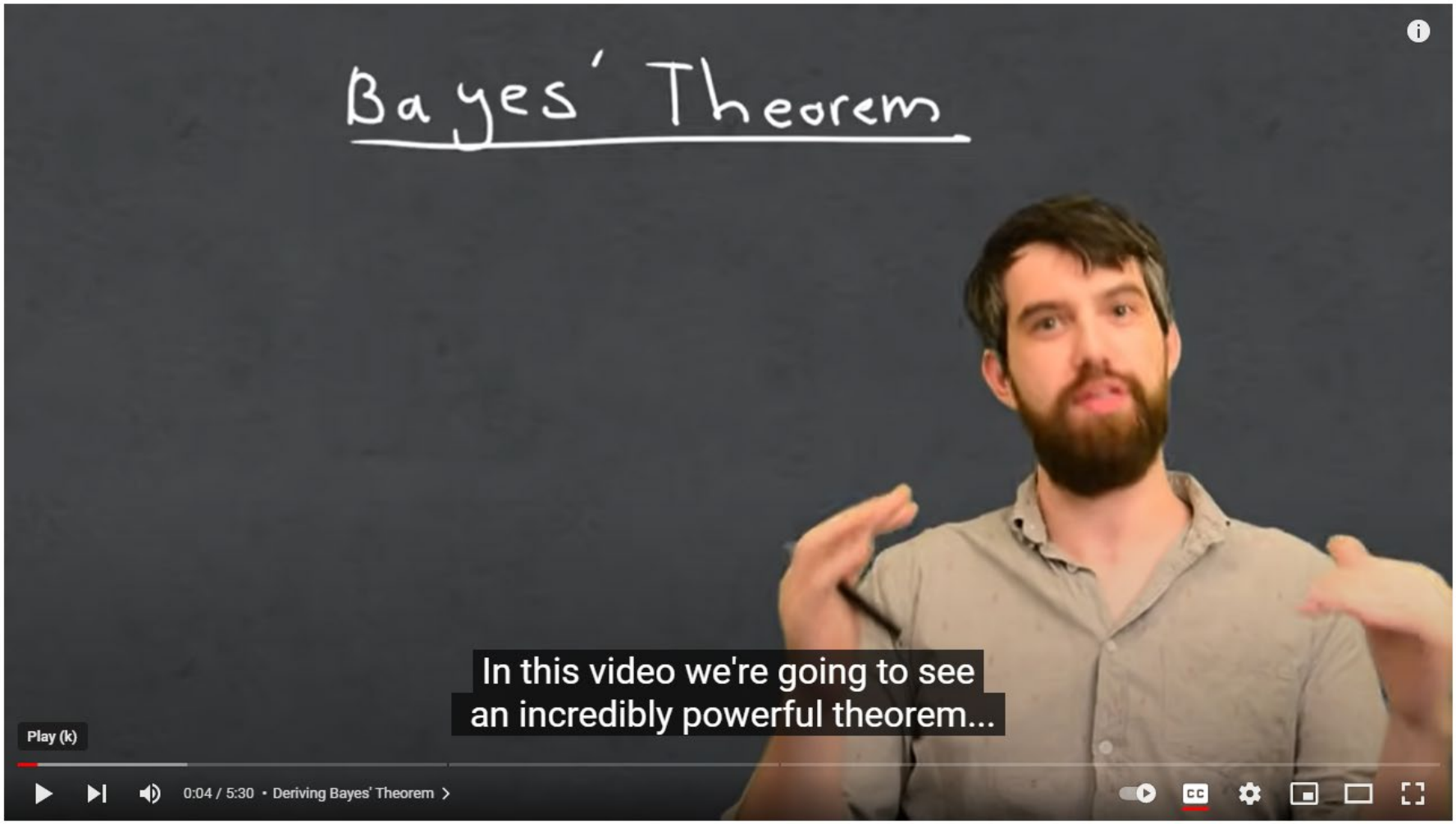
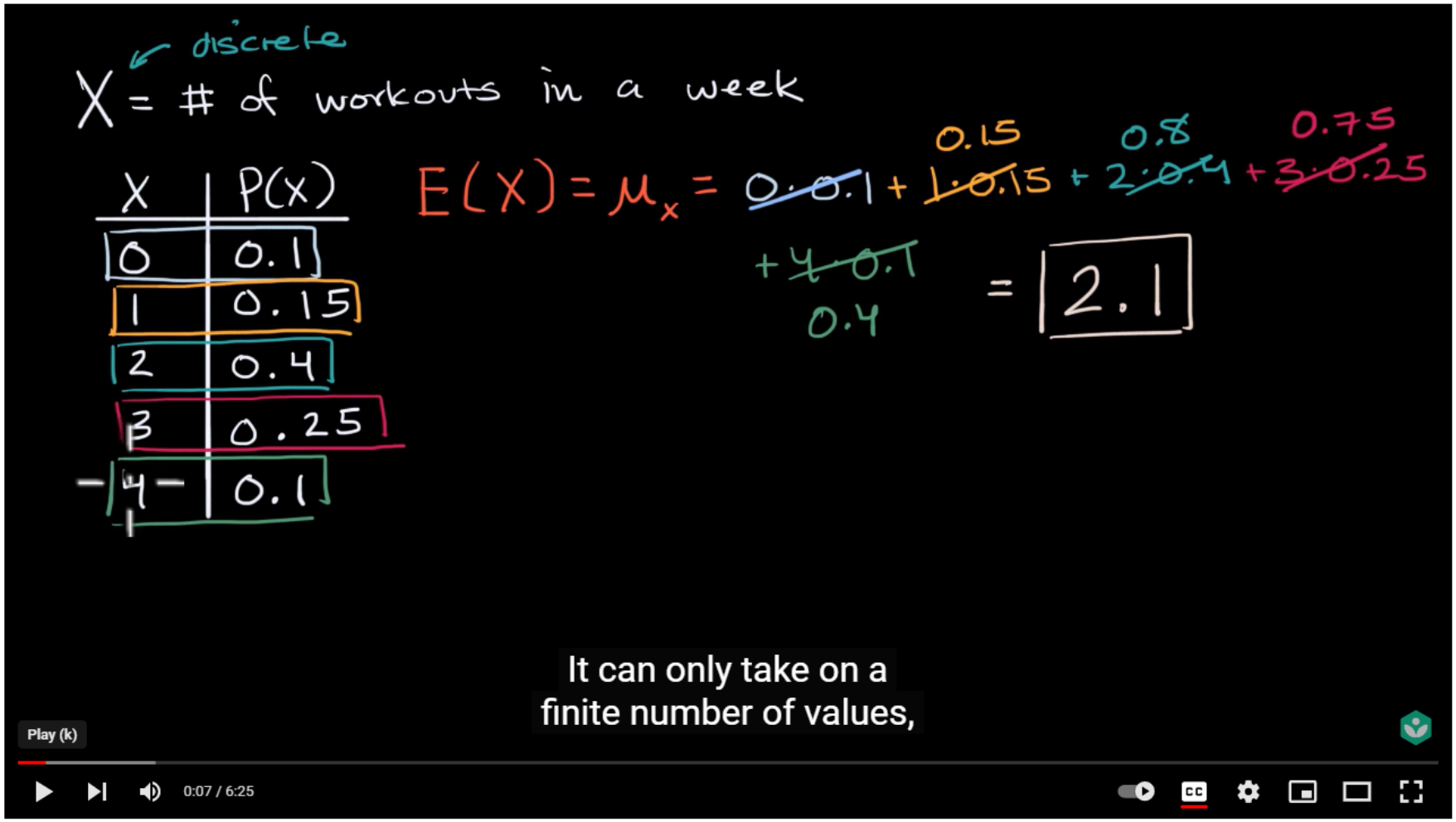
Evidence to support SLO 3



Evidence to support SLO 4



Variance and standard deviation of a discrete random variable | AP Statistics | Khan Academy

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Assessment Record

Program: Math-MTH 112 **Assessment period:** 2020-21

Program or Department Mission:
The Department of Mathematics/Engineering/Physical Sciences offers a broad range of courses that service the careerprograms of the college and that will transfer to baccalaureate degree granting institutions. The department also offers developmental mathematics courses to prepare students for college level mathematics.

Course Student Learning Outcomes & Assessment Plan

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
SLO 1: Find the inverse of a given function.	Rubric based assessment of related common final exam problems. See Addendum A	70% of students learning at a rubric level of 2 or higher	**Data collected during SPR21 and SU21 semesters.** **97% of students achieved a rubric level of 2 or higher (486/501).** **Shelby Campus** Level 4 1/5 20% Level 3 0/0 0% Level 2 1/5 20% Level 1 2/5 40% Level 0 1/5 20% **Clanton Campus**	**Observations/Changes:** The department will add instructional videos for this objective to re-enforce the concept and help more students achieve level 4 success when finding the inverse of a function.

			Level 4 2/6 33.3% Level 3 0/0 0% Level 2 2/6 33.3% Level 1 2/6 33.3% Level 0 0/6 0% **Online** Level 4 293/490 59.8% Level 3 26/490 5.3% Level 2 161/490 32.9% Level 1 8/490 1.6% Level 0 2/490 0.4%	
SLO 2: Use properties of exponents/logarithms to solve given problems.	Rubric based assessment of related common final exam problems. See Addendum A	70% of students learning at a rubric level of 2 or higher	**Data collected during SPR21 and SU21 semesters.** **96.8% schoolwide performed at level 2 or higher. (485/501)** **Shelby Campus** Level 4 1/5 20% Level 3 0/5 0% Level 2 0/5 0% Level 1 4/5 80% Level 0 0/5 0% **Clanton Campus** Level 4 1/6 16.7% Level 3 0/6 0% Level 2 0/6 0% Level 1 5/6 83.3% Level 0 0/6 0% **Online** Level 4 424/490 86.5% Level 3 38/490 7.8% Level 2 16/490 3.3% Level 1 6/490 1.2% Level 0 6/490 1.2%	**Observations/Changes:** While level 4 success is high for this objective, there is still room for improvement in the percentage of students performing at level 4. The department's goal for 2021-2022 is to increase this percentage. Therefore, MTH 112 instructors will add instructional video(s) on this objective to re-enforce the concept and help more students achieve level 4 success when solving a logarithmic equation. These videos will be delivered during the semester and again before the final exam.

SLO 3: Find the zeros of a polynomial function	Rubric based assessment of related common final exam problems. See Addendum A	70% of students learning at a rubric level of 2 or higher	**Data collected during SPR21 and SU21 semesters.** **98.2% schoolwide performed at level 2 or higher. (492/501)** Shelby Campus Level 4 3/5 60% Level 3 1/5 20% Level 2 1/5 20% Level 1 0/5 0% Level 0 0/5 0% Clanton Campus Level 4 1/6 16.7% Level 3 0/6 0% Level 2 5/6 83.3% Level 1 0/6 0% Level 0 0/6 0% Online Level 4 397/490 81.0% Level 3 39/490 8.0% Level 2 45/490 9.2% Level 1 4/490 0.8% Level 0 5/490 1.0%	**Observations/Changes:** To increase the percentage of students scoring at level 4, the department will add instructional video(s) for this objective to re-enforce the concept and help more students achieve level 4 success when finding the zeros of a polynomial function.
SLO 4: Graph transformations of basic functions.	Rubric based assessment of related common final exam problems. See Addendum A	70% of students learning at a rubric level of 2 or higher	**Data collected during SPR21 and SU21 semesters.** **95.4% schoolwide performed at level 2 or higher. (478/501)** **Shelby Campus** Level 4 3/5 60% Level 3 2/5 40% Level 2 0/5 0%	**Observations/Changes:** The department will add instructional video(s) targeted specifically for this objective to re-enforce the concept and help more students achieve level 4 success when graphing transformations of functions.

			Level 1 0/5 0% Level 0 0/5 0% **Clanton Campus** Level 4 2/6 33.3% Level 3 0/6 0% Level 2 4/6 66.7% Level 1 0/6 0% Level 0 0/6 0% **Online** Level 4 269/490 54.9% Level 3 52/490 10.6% Level 2 146/490 29.8% Level 1 17/490 3.5% Level 0 6/490 1.2%	
Plan submission date:			**Submitted by:**	

Return to SLO 1

Return to SLO 2

Return to SLO 3

Return to SLO 4

Mathematics 100 Course Level Outcomes Assessment Rubric

Level 4: Student provides a complete and correct solution process that is well organized, with no errors.

Level 3: Student provides a complete solution process that is well organized but contains minor errors.

Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.

Level 1: Student attempts a solution but demonstrates little understanding of methods required to produce a correct solution with expected organization.

Level 0: Student does not attempt a solution.

Return to SLO 1

Return to SLO 2

Return to SLO 3

Return to SLO 4

Addendum A

Common Final Exam Assessment Problems

Assessment of Objective 1 - Find the inverse of a given function.

Problem: Find f^{-1}, the inverse of f.

$$f(x)= x^3 + 9$$

Assessment of Objective 2 - Use properties of exponents/logarithms to solve given problems.

Problem: Solve for x:

$$\log(3x + 5) + 4 = 6$$

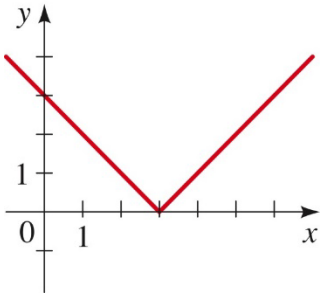
Assessment of Objective 3 - Find the zeros of a polynomial function

Problem: Find all the zeros of P.

$$P(x) = x^3 + 3x^2 - 4$$

Assessment of Objective 4 - Graph through transformation of basic functions

Problem: Given the graph of function f. Sketch the graph of $g(x) = -f(x - 2) + 1$.



[Return to SLO 1](#)

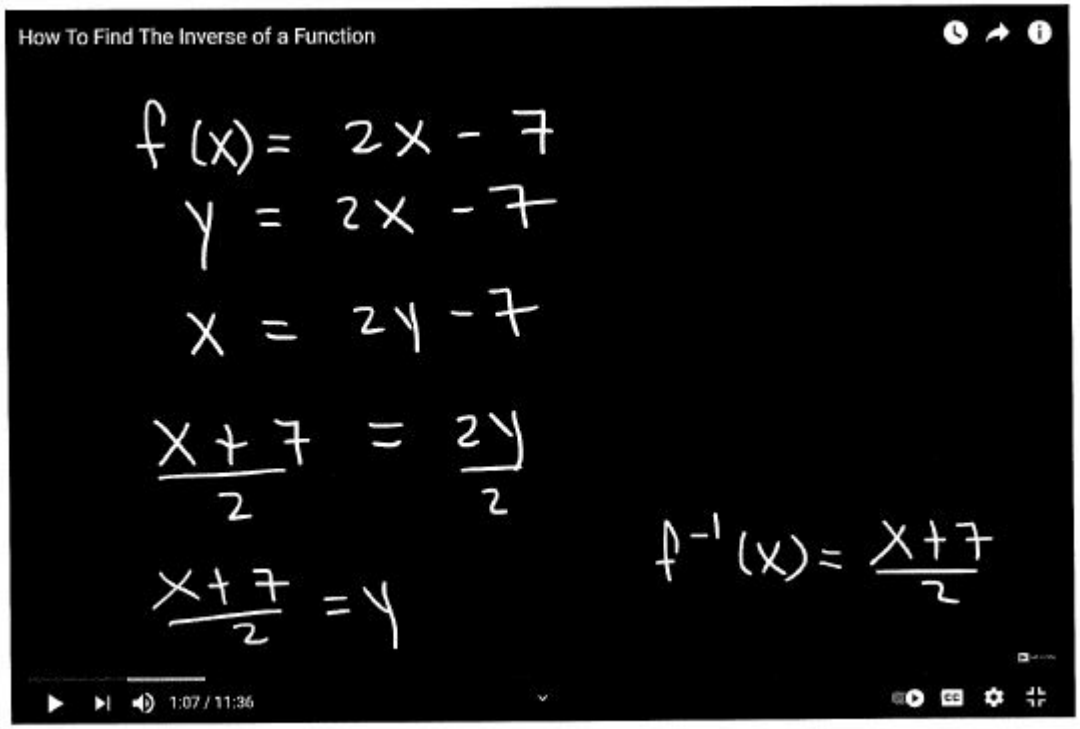
[Return to SLO 2](#)

[Return to SLO 3](#)

[Return to SLO 4](#)

Evidence SLO 1

Addendum B



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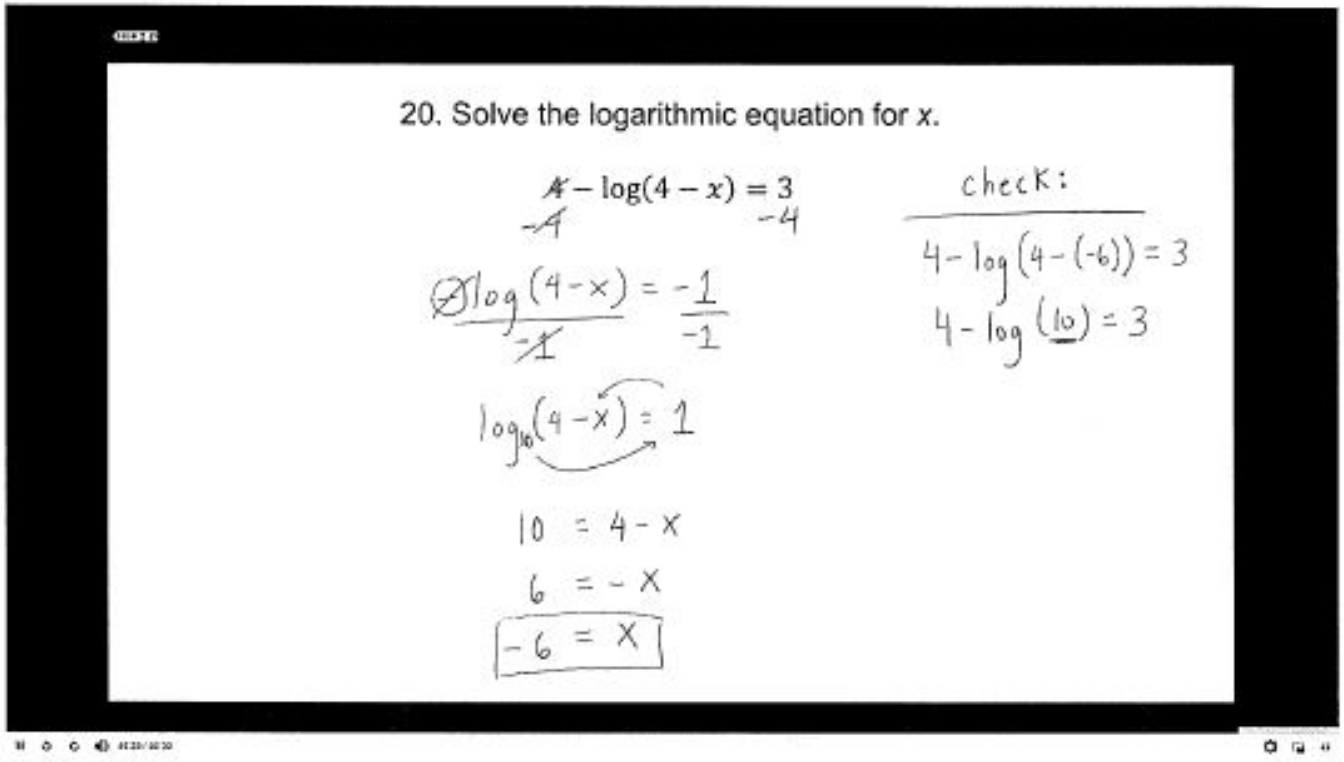
[Return to SLO 2]

[Return to SLO 3]

[Return to SLO 4]

Evidence SLO 2

Addendum C



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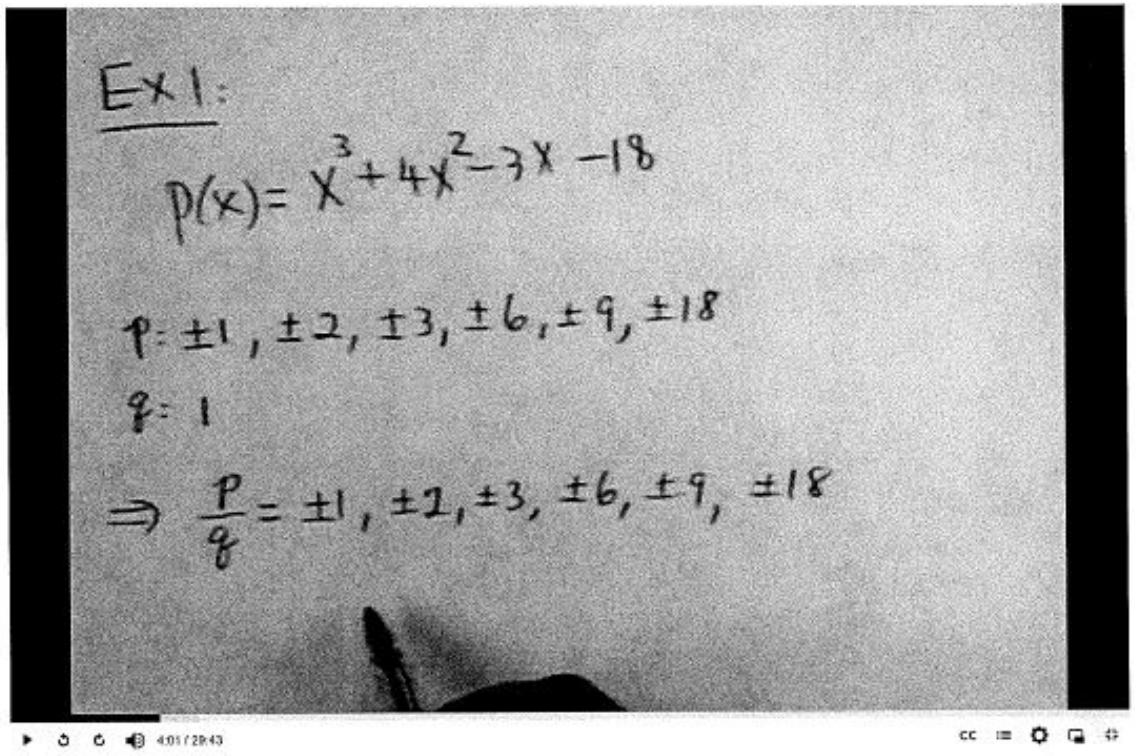
[Return to SLO 2]

[Return to SLO 3]

[Return to SLO 4]

Evidence SLO 3

Addendum D



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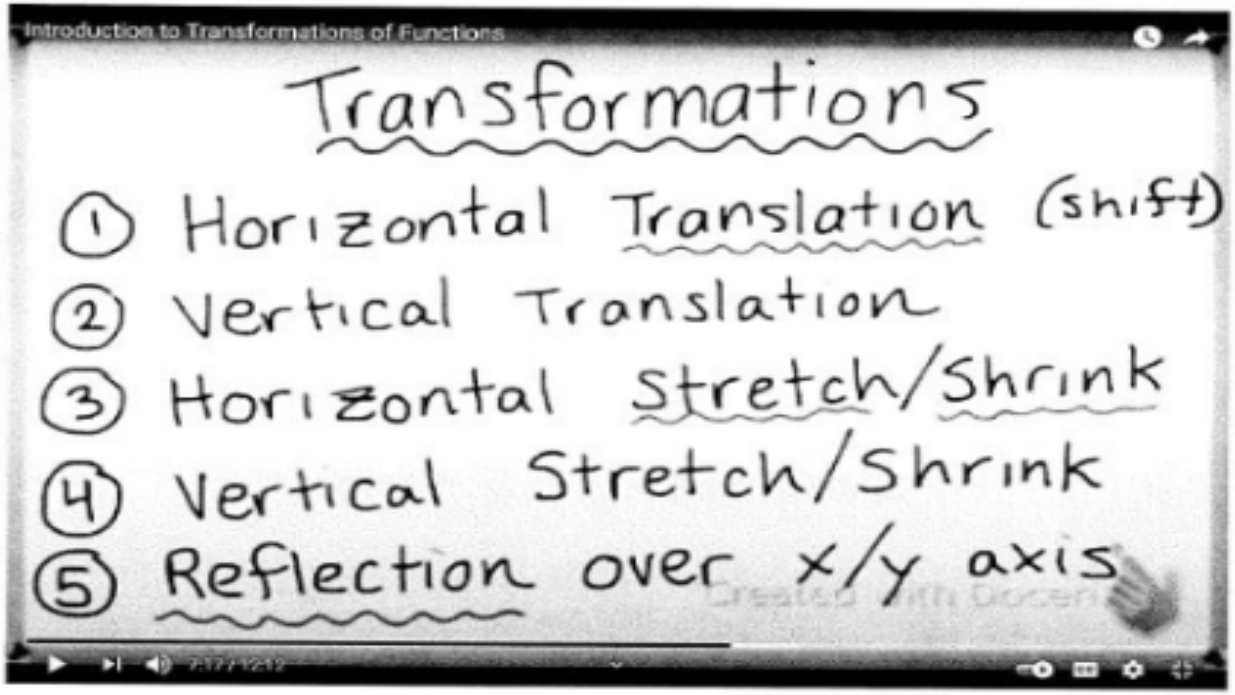
[Return to SLO 3]

[Return to SLO 4]

Evidence SLO 4

Addendum E



Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2020-Summer 2021

Program or Department Mission:
The Department of Mathematics/Engineering/Physical Sciences offers a broad range of courses that service the career programs of the college and that will transfer to baccalaureate degree granting institutions. The department also offers developmental mathematics courses to prepare students for college level mathematics.

Instructional Program Outcomes & Assessment Plan – MTH 113

Mathematics Course Level Outcomes Assessment Rubric

Level 4: Student provides a complete and correct solution process that is well organized, with no errors.

Level 3: Student provides a complete solution process that is well organized, but contains minor errors.

Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.

Level 1: Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.

Level 0: Student does not attempt a solution.

Evaluated Course Objectives

The student will demonstrate understanding of concepts, develop competent skills, and demonstrate applications by his/her ability to

1. Graph a given trigonometric function
2. Find the values for trigonometric functions using a right triangle.
3. Perform algebraic operations on vectors.
4. Convert and use the trigonometric form of a complex number.
5. Convert an equation from polar form to rectangular form.

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence **Data collected during SPR21 and SUM21. Online assessments are scored at 4, 2, or 0.**	Use of Results
MTH 113 Objective 1 Graph a given trigonometric function	Rubric based assessment of related common test problems **Problem:** Graph the function $y = 2\cos\left(\frac{2}{3}x - \frac{\pi}{2}\right)$	70% of students learning at a rubric level of 2 or higher	**91.1% of the students assessed performed at Level 2 or higher (152/165)** Jefferson Level 4: 0.0% Level 3: 0.0% Level 2: 0.0% Level 1: 0.0% Level 0: 0.0% Shelby Level 4: 0.0% Level 3: 0.0% Level 2: 0.0% Level 1: 0.0% Level 0: 0.0% Clanton Level 4: 2/6 33.3% Level 3: 0/6 0.0% Level 2: 4/6 66.7% Level 1: 0/6 0.0% Level 0: 0/6 0.0%	**Observations/Changes:** MTH 113 instructors will assign a worksheet that emphasizes graphing a given trigonometric function. Examples: Graph Trigonometric Functions (1), cosine function with solution Graph Trigonometric Functions (3), cosine function with solution Due to COVID, there was only one on-campus class (Clanton). This is reflected in no data collection at Jefferson, Shelby, and Pell City campuses. All other classes were online or dual enrollment.

			Pell City Level 4: 0.0% Level 3: 0.0% Level 2: 0.0% Level 1: 0.0% Level 0: 0.0% Online Level 4: 96/130 73.8% Level 3: 0/130 0.0% Level 2: 28/130 21.5% Level 1: 1/130 0.8% Level 0: 5/130 3.8% Dual Enrollment Level 4: 8/29 27.6% Level 3: 6/29 20.7% Level 2: 8/29 27.6% Level 1: 7/29 24.1% Level 0: 0/29 0.0%	
<u>MTH 113 Objective 2</u> Find the values for trigonometric functions using a right triangle.	Rubric based assessment of related common test problems **Problem:** Let θ be an angle in quadrant IV such that $\tan\theta = -\frac{2}{7}$. Find the exact values of cos θ and csc θ	70% of students learning at a rubric level of 2 or higher	**98.8% of the students assessed performed at Level 2 or higher (163/165)** Jefferson Level 4: 0.0% Level 3: 0.0% Level 2: 0.0% Level 1: 0.0% Level 0: 0.0% Shelby Level 4: 0.0% Level 3: 0.0% Level 2: 0.0% Level 1: 0.0% Level 0: 0.0%	**Observations/Changes:** MTH 113 instructors will reinforce student learning by completing a project that emphasizes finding the values for trigonometric functions using a right triangle. Example: Addendum A Due to COVID, there was only one on-campus class (Clanton). This is reflected in no data collection at Jefferson, Shelby, and Pell City campuses. All other classes were online or dual enrollment.

			Clanton Level 4: 5/6 83.3% Level 3: 0/6 0.0% Level 2: 1/6 16.7% Level 1: 0/6 0.0% Level 0: 0/6 0.0% Pell City Level 4: 0.0% Level 3: 0.0% Level 2: 0.0% Level 1: 0.0% Level 0: 0.0% Online Level 4: 107/130 82.3% Level 3: 1/130 0.8% Level 2: 21/130 16.2% Level 1: 0/130 0.0% Level 0: 1/130 0.8% Dual Enrollment Level 4: 17/29 58.6% Level 3: 4/29 13.8% Level 2: 7/29 24.1% Level 1: 1/29 3.4% Level 0: 0/29 0.0%	
<u>MTH 113 Objective 3</u> Perform algebraic operations on vectors.	Rubric based assessment of related common test problems **Problem:** Let θ be an angle in quadrant IV such that $\tan\theta = -\frac{2}{7}$.	70% of students learning at a rubric level of 2 or higher	**98.2% of the students assessed performed at Level 2 or higher (162/165)** Jefferson Level 4: 0.0% Level 3: 0.0% Level 2: 0.0% Level 1: 0.0% Level 0: 0.0% Shelby Level 4: 0.0%	**Observations/Changes:** MTH 113 instructors will reinforce student learning by watching a video that emphasizes performing algebraic operations on vectors. Example: https://youtu.be/gCWiw5ZqjnA Due to COVID, there was only one on-campus class (Clanton). This is reflected in no data collection at Jefferson, Shelby,

			Level 3: 0.0% Level 2: 0.0% Level 1: 0.0% Level 0: 0.0% Clanton Level 4: 5/6 83.3% Level 3: 0/6 0.0% Level 2: 1/6 16.7% Level 1: 0/6 0.0% Level 0: 0/6 0.0% Pell City Level 4: 0.0% Level 3: 0.0% Level 2: 0.0% Level 1: 0.0% Level 0: 0.0% Online Level 4: 107/130 82.3% Level 3: 0/130 0.0% Level 2: 23/130 17.7% Level 1: 0/130 0.0% Level 0: 0/130 0.0% Dual Enrollment Level 4: 21/29 72.4% Level 3: 3/29 10.3% Level 2: 2/29 6.9% Level 1: 3/29 10.3% Level 0: 0/29 0.0%	and Pell City campuses. All other classes were online or dual enrollment.
<u>MTH 113 Objective 4</u> Convert and use the trigonometric form of a complex number.	Rubric based assessment of related common test problems **Problem:** Use DeMoivre's theorem to find $(1+i)^6$. Put	70% of students learning at a rubric level of 2 or higher	**95.8% of the students assessed performed at Level 2 or higher (158/165)** Jefferson Level 4: 0.0% Level 3: 0.0% Level 2: 0.0%	**Observations/Changes:** MTH 113 instructors will reinforce student learning by watching a video explanation that emphasizes converting and using the trigonometric form of a complex number. Example: https://youtu.be/ZxhTAiwv_Ck

	your answer in standard form.		Level 1: 0.0% Level 0: 0.0% Shelby Level 4: 0.0% Level 3: 0.0% Level 2: 0.0% Level 1: 0.0% Level 0: 0.0% Clanton Level 4: 3/6 50.0% Level 3: 0/6 0.0% Level 2: 2/6 33.3% Level 1: 0/6 0.0% Level 0: 1/6 16.7% Pell City Level 4: 0.0% Level 3: 0.0% Level 2: 0.0% Level 1: 0.0% Level 0: 0.0% Online Level 4: 89/130 68.5% Level 3: 1/130 0.8% Level 2: 35/130 26.9% Level 1: 0/130 0.0% Level 0: 5/130 3.8% Dual Enrollment Level 4: 13/29 44.8% Level 3: 4/29 13.8% Level 2: 11/29 37.9% Level 1: 1/29 3.4% Level 0: 0/29 0.0%	Due to COVID, there was only one on-campus class (Clanton). This is reflected in no data collection at Jefferson, Shelby, and Pell City campuses. All other classes were online or dual enrollment.

MTH 113 Objective 5 Convert an equation from polar form to rectangular form.	Rubric based assessment of related common test problems **Problem:** Convert the equation $r = 6\cos\theta$ to rectangular form.	70% of students learning at a rubric level of 2 or higher	**94.5% of the students assessed performed at Level 2 or higher (156/165)** Jefferson Level 4: 0.0% Level 3: 0.0% Level 2: 0.0% Level 1: 0.0% Level 0: 0.0% Shelby Level 4: 0.0% Level 3: 0.0% Level 2: 0.0% Level 1: 0.0% Level 0: 0.0% Clanton Level 4: 3/6 50.0% Level 3: 0/6 0.0% Level 2: 3/6 50.0% Level 1: 0/6 0.0% Level 0: 0/6 0.0% Pell City Level 4: 0.0% Level 3: 0.0% Level 2: 0.0% Level 1: 0.0% Level 0: 0.0% Online Level 4: 82/130 63.1% Level 3: 13/130 10.0% Level 2: 34/130 26.2% Level 1: 0/130 0.0% Level 0: 1/130 0.8% Dual Enrollment	**Observations/Changes:** MTH 113 instructors will reinforce student learning by giving a step-by-step worksheet that emphasizes converting an equation from polar form to rectangular form. Example: https://image2.slideserve.com/4766066/solutions-example-1-l.jpg Due to COVID, there was only one on-campus class (Clanton). This is reflected in no data collection at Jefferson, Shelby, and Pell City campuses. All other classes were online or dual enrollment.

			Level 4: 18/29 62.1% Level 3: 0/29 0.0% Level 2: 3/29 10.3% Level 1: 7/29 24.1% Level 0: 1/29 3.4%	
Plan submission date: September 9, 2020			**Submitted by: Louise Fall**	

MTH 113 – Rubric

Mathematics Course Level Outcomes Assessment Rubric

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Level 0: Student does not attempt a solution.

Evidence in support of SLO 1

From www.analyzemath.com

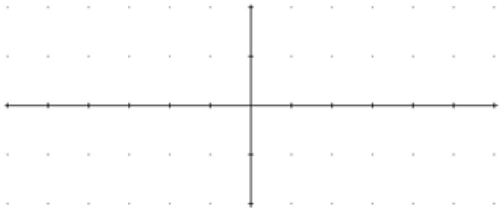
Trigonometry Worksheet: Graph Trigonometric Functions (3)

Graph the trigonometric function given by

$$y = -3\cos(2x - \frac{\pi}{4})$$

Draw freehand

Add comments



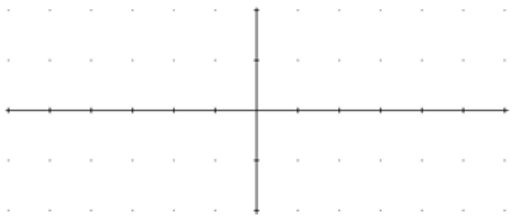
From www.analyzemath.com

From www.analyzemath.com

Trigonometry Worksheet: Graph Trigonometric Functions (1)

Graph the trigonometric function given by

$$y = 2\cos(2x)$$



From www.analyzemath.com

Example Addendum A

MTH 113 Project Guidelines

1. You may choose to work by yourself or in pairs.

2. Create or find a trig word problem similar to problems we have done in class involving right triangle trig, law of sines, law of cosines, etc. You can NOT use a problem in our textbook. You must submit the problem in written form (typed) and include the name or names of the individuals in the group.

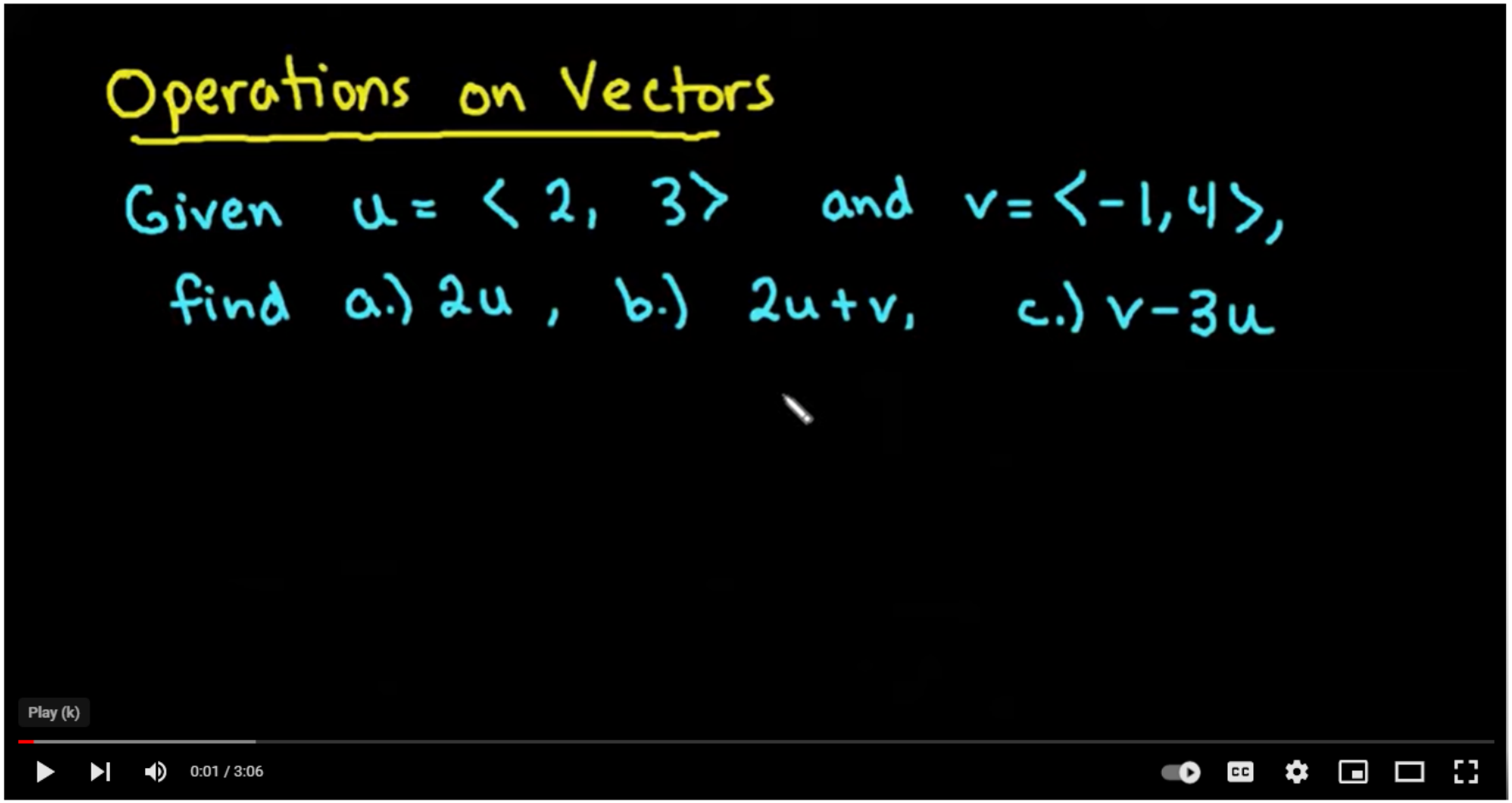
3. Use whatever type of materials you wish to depict the trig problem you have selected. You must turn in a written form of the solution to the problem (typed preferred).

4. Projects will be on display and will be judged by outside judges. Bonus points may be awarded for 1st, 2nd and 3rd place.

5. Project due date:_____

Please note that you this is not a grade based on effort. Just because you turn in a project does not mean you earn 50 points. I do follow the grading criteria described below. The more creative the problem, use of materials and the more difficult the problem, the higher the grade. I have had students earn failing grades on this assignment.

Evidence in support of SLO 3



Operations on Vectors

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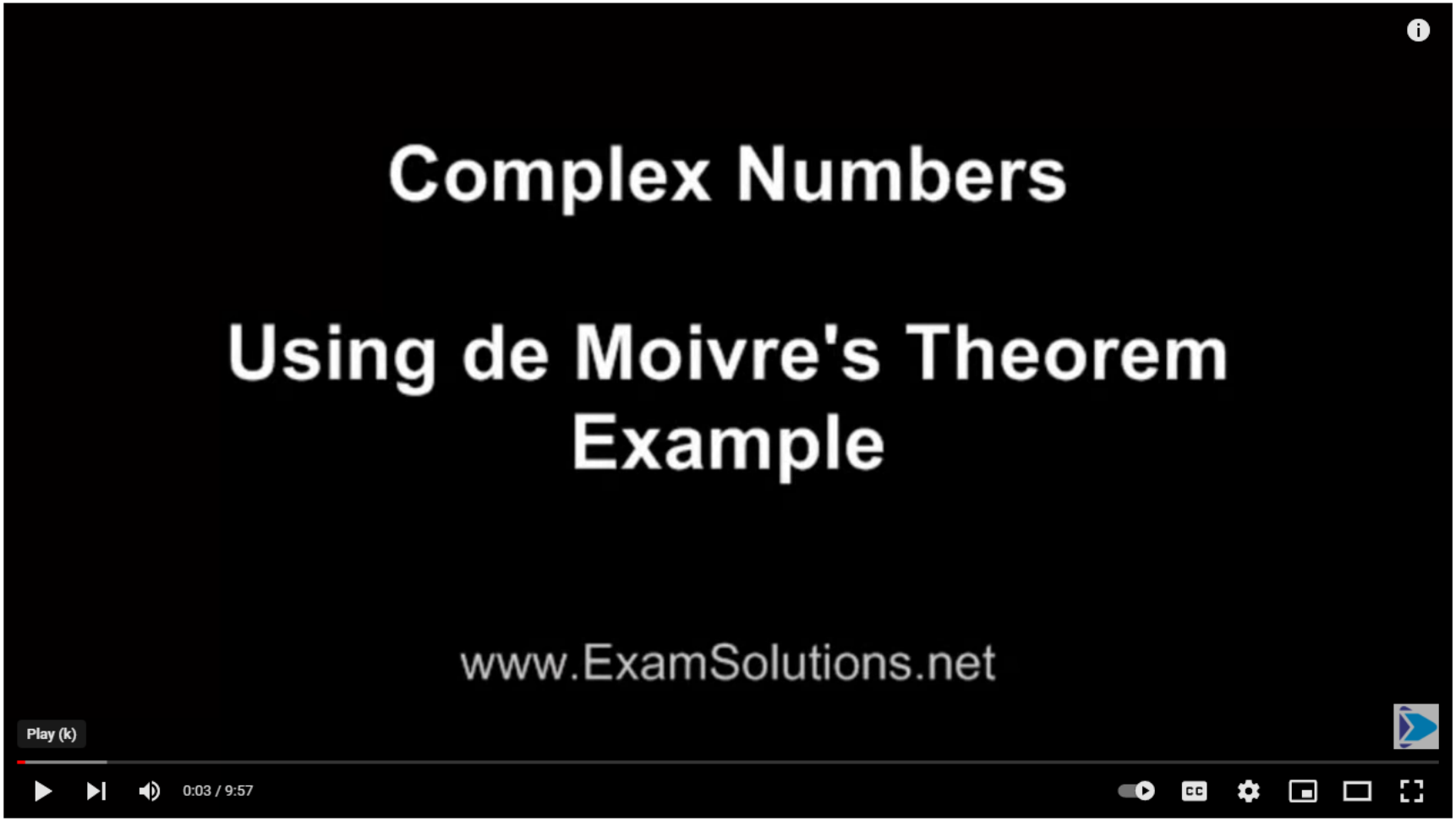
Evidence in support of SLO 4



Using de Moivre's Theorem - Example (2) : ExamSolutions Maths Revision Tutorials

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Solutions: Example 1

- Convert $r = 4\sin\theta$ from the polar equation the rectangular equation.

$r = 4\sin\theta$	Given equation
$r^2 = 4r\sin\theta$	Multiply each side by r
$r^2 = 4y$	$y = r\sin\theta$
$x^2 + y^2 = 4y$	$r^2 = x^2 + y^2$ Equation of a circle
$x^2 + (y^2 - 4y) = 0$	Subtract 4y from each side
$x^2 + (y^2 - 4y + 4) = 4$	Complete the square in y
$x^2 + (y - 2)^2 = 4$	Factor y

This is the standard form of the equation of a circle with center (0,2) and radius 2.

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2020 – Summer 2021

Program or Department Mission:
The Department of Mathematics/Engineering/Physical Sciences offers a broad range of courses that service the career programs of the college and that will transfer to baccalaureate degree granting institutions. The department also offers developmental mathematics courses to prepare students for college level mathematics.

Instructional Program Outcomes & Assessment Plan – MTH 116

Mathematics Course Level Outcomes Assessment Rubric

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Level 1: Student attempts a solution but demonstrates little understanding of methods required to produce a correct solution with expected organization.

Level 0: Student does not attempt a solution.

Evaluated Course Objectives
The student will demonstrate knowledge of functions and their graphs by his/her ability to
1. Solve a linear equation in one variable
2. Calculate the volume of a solid object or container
3. Calculate percentage

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
Assessment of Objective 1 Solve a linear equation in one variable	Rubric-based assessment of departmental common final exam problems Objective 1 example common final exam problem: $5(x+3) - 6(x+12) = 0$	70% of students learning at a rubric level of 2 or higher	***Data collected from FA20, SPR21, and SU21.** **Jefferson Campus** No data reported. All sections of MTH 116 were taught online during the pandemic. **Shelby Campus** No data reported. All sections of MTH 116 were taught online during the pandemic. **Online** Level 4 113/130 86.92% Level 3 0/130 0% Level 2 14/130 10.77% Level 1 0/130 0% Level 0 3/130 2.31% **Overall Performance** Level 4 113/130 86.92% Level 3 0/130 0% Level 2 14/130 10.77% Level 1 0/130 0% Level 0 3/130 2.31%	**Observations/Changes:** Because the WebAssign problem bank for this SLO is limited, the instructors will reinforce student learning of this objective by assigning problems 13-27 odd, and 29-39 from the textbook as additional practice. Last year (19-20) we provided an additional video tutorial detailing the process for solving a linear equation in one variable. Level 2 and higher success rates increased as a result from 93.59% in 19-20 to 97.69% in 20-21.

Assessment of Objective 2 Calculate the volume of a solid object or container	Rubric-based assessment of departmental common final exam problems Objective 2 example common final exam problem: *A cylindrical container has a radius of 17 inches and a height of 63 inches. How many gallons will it hold? Round your answer to two decimals.*	70% of students learning at a rubric level of 2 or higher	***Data collected from FA20, SPR21, and SU21.** **Jefferson Campus** No data reported. All sections of MTH 116 were taught online during the pandemic. **Shelby Campus** No data reported. All sections of MTH 116 were taught online during the pandemic. **Online** Level 4 38/130 29.23% Level 3 0/130 0% Level 2 75/130 57.69% Level 1 0/130 0% Level 0 17/130 13.08% **Overall Performance** Level 4 38/130 29.23% Level 3 0/130 0% Level 2 75/130 57.69% Level 1 0/130 0% Level 0 17/130 13.08%	**Observations/Changes:** It appears that the video mentioned focusing on finding the volume of different objects in the 19-20 report for this SLO was no help to students. Level 2 and higher success rates went from 87.18% in 19-20 to 86.92% this year. To explore further the exact point at which students are missing this learning objective, the instructors will make and assign a tutorial video that specifically addresses the difference between volume and capacity and contains additional examples. Hopefully this new video will address the roadblocks that students are experiencing when solving this type of problem.

<table>
<tr>
<td><u>Assessment of Objective 3</u>
Calculate percentage.</td>
<td>Rubric-based assessment of departmental common final exam problems

Objective 3 example common final exam problem:

A salesperson has total sales of $5687.50 and this amount represents 12.5% of her sales goal for the month. What was the amount of her sales goal for the month in dollars? Round your answer to two decimals.</td>
<td>70% of students learning at a rubric level of 2 or higher</td>
<td>*Data collected from FA20, SPR21, and SU21.

<u>Jefferson Campus</u>
No data reported. All sections of MTH 116 were taught online during the pandemic.

<u>Shelby Campus</u>
No data reported. All sections of MTH 116 were taught online during the pandemic.

<u>Online</u>
Level 4 64/130 49.23%
Level 3 0/130 0%
Level 2 52/130 40%
Level 1 0/130 0%
Level 0 14/130 10.77%

<u>Overall Performance</u>
Level 4 64/130 49.23%
Level 3 0/130 0%
Level 2 52/130 40%
Level 1 0/130 0%
Level 0 14/130 10.77%</td>
<td>Observations/Changes:
The tutorial video created because of the 19-20 data seems to have affected student learning. 88.46% of students scored at a level 2 or higher last year as compared to 89.23% of students this year.

For the 21-22 year, instructors recommend that an additional focus be placed on further increasing level 4 performance for this objective. A Khan Academy video will be included as an additional resource for students on this objective.</td>
</tr>
<tr>
<td>Plan submission date: 9/7/2021</td>
<td colspan="2">Submitted by: J. Holley</td>
<td></td>
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</tr>
</table>

Mathematics Course Level Outcomes Assessment Rubric

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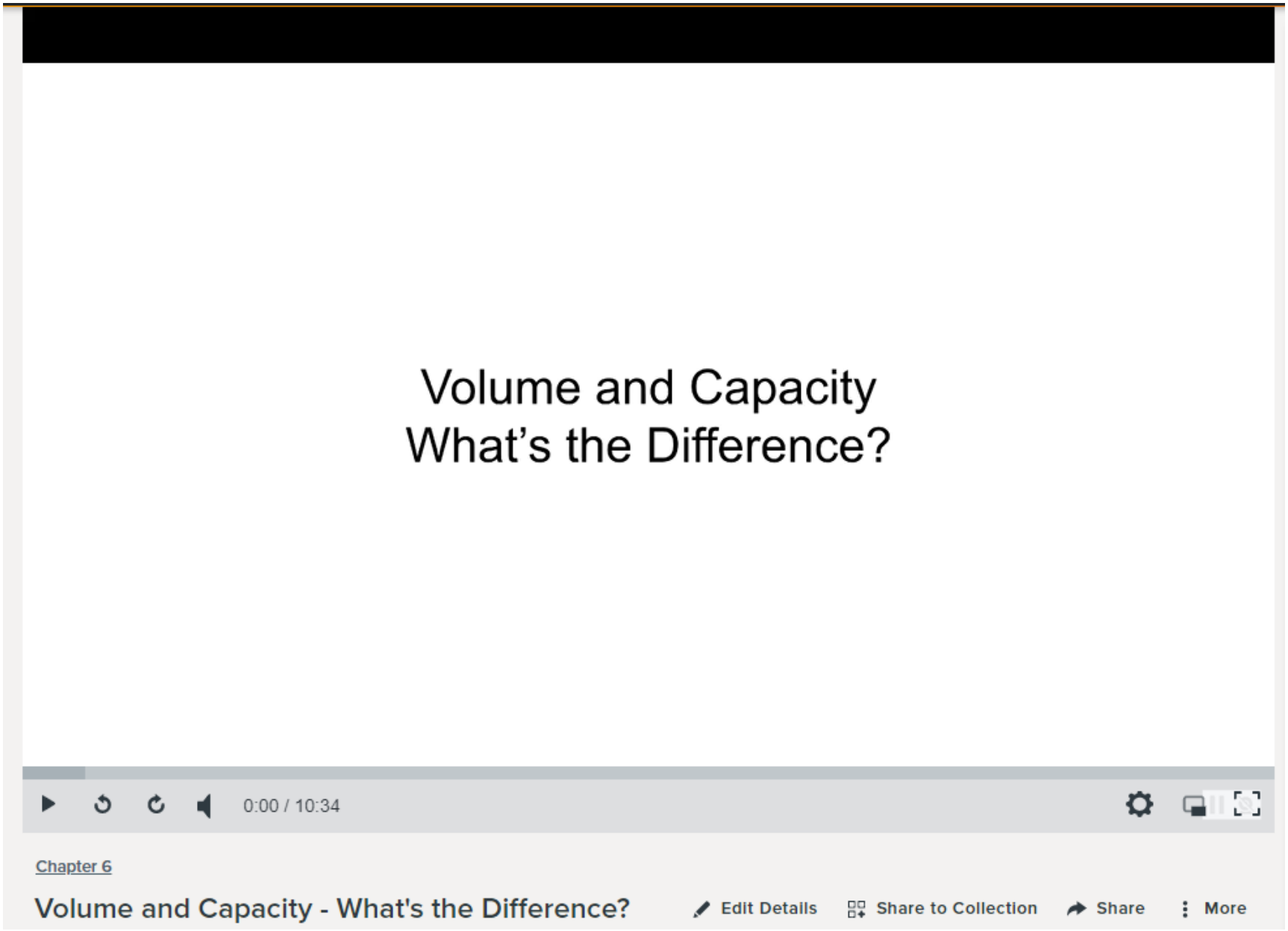
Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.

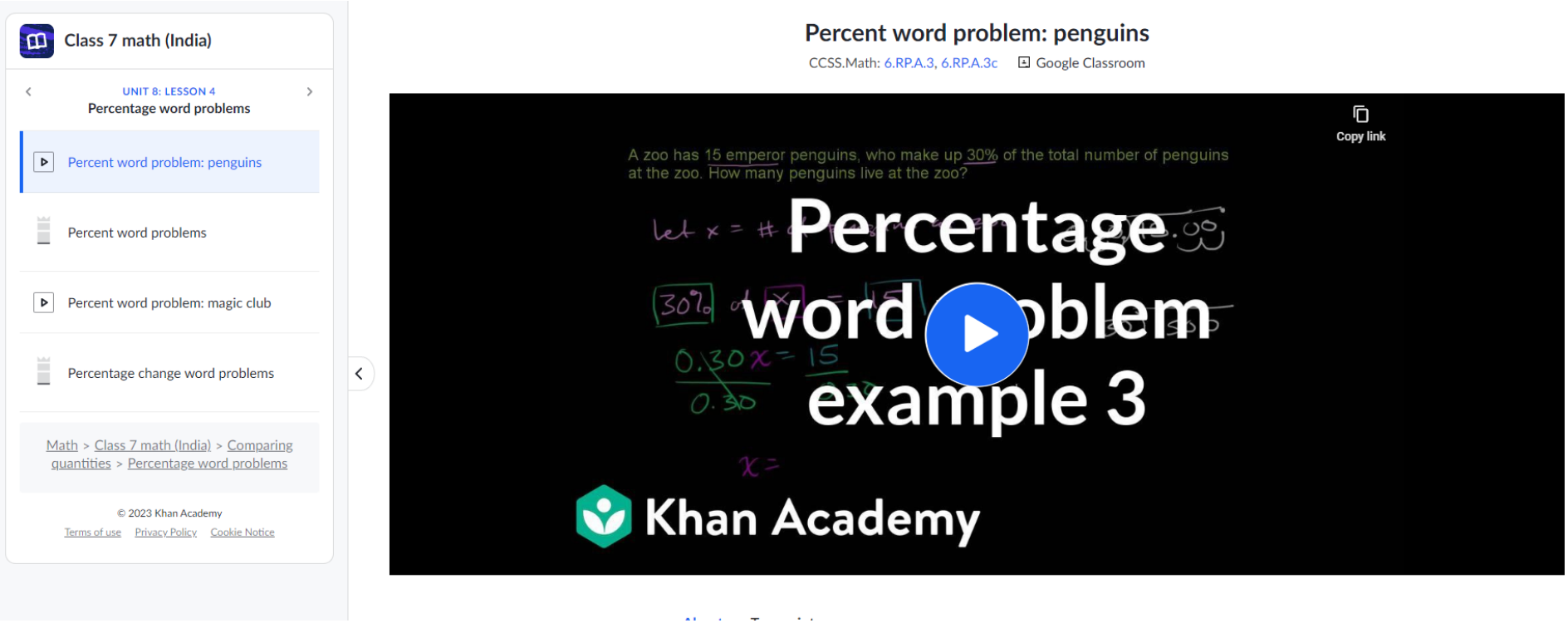
Level 1: Student attempts a solution but demonstrates little understanding of methods required to produce a correct solution with expected organization.

Level 0: Student does not attempt a solution.

Evidence to support SLO 2



Evidence to support SLO 3



Assessment Record

Program: Math-MTH 120 **Assessment period:** 2020 – 2021

Program or Department Mission:
The Department of Mathematics/Engineering/Physical Sciences offers a broad range of courses that service the career programs of the college and that will transfer to baccalaureate degree granting institutions. The department also offers developmental mathematics courses to prepare students for college level mathematics.

Course Student Learning Outcomes & Assessment Plan

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
SLO 1: Find an equation of the tangent line to the graph of a given function at a specified point	Rubric based assessment of related common final exam problems **Problem:** Find an equation of the tangent line to the graph of the function at the point (-2, 27) $f(x) = (1-x)(x^2-1)^2$	70% of students learning at a rubric level of 2 or higher	**Annual campus-wide total at rubric level 2 or higher: 104/108=96.3%** **Shelby Campus** Level 4 9/11 81.8% Level 3 0/11 0.0% Level 2 2/11 18.2% Level 1 0/11 0.0% Level 0 0/11 0.0% **Online** Level 4 90/97 92.8% Level 3 0/97 0.0% Level 2 3/97 3.1% Level 1 0/97 0.0%	**Observations/Changes:** Math 120 Instructors had recommended implementing a lot more videos to help students understand the material better. With the Techsmith Relay and a Surface computer, the instructors were able to produce videos quickly, and students have responded very favorably. For the year 2021-2022, the department recommends reinforcing the student learning of this objective by watching an extra lecture/PowerPoint, such as Example

			Level 0 4/97 4.1%	Addendum A, that emphasizes finding an equation of the tangent line to the graph of a given function at a specified point. The additional examples should increase student success.
MTH 120 Objective 2 Solve a related rates problem	Rubric based assessment of related common final exam problems **Problem:** Two ships leave the same port at noon. Ship *A* sails north at 15 mph, and ship *B* sails east at 12 mph. How fast is the distance between them changing at 1 p.m.?	70% of students learning at a rubric level of 2 or higher	**Annual campus-wide total at rubric level 2 or higher: 91/108=84.3%** Shelby Level 4 8/11 72.7% Level 3 0/11 7.8% Level 2 1/11 9.1% Level 1 0/11 0.0% Level 0 2/11 18.2% Online Level 4 73/97 75.3% Level 3 0/97 0.0% Level 2 10/97 10.3% Level 1 0/97 0.0% Level 0 14/97 14.4%	**Observations/Changes:** Math 120 Instructors had recommended implementing a lot more videos to help students understand the material better. With the Techsmith Relay and a Surface computer, the instructors were able to produce videos quickly, and students have responded very favorably For the year 2021-22, the department recommends replacement of a common final problem for this objective to accurately assess student learning of this topic.

MTH 120 Objective 3 Find the absolute extrema of a given function	Rubric based assessment of related common final exam problems **Problem:** Find the absolute maximum value and the absolute minimum value, if any, of the given function. $f(x) = \frac{x}{\sqrt{x^2+7}}$ on [-7, 7]	70% of students learning at a rubric level of 2 or higher	**Annual campus-wide total at rubric level 2 or higher: 105/108=97.2%** Shelby Level 4 6/11 54.5% Level 3 0/11 7.8% Level 2 4/11 36.4% Level 1 0/11 0.0% Level 0 1/11 9.1% Online Level 4 87/97 89.7% Level 3 0/97 0.0% Level 2 8/97 8.2% Level 1 0/97 0.0% Level 0 2/97 2.1%	**Observations/Changes:** Math 120 Instructors had recommended implementing a lot more videos to help students understand the material better. With the Techsmith Relay and a Surface computer, the instructors were able to produce videos quickly, and students have responded very favorably For the year 2021-2022, the department recommends reinforcing the student learning of this objective by using a video tutorial, such as Example Addendum C, that emphasizes finding the absolute extrema of a given function. The additional explanation should increase student success. Example Addendum C:
MTH 120 Objective 4 Solve an initial value problem	Rubric based assessment of related common final exam problems **Problem:** Find $f(x)$ by solving the initial value problem $f'(x) = 3e^x - 2x$; $f(0) = 1$	70% of students learning at a rubric level of 2 or higher	**Annual campus-wide total at rubric level 2 or higher: 103/108=95.3%** Shelby Level 4 8/11 72.7% Level 3 0/11 0.0% Level 2 3/11 27.3% Level 1 0/11 0.0% Level 0 0/11 0.0% Online Level 4 88/97 90.7%	**Observations/Changes:** Math 120 Instructors had recommended implementing a lot more videos to help students understand the material better. With the Techsmith Relay and a Surface computer, the instructors were able to produce videos quickly, and students have responded very favorably

			Level 3 0/97 0.0% Level 2 4/97 4.1% Level 1 0/97 0.0% Level 0 5/97 5.2%	
<u>MTH 120 Objective 5</u> Determine the Consumers' and Producers' Surplus	Rubric based assessment of related common final exam problems **Problem:** The management of the Titan Tire Company has determined that the quantity demanded x of their Super Titan tires/week is related to the unit price p by the relation $$p = 170 - x^2$$ Where p is measured in dollars and x is measured in units of a thousand. Titan will make x units of the tires available in the market if the unit price is $$p = 74 + \frac{1}{2}x^2$$	70% of students learning at a rubric level of 2 or higher	**Annual campus-wide total at rubric level 2 or higher: 95/108=88.0%** Shelby Level 4 9/11 81.8% Level 3 0/11 7.8% Level 2 1/11 9.1% Level 1 0/11 2.0% Level 0 1/11 9.1% Online Level 4 52/97 53.6% Level 3 0/97 0.0% Level 2 33/97 34.0% Level 1 0/97 0.0% Level 0 12/97 12.4%	**Observations/Changes:** Math 120 Instructors had recommended implementing a lot more videos to help students understand the material better. With the Techsmith Relay and a Surface computer, the instructors were able to produce videos quickly, and students have responded very favorably For the year 2021-2022, the department recommends reinforcing the student learning of this objective by creating video tutorials, such as Example Addendum E, that emphasize determining the Consumers' and/or Producers' Surplus. The additional example(s) should increase student success. Example Addendum E:

	dollars. Determine the consumers' surplus and the producers' surplus when the market unit price is set at the equilibrium price. Round your answers to the nearest dollar.			
Plan submission date: June 23, 2021			**Submitted by: Vicki Adams**	

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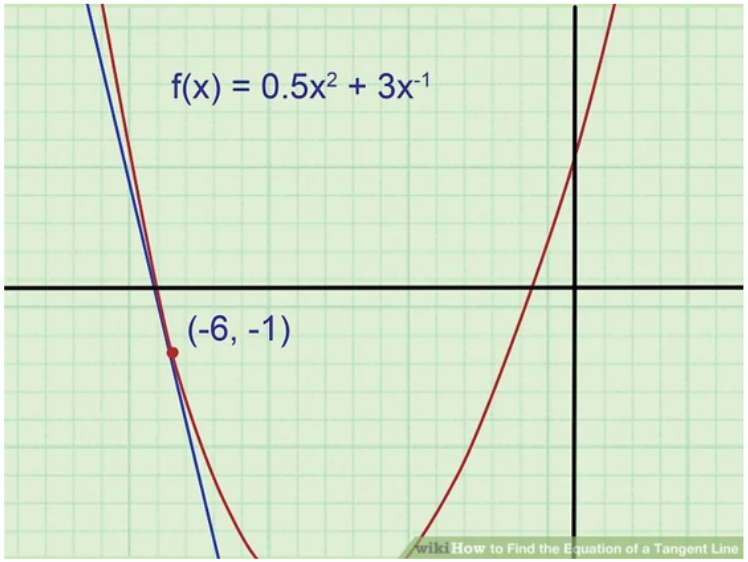
Level 0: Student does not attempt a solution.

Evidence to support SLO 1

Addendum A

https://www.wikihow.com/Find-the-Equation-of-a-Tangent-Line

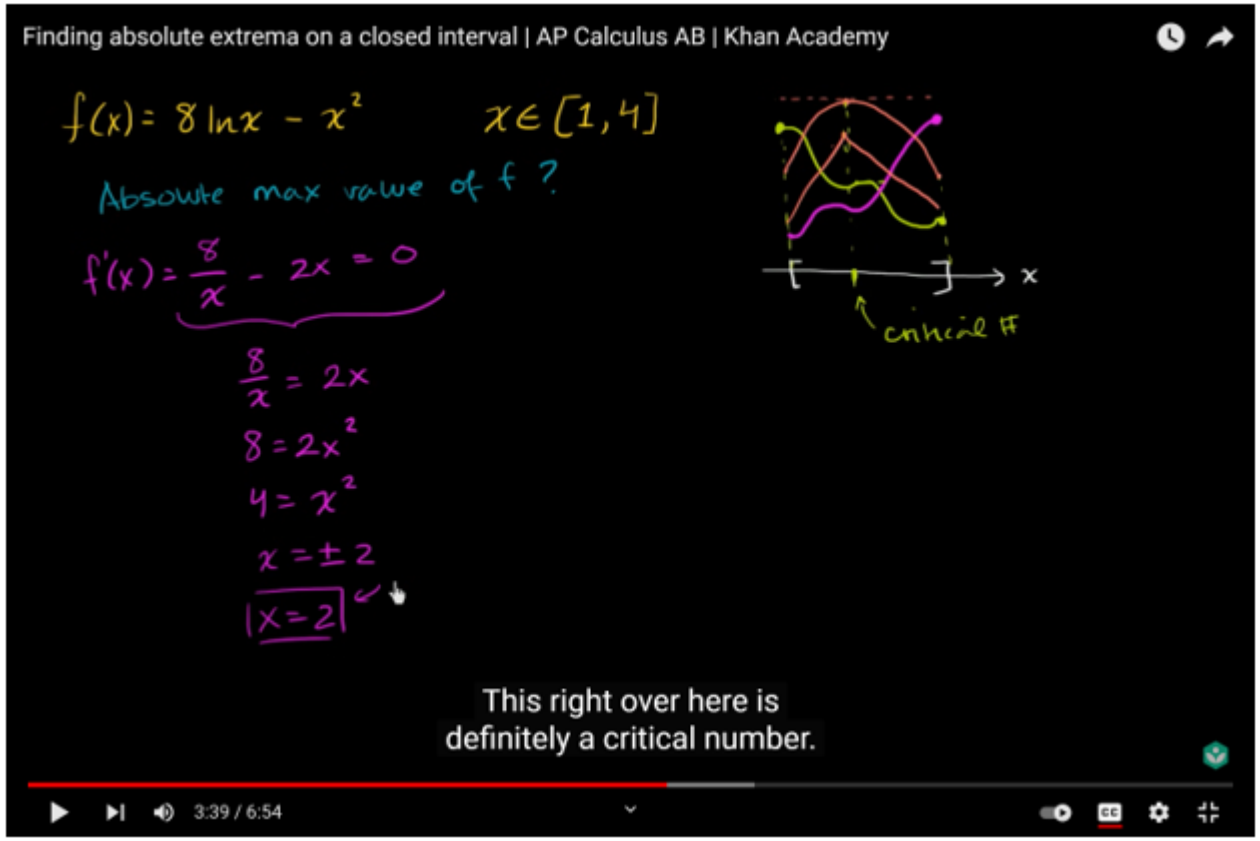
Sample screenshots/instructions of the video tutorial:



1 **Sketch the function and tangent line (recommended).** A graph makes it easier to follow the problem and check whether the answer makes sense. Sketch the function on a piece of graph paper, using a graphing calculator as a reference if necessary. Sketch the tangent line going through the given point. (Remember, the tangent line runs through that point and has the same slope as the graph at that point.)

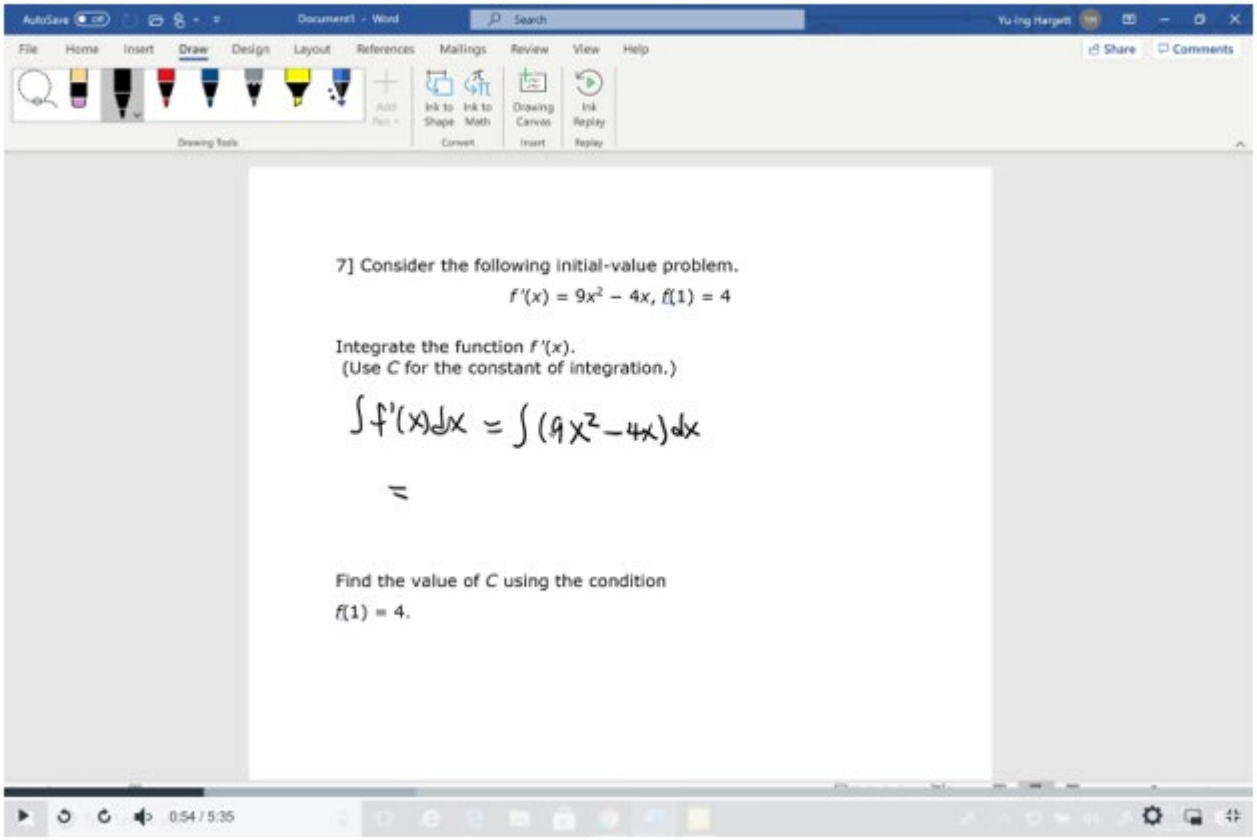
- **Example 1:** Sketch the graph of the parabola . Draw the tangent going through point (-6, -1).
  You don't know the tangent's equation yet, but you can already tell that its slope is negative, and that its y-intercept is negative (well below the parabola vertex with y value -5.5). If your final answer doesn't match these details, you'll know to check your work for mistakes.

Evidence to support SLO 3



Evidence to support SLO 4

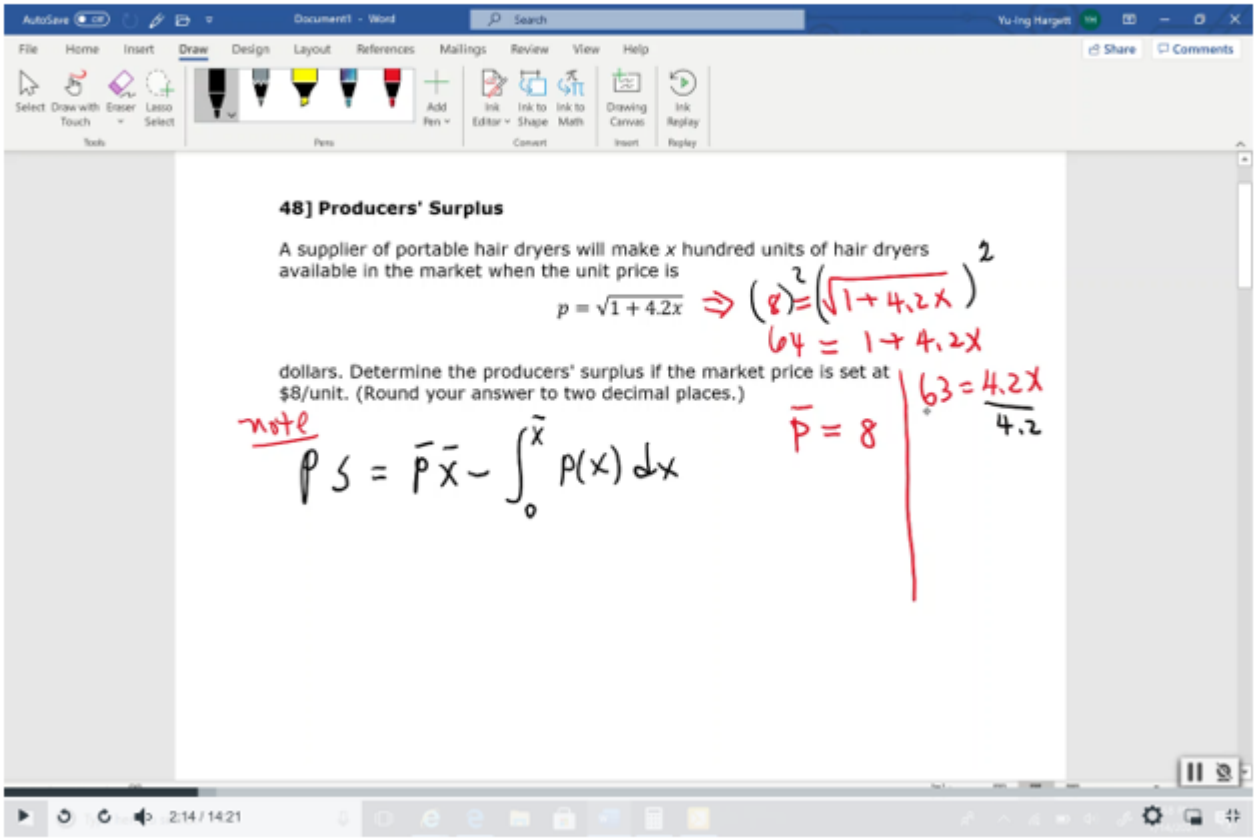
https://jeffersonstate.techsmithrelay.com/xbo5



Evidence to support SLO 5

Objective 5 Addendum E

https://jeffersonstate.techsmithrelay.com/M1cY



Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment Period:** 2020 – 2021

Program or Department Mission

The Department of Mathematics/Engineering/Physical Sciences offers a broad range of courses that service the career programs of the college and that will transfer to baccalaureate degree granting institutions. The department also offers developmental mathematics courses to prepare students for college level mathematics.

Instructional Program Outcomes & Assessment Plan – MTH 125S

Mathematics Course Level Outcomes Assessment Rubric

Level 4: Student provides a complete and correct solution process that is well organized, with no errors.

Level 3: Student provides a complete solution process that is well organized but contains minor errors.

Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.

Level 1: Student attempts a solution but demonstrates little understanding of methods required to produce a correct solution with expected organization.

Level 0: Student does not attempt a solution.

Evaluated Course Objectives
The General Educational Objective is met through the course objectives which require use of mathematical concepts, notations, and manipulations necessary in students' field of study. Student mastery of the specific course objectives that follow will be evaluated by analyzing solutions for appropriate problems from the comprehensive final exam. The final exam will not be a multiple-choice exam. Students are required to show all of their work and will be graded on the quality of their technique, notation, and accuracy.

The student will demonstrate knowledge of calculus by his/her ability to

1. Solve a limit problem.
2. Compute a derivative.
3. Compute an indefinite integral.

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
MTH 125S Objective 1 Demonstrate knowledge of the methods presented in this course by his/her ability to calculate the limit of a function.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	*Data collected during SPR21 and SU21. Shelby Campus Level 4 20/23 87% Level 3 0% Level 2 3/23 13% Level 1 0% Level 0 0% Clanton Campus Level 4 0% Level 3 1/4 25% Level 2 3/4 75% Level 1 0% Level 0 0% Online Level 4 176/185 95.1% Level 3 0%	**Observations/Changes:** MTH 125S instructors recommend reinforcing student learning of this objective by using the following link to access videos along with practice problems. It is good for students to view another approach. Limit approach videos and practice problems

			Level 2 9/185 4.9% Level 1 0% Level 0 0%	
MTH 125S Objective 2 Demonstrate knowledge of the methods presented in this course by his/her ability to compute the derivative of a function.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	*Data collected during SPR21 and SU21. Shelby Campus Level 4 22/23 95.7% Level 3 0% Level 2 1/23 4.3% Level 1 0% Level 0 0% Clanton Campus Level 4 4/4 100% Level 3 0% Level 2 0% Level 1 0% Level 0 0% Online Level 4 184/185 99.5% Level 3 0% Level 2 1/185 0.5% Level 1 0% Level 0 0%	**Observations/Changes:** MTH 125S instructors recommend reinforcing student learning of this objective by using an online tool to explore the power rule of derivatives with the following link. Power Rule Exploration

MTH 125S Objective 3 Demonstrate knowledge of the methods presented in this course by his/her ability to compute an indefinite integral.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	*Data collected during SPR21 and SU21. Shelby Campus Level 4 19/23 82.6% Level 3 0% Level 2 2/23 8.7% Level 1 0% Level 0 2/23 8.7% Clanton Campus Level 4 3/4 75% Level 3 1/4 25% Level 2 0% Level 1 0% Level 0 0% Online Level 4 175/185 94.6% Level 3 10/185 5.4% Level 2 0% Level 1 0%	**Observations/Changes:** MTH 125S instructors recommend reinforcing student learning of this objective by using the following link to access videos along with practice problems. It is good for students to view another approach. www.brightstorm.com

Return to SLO 1

Return to SLO 2

Return to SLO 3

Mathematics 100 Course Level Outcomes Assessment Rubric

Level 4: Student provides a complete and correct solution process that is well organized, with no errors.

Level 3: Student provides a complete solution process that is well organized but contains minor errors.

Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.

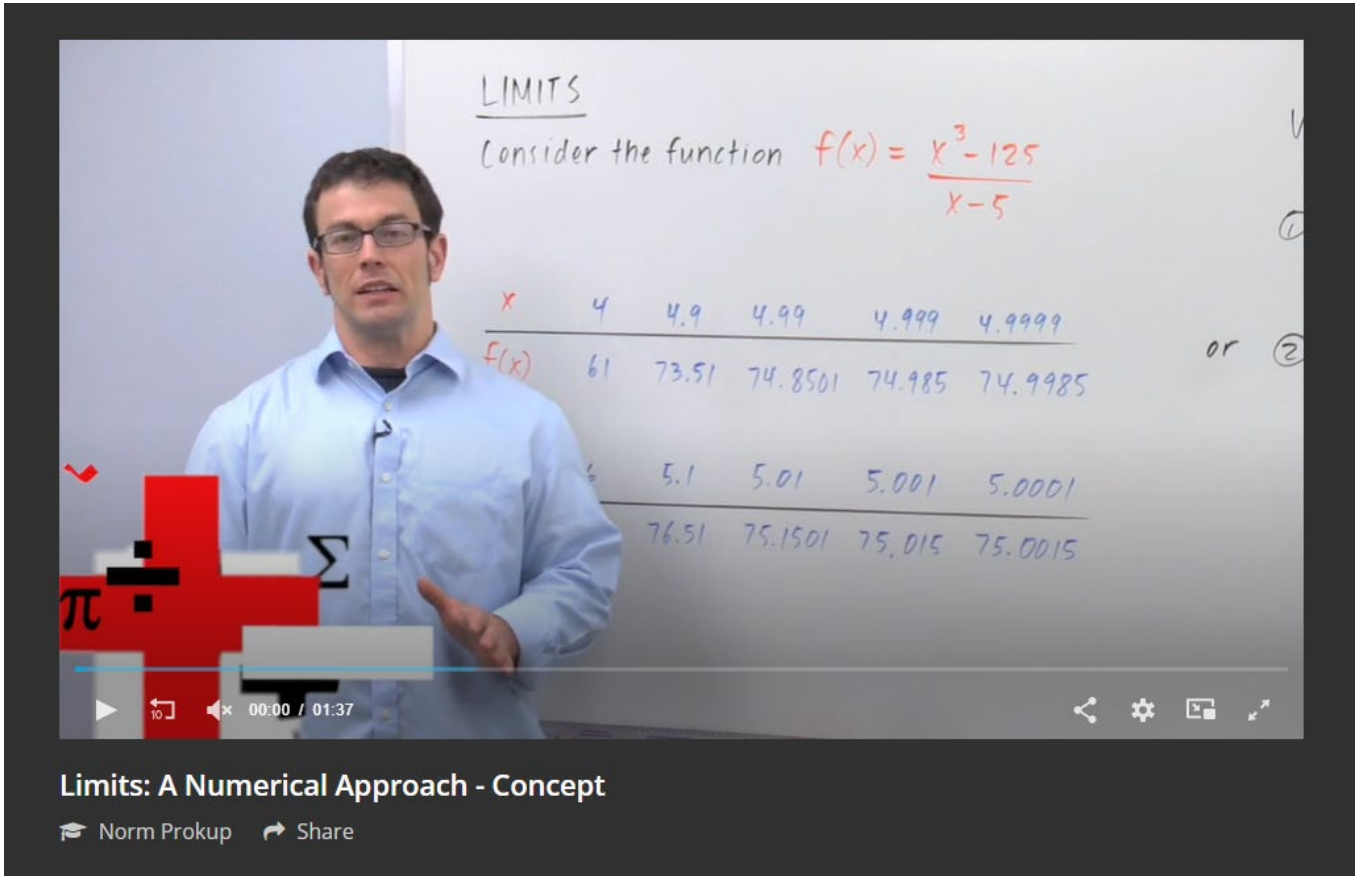
Level 1: Student attempts a solution but demonstrates little understanding of methods required to produce a correct solution with expected organization.

Level 0: Student does not attempt a solution.

[Return to SLO 1]

[Return to SLO 2]

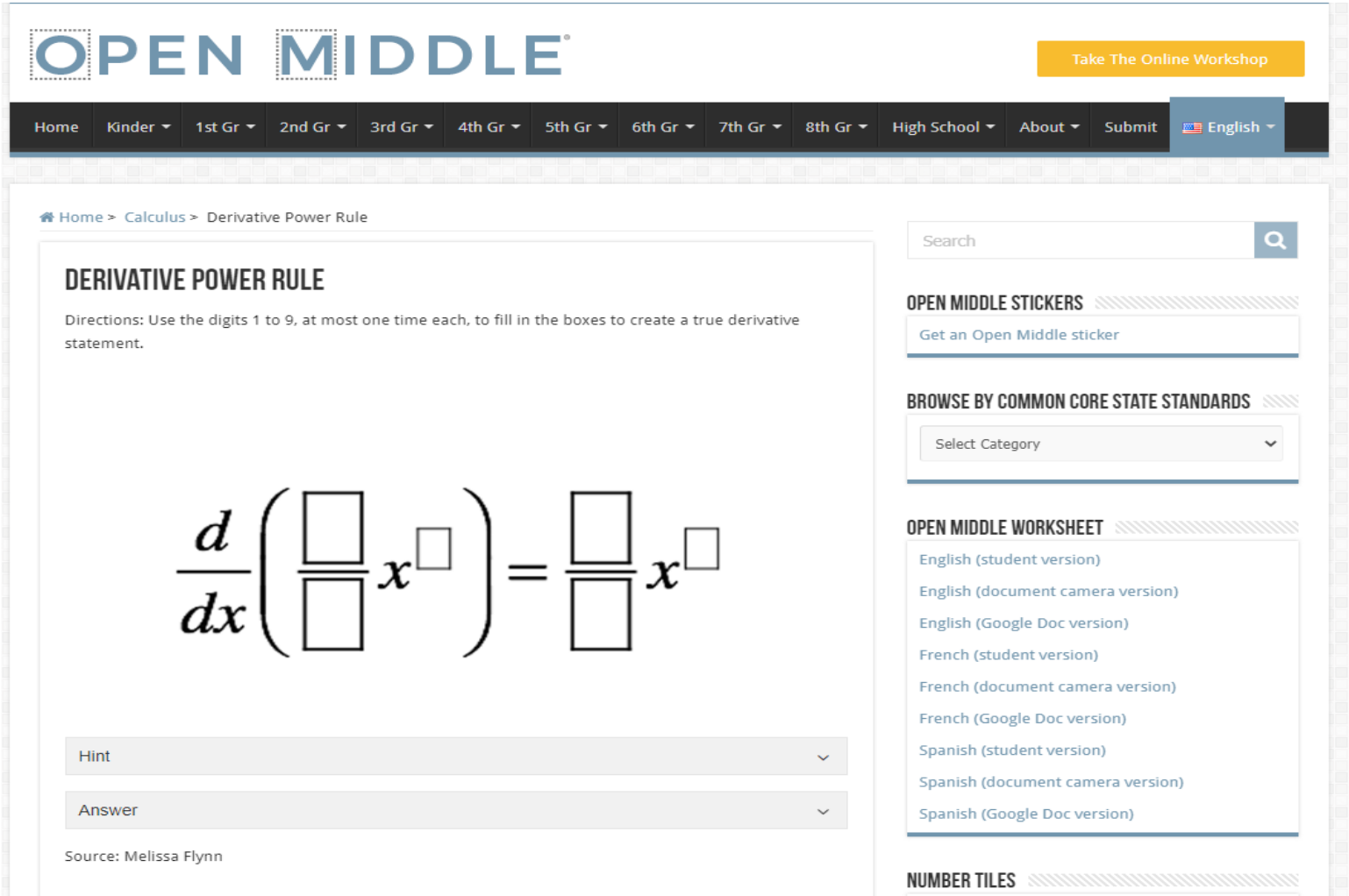
[Return to SLO 3]



[Return to SLO 1]

[Return to SLO 2]

[Return to SLO 3]



[Return to SLO 1](#)

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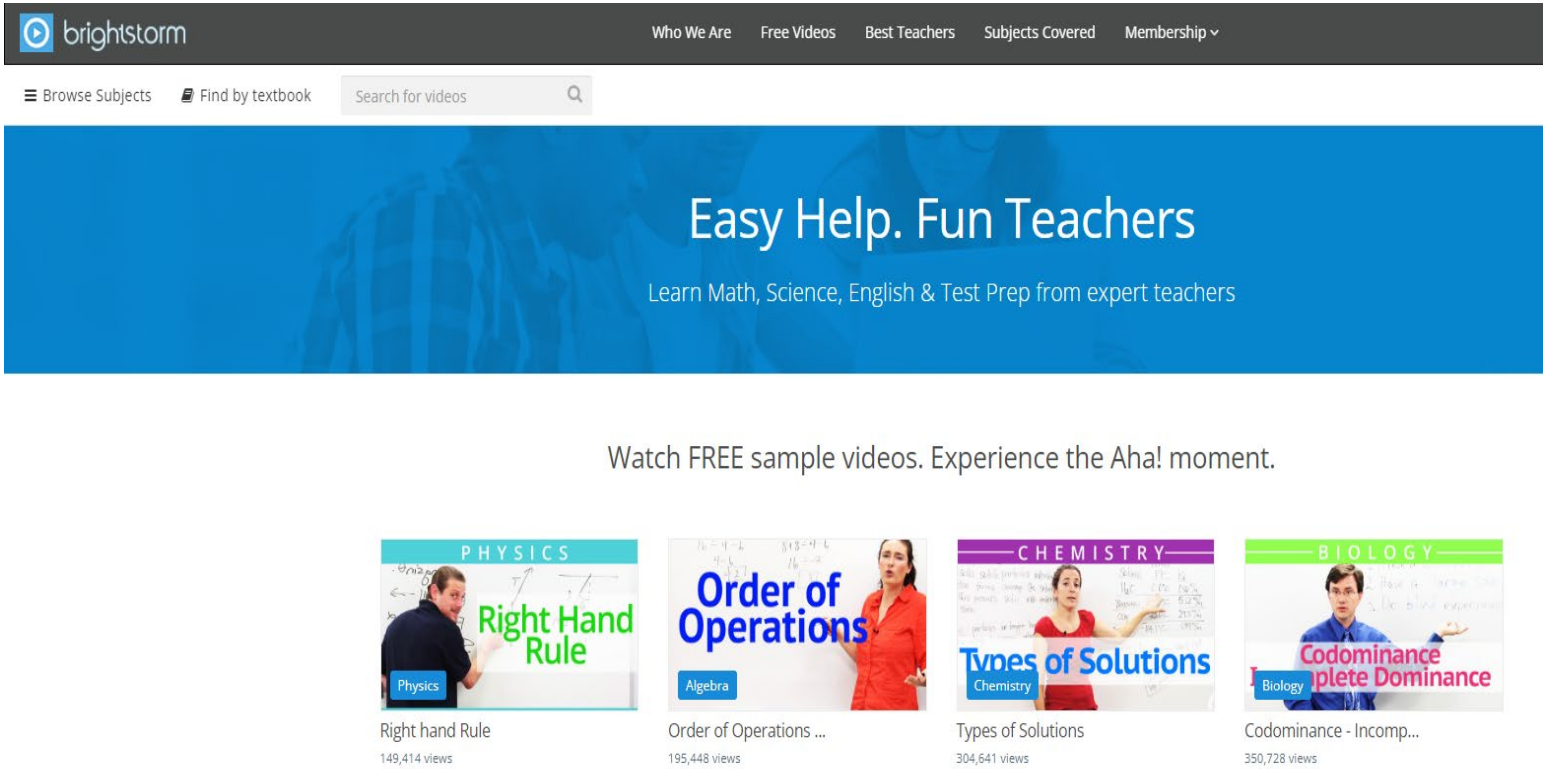

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment Period:** 2020 – 2021

Program or Department Mission

The Department of Mathematics/Engineering/Physical Sciences offers a broad range of courses that service the career programs of the college and that will transfer to baccalaureate degree granting institutions. The department also offers developmental mathematics courses to prepare students for college level mathematics.

Instructional Program Outcomes & Assessment Plan – MTH 126S

Mathematics Course Level Outcomes Assessment Rubric

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Level 3: Student provides a complete solution process that is well organized but contains minor errors.
Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.
Level 1: Student attempts a solution but demonstrates little understanding of methods required to produce a correct solution with expected organization.
Level 0: Student does not attempt a solution.

Evaluated Course Objectives

Student mastery of the specific course objectives that follow will be evaluated by analyzing solutions for appropriate problems from the comprehensive final exam. The final exam will not be a multiple-choice exam. Students are required to show all of their work and will be graded on the quality of their technique, notation, and accuracy.

The student will demonstrate knowledge of calculus by his/her ability to

1. Find the length of an arc of a plane function, using the definite integral.
2. Use the method of partial fractions to evaluate an integral.
3. Write the Taylor series for a given function.

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
MTH 126S Objective 1 Demonstrate knowledge of the methods presented in this course by his/her ability to find the length of an arc of a plane function, using the definite integral.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	Online Level 4 139/151 90.7% Level 3 Level 2 13/151 8.6% Level 1 Level 0 1/151 0.7%	**Observations/Changes:** MTH 126S Instructors recommend reinforcing student learning of this objective by using an online tool to explore arc length with the following link. Arc Length Exploration
MTH 126S Objective 2 Demonstrate knowledge of the methods presented in this course by his/her ability to use the method of partial fractions to evaluate an integral.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	Online Level 4 141/151 93.4% Level 3 Level 2 10/151 6.6% Level 1 Level 0	**Observations/Changes:** MTH 126S instructors recommend reinforcing student learning of this objective by using the following link to access videos along with practice problems. It is good for students to view another approach. Partial Fraction video and practice problems

MTH 126S Objective 3 Demonstrate knowledge of the methods presented in this course by his/her ability to write a Taylor Series for a given function	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	Online Level 4 131/151 86.8% Level 3 Level 2 15/151 9.9% Level 1 Level 0 5/151 3.3%	**Observations/Changes:** MTH 126S instructors recommend reinforcing student learning of this objective by using the following link to access videos along with practice problems. It is good for students to view another approach. Taylor Series Expansion

MATH 126S – Rubric

Mathematics Course Level Outcomes Assessment Rubric

Level 4: Student provides a complete and correct solution process that is well organized, with no errors.

Level 3: Student provides a complete solution process that is well organized but contains minor errors.

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Level 0: Student does not attempt a solution.

Evidence in support of SLO 1

Arc Length Exploration

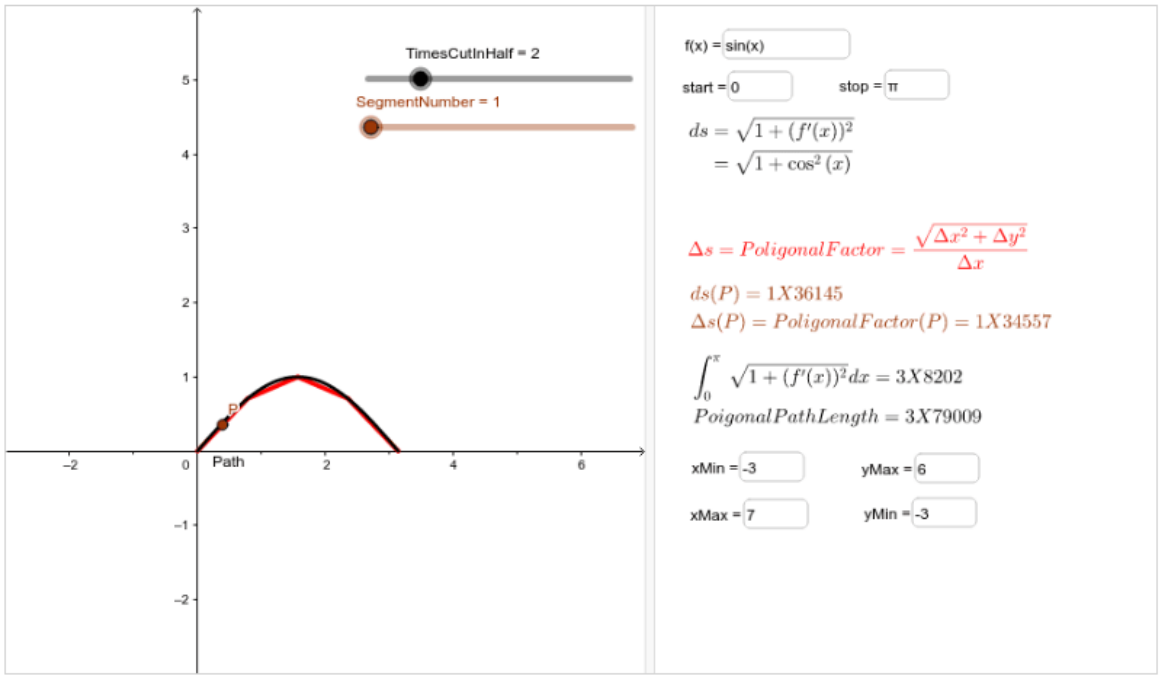
Author: Mike May

This applet is designed to let you explore arclength of the graph of a function.

A curve y=f(x) is given and compared to the polygonal path obtained by cutting the x interval in half a number of times and connecting points on the curve by straight lines.

ds is the normal integration factor evaluated at the midpoints of the straight lines.
Δs is the ratio of each straight line to its base.

If you cut the interval in half 10 times, there are over 1000 subintervals and the approximation is very good.



As always, when exploring with a new method, start with a curve whose length you know.

Evidence in support of SLO 2

Integration By Partial Fractions

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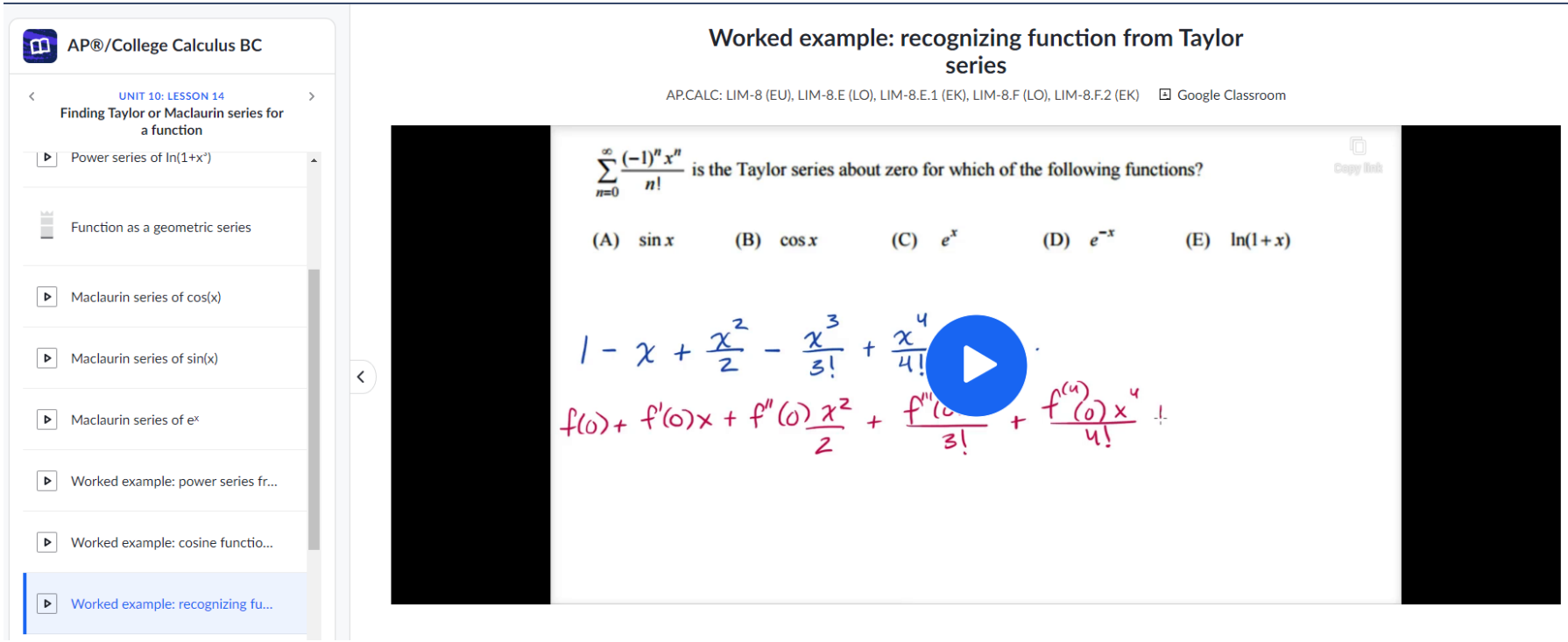
Evidence in support of SLO 3



Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** 2020 – 2021

Program or Department Mission:
The Department of Mathematics/Engineering/Physical Sciences offers a broad range of courses that service the career programs of the college and that will transfer to baccalaureate degree granting institutions. The department also offers developmental mathematics courses to prepare students for college level mathematics.

Instructional Program Outcomes & Assessment Plan – MTH 227

Mathematics Course Level Outcomes Assessment Rubric

Level 4: Student provides a complete and correct solution process that is well organized, with no errors.

Level 3: Student provides a complete solution process that is well organized, but contains minor errors.

Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.

Level 1: Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.

Level 0: Student does not attempt a solution.

Evaluated Course Objectives

The General Educational Objective is met through the course objectives which require use of mathematical concepts, notations, and manipulations necessary in students' field of study. Student mastery of the specific course objectives that follow will be evaluated by analyzing solutions for appropriate problems from the comprehensive final exam. The final exam will not be a multiple-choice exam. Students are required to show all of their work and will be graded on the quality of their technique, notation, and accuracy.

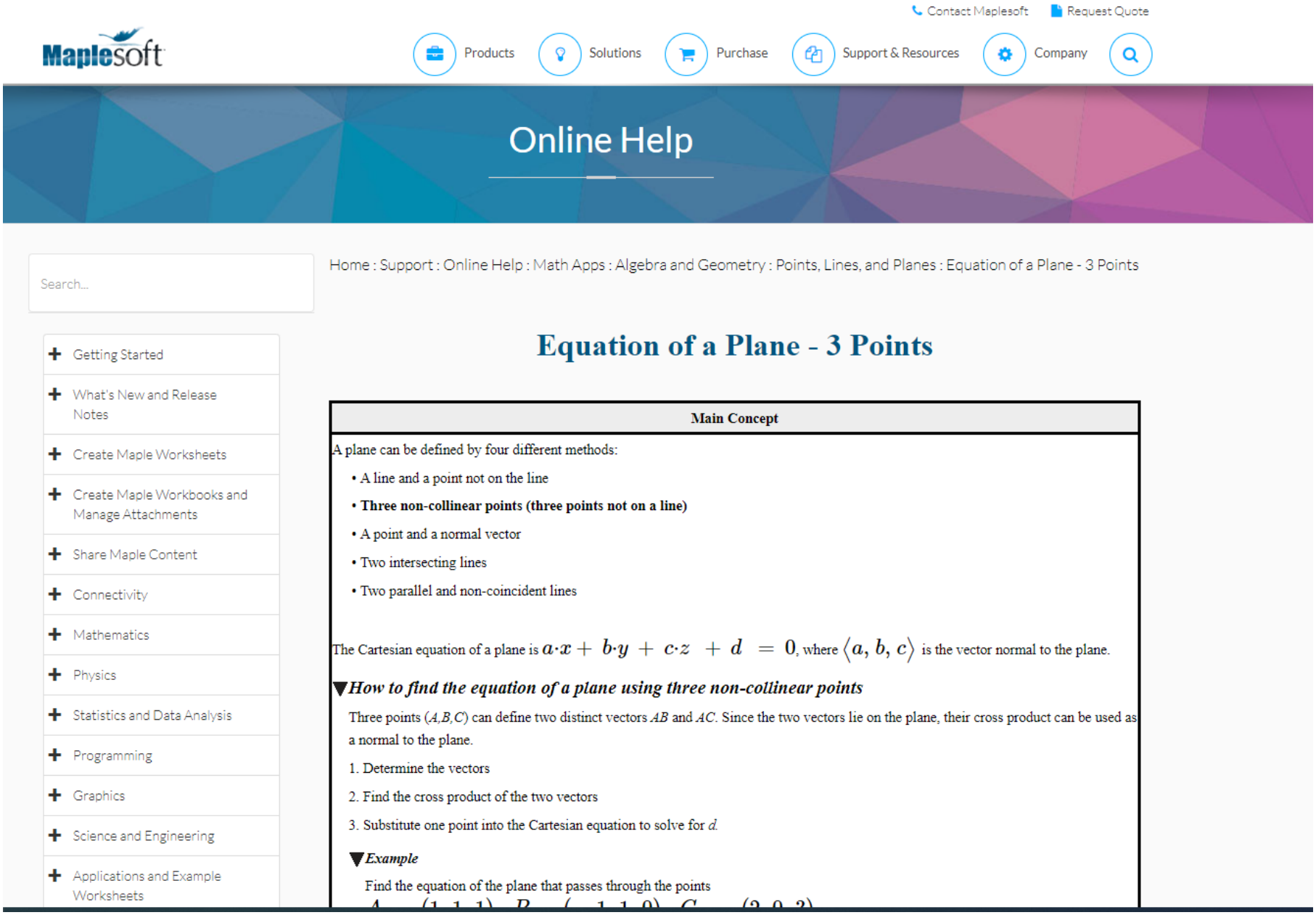
The student will demonstrate knowledge of calculus by his/her ability to

1. Find the equation of a plane.
2. Compute the directional derivative of a function.
3. Set up and evaluate a double integral.

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
MTH 227 Objective 1 Demonstrate knowledge of the methods presented in this course by his/her ability to find the equation of a plane.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	Online Level 4 67/82 81.7% Level 3 7/82 8.5% Level 2 7/82 8.5% Level 1 1/82 1.2% Level 0 0%	**Observations/Changes:** MTH 227 Instructors recommend reinforcing student learning of this objective by using an online tool to explore finding the equation of a plane with the following link. Plane Equation Exploration
MTH 227 Objective 2 Demonstrate knowledge of the methods presented in this course by his/her ability to compute the directional derivative of a function.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	Online Level 4 70/82 85.4% Level 3 7/82 8.5% Level 2 5/82 8.5% Level 1 0% Level 0 0%	**Observations/Changes:** MTH 227 instructors recommend reinforcing student learning of this objective by using the following link to access videos along with practice problems. It is good for students to view another approach. Directional Derivative Video and Practice Problems

MTH 227 Objective 3 Demonstrate knowledge of the methods presented in this course by his/her ability set up and evaluate a double integral.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	Online Level 4 Level 3 Level 2 Level 1 Level 0	 69/82 9/82 3/82 1/82 	 84.1% 11.0% 3.7% 1.2% 0%	**Observations/Changes:** MTH 227 instructors recommend reinforcing student learning of this objective by using the following link to access practice problems. It is good for students to have more practice to master the objective. Set Up and Evaluate Double Integral Practice Problems

Evidence for SLO 1



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Equation of a Plane - 3 Points

Main Concept

A plane can be defined by four different methods:

- A line and a point not on the line
- **Three non-collinear points (three points not on a line)**
- A point and a normal vector
- Two intersecting lines
- Two parallel and non-coincident lines

The Cartesian equation of a plane is $a \cdot x + b \cdot y + c \cdot z + d = 0$, where $\langle a, b, c \rangle$ is the vector normal to the plane.

How to find the equation of a plane using three non-collinear points

Three points (A,B,C) can define two distinct vectors AB and AC. Since the two vectors lie on the plane, their cross product can be used as a normal to the plane.

1. Determine the vectors
2. Find the cross product of the two vectors
3. Substitute one point into the Cartesian equation to solve for d.

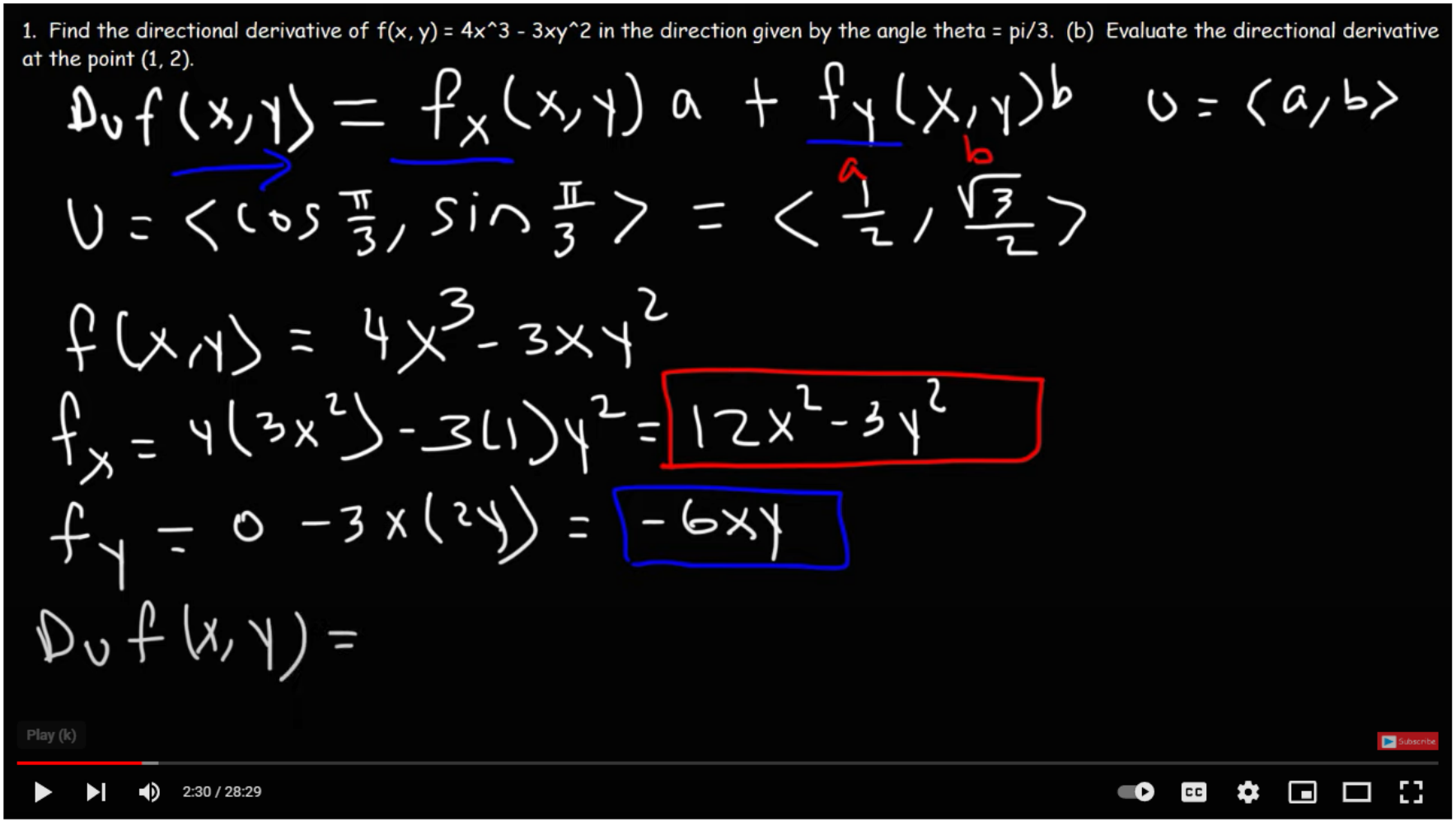
Example

Find the equation of the plane that passes through the points

$A = (1, 1, 1)$ $B = (-1, 1, 0)$ $C = (2, 0, 2)$

September 2021

Evidence for SLO 2



How To Find The Directional Derivative and The Gradient Vector

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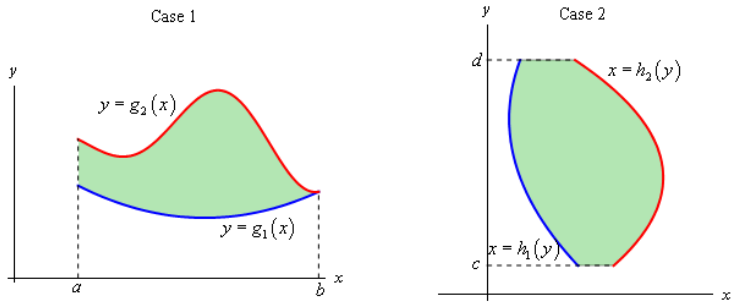
Section 15.3 : Double Integrals Over General Regions

In the previous section we looked at double integrals over rectangular regions. The problem with this is that most of the regions are not rectangular so we need to now look at the following double integral,

$$\iint_D f(x,y)\,dA$$

where D is any region.

There are two types of regions that we need to look at. Here is a sketch of both of them.



We will often use *set builder notation* to describe these regions. Here is the definition for the region in Case 1

$$D = \{(x,y)\,|a \le x \le b,\ g_1(x) \le y \le g_2(x)\}$$

and here is the definition for the region in Case 2.

$$D = \{(x,y)\,|h_1(y) \le x \le h_2(y),\ c \le y \le d\}$$

This notation is really just a fancy way of saying we are going to use all the points, (x,y), in which both of the coordinates satisfy the two given inequalities.

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2020 – Summer 2021

Program or Department Mission:
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Instructional Program Outcomes & Assessment Plan – MTH 238

Mathematics Course Level Outcomes Assessment Rubric

Level 4: Student provides a complete and correct solution process that is well organized, with no errors.

Level 3: Student provides a complete solution process that is well organized, but contains minor errors.

Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.

Level 1: Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.

Level 0: Student does not attempt a solution.

General Education Objective

Students will use abstract ideas, symbols, and fundamental skills of mathematics to analyze and solve problems.

Evaluated Course Objectives

Student mastery of the specific course objectives that follow will be evaluated by analyzing solutions for appropriate problems from the comprehensive final exam. The final exam will not be a multiple-choice exam. Students are required to show all of their work and will be graded on the quality of their technique, notation, and accuracy.

The student will demonstrate knowledge of the methods presented in this course by his/her ability to

1. Use an integrating factor to solve a first order linear equation.
2. Solve second order linear homogeneous equations with constant coefficients.
3. Use the Laplace transform to solve a given initial valve problem.

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
MTH 238 Objective 1 Use an integrating factor to solve a first order linear equation.	Rubric based assessment of a final exam problem related to objective 1	70% of students learning at a rubric level of 2 or higher	Internet Campus Level 4 28/35 80% Level 3 5/35 14% Level 2 2/35 6% Level 1 0/35 0% Level 0 0/35 0% No on-campus course offered this year	**Observations/Changes:** 100% (35/35) performed at Level 2 or higher. The overall percentage of students that scored at level 2 or higher remained the same during this academic year as last year. Our recommendation is to continue to concentrate more on other areas of the course, though we could add more

				challenging problems in this area. See Addendum A.
MTH 238 Objective 2 Solve second order linear homogeneous equations with constant coefficients.	Rubric based assessment of a final exam problem that pertains to objective 2	70% of students learning at a rubric level of 2 or higher	Internet Campus Level 4 25/35 71% Level 3 5/35 14% Level 2 3/35 9% Level 1 2/35 6% Level 0 0/25 0% No on-campus course offered this year	**Observations/Changes:** 94% (32/35) performed at Level 2 or higher. Down from 100% last year. The overall percentage of students that scored at level 2 or higher decreased this academic year. Our recommendation is to add additional practice in the area on the practice problems. See Addendum B.Addendum B These students seemed to come into the course with weaker algebra skills, probably due the shift to online testing formats that do not require the students to work out problems to find the correct answer.

MTH 238 Objective 3 Use the Laplace transform to solve a given initial valve problem.	Rubric based assessment of a final exam problem that illustrates objective 3	70% of students learning at a rubric level of 2 or higher	Internet Campus Level 4 26/35 74% Level 3 4/35 11% Level 2 2/35 6% Level 1 3/35 9% Level 0 0/25 0% No on-campus course offered this year	**Observations/Changes:** 91% (32/35) performed at Level 2 or higher. Down slightly from 96% last year. The overall percentage of students that scored at level 2 or higher decreased slightly this academic year. Our recommendation is to continue to contrate on calculus and algebraic techniques required to apply inverse Laplace transform formulas. See Addendum C. As mentioned in the objective 2 analysis, students seemed have weaker computational skills, in calculus this time coming into the course, probably due to the use of testing formats in previous courses that do not require students to work problems to get the correct answer.

Addendum A

We will include questions similar to the following in the practice problem:

Solve the first order non-linear differential equation. $dy/dx - 2xy = -2x \exp(-x^2)\, y^2$ (Since they are slightly more challenging than the standard linear counterparts.)

Addendum B

We will include questions similar to the following in the homework problem that might include a broader variety of algebraic factoring techniques:

Solve the linear constant coefficient differential equation. $y''' - 3y'' + 3y' - 1 = 0.$

Addendum C

Compute the inverse Laplace transform. $Y(s) = 1/[(s-1)(s^2+1)]$ (Since it requires the use of partial fraction decomposition that it commonly used in computing the solutions of differential equations using the method of Laplace transforms.)

Evaluated Course Objectives and Related Example Problems

The General Educational Objective is met through the course objectives which require use of mathematical concepts, notations, and manipulations necessary in students' field of study. Student mastery of the specific course objectives that follow will be evaluated by analyzing solutions for appropriate problems from the comprehensive final exam. The final exam will not be a multiple-choice exam. Students are required to show all of their work and will be graded on the quality of their technique, notation, and accuracy.

The student will demonstrate knowledge of the methods presented in this course by his/her ability to

1. Use an integrating factor to solve a first order linear equation.

   Example Problem 1

   Find the general solution the differential equation by separation of variables.

   $$\frac{dy}{dx} = \frac{28x^3 + \cos x}{5y^4}$$

2. Solve second order linear homogeneous equations with constant coefficients.

   Example Problem 2

   Find the general solution of the homogenous differential equation.

   $$y'' - 10y' + 29y = 0$$

3. Use the Laplace transform to solve a given initial valve problem.

   Example Problem 3

   Solve the initial value problem using the method of Laplace transforms.

   $$\begin{cases} y'' - 9y = \delta(t-3) \\ y(0) = 0 \\ y'(0) = 0 \end{cases}$$

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2020 – Summer 2021

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Instructional Program Outcomes & Assessment Plan – MTH 238

Mathematics Course Level Outcomes Assessment Rubric

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Level 0: Student does not attempt a solution.

Evaluated Course Objectives
Student mastery of the specific course objectives that follow will be evaluated
by analyzing solutions for appropriate problems from the comprehensive final exam. The final exam will not be a multiple-choice exam. Students are required to show all of their work and will be graded on the quality of their technique, notation, and accuracy.

The student will demonstrate knowledge of the methods presented in this course by his/her ability to

1. Use an integrating factor to solve a first order linear equation.
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3. Use the Laplace transform to solve a given initial valve problem.

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MTH 238 Objective 1 Use an integrating factor to solve a first order linear equation.	Rubric based assessment of a final exam problem related to objective 1	70% of students learning at a rubric level of 2 or higher	Internet Campus Level 4 28/35 80% Level 3 5/35 14% Level 2 2/35 6% Level 1 0/35 0% Level 0 0/35 0% No on-campus course offered this year	100% (35/35) performed at Level 2 or higher. The overall percentage of students that scored at level 2 or higher remained the same during this academic year as last year. Our recommendation is to continue to concentrate more on other areas of the course, though we could add more challenging problems in this area. See Addendum A.

MTH 238 Objective 2 Solve second order linear homogeneous equations with constant coefficients.	Rubric based assessment of a final exam problem that pertains to objective 2	70% of students learning at a rubric level of 2 or higher	Internet Campus Level 4 25/35 71% Level 3 5/35 14% Level 2 3/35 9% Level 1 2/35 6% Level 0 0/25 0% No on-campus course offered this year	94% (32/35) performed at Level 2 or higher. Down from 100% last year. The overall percentage of students that scored at level 2 or higher decreased this academic year. Our recommendation is to add additional practice in the area on the practice problems. See Addendum B. Addendum B These students seemed to come into the course with weaker algebra skills, probably due the shift to online testing formats that do not require the students to work out problems to find the correct answer.

MTH 238 Objective 3 Use the Laplace transform to solve a given initial valve problem.	Rubric based assessment of a final exam problem that illustrates objective 3	70% of students learning at a rubric level of 2 or higher	Internet Campus Level 4 26/35 74% Level 3 4/35 11% Level 2 2/35 6% Level 1 3/35 9% Level 0 0/25 0% No on-campus course offered this year	91% (32/35) performed at Level 2 or higher. Down slightly from 96% last year. The overall percentage of students that scored at level 2 or higher decreased slightly this academic year. Our recommendation is to continue to contrate on calculus and algebraic techniques required to apply inverse Laplace transform formulas. See Addendum C. As mentioned in the objective 2 analysis, students seemed have weaker computational skills, in calculus this time coming into the course, probably due to the use of testing formats in previous courses that do not require students to work problems to get the correct answer.

Addendum A

We will include questions similar to the following in the practice problem:

Solve the first order non-linear differential equation. $dy/dx - 2xy = -2x \exp(-x^2)\, y^2$ (Since they are slightly more challenging than the standard linear counterparts.)

Addendum B

We will include questions similar to the following in the homework problem that might include a broader variety of algebraic factoring techniques:

Solve the linear constant coefficient differential equation. $y''' - 3y'' + 3y' - 1 = 0.$

Addendum C

Compute the inverse Laplace transform. $Y(s) = 1/[(s-1)(s^2+1)]$ (Since it requires the use of partial fraction decomposition that it commonly used in computing the solutions of differential equations using the method of Laplace transforms.)

Evaluated Course Objectives and Related Example Problems

The General Educational Objective is met through the course objectives which require use of mathematical concepts, notations, and manipulations necessary in students' field of study. Student mastery of the specific course objectives that follow will be evaluated by analyzing solutions for appropriate problems from the comprehensive final exam. The final exam will not be a multiple-choice exam. Students are required to show all of their work and will be graded on the quality of their technique, notation, and accuracy.

The student will demonstrate knowledge of the methods presented in this course by his/her ability to

1. Use an integrating factor to solve a first order linear equation.

   Example Problem 1

   Find the general solution the differential equation by separation of variables.

   $$\frac{dy}{dx} = \frac{28x^3 + \cos x}{5y^4}$$

2. Solve second order linear homogeneous equations with constant coefficients.

   Example Problem 2

   Find the general solution of the homogenous differential equation.

   $$y'' - 10y' + 29y = 0$$

3. Use the Laplace transform to solve a given initial valve problem.

   Example Problem 3

   Solve the initial value problem using the method of Laplace transforms.

   $$\begin{cases} y'' - 9y = \delta(t-3) \\ y(0) = 0 \\ y'(0) = 0 \end{cases}$$

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment Period:** FALL 2020 - SUMMER 2021

Program or Department Mission

The Department of Mathematics/Engineering/Physical Sciences offers a broad range of courses that service the career programs of the college and that will transfer to baccalaureate degree granting institutions. The department also offers developmental mathematics courses to prepare students for college level mathematics.

Instructional Program Outcomes & Assessment Plan – MTH 265

Mathematics Course Level Outcomes Assessment Rubric

Level 4: Student provides a complete and correct solution process that is well organized, with no errors.

Level 3: Student provides a complete solution process that is well organized, but contains minor errors.

Level 2: Student demonstrates understanding of methods required to produce a correct solution, but the solution process lacks expected organization and/or contains errors deemed more significant.

Level 1: Student attempts a solution, but demonstrates little understanding of methods required to produce a correct solution with expected organization.

Level 0: Student does not attempt a solution.

Evaluated Course Objectives

The General Educational Objective is met through the course objectives which require use of mathematical concepts, notations, and manipulations necessary in students' field of study. Student mastery of the specific course objectives that follow will be evaluated by analyzing solutions for appropriate problems from the comprehensive final exam. The final exam will not be a multiple-choice exam. Students are required to show all their work and will be graded on the quality of their technique, notation, and accuracy.

The student will demonstrate knowledge of statistics by his/her ability to

1. Calculate variance and standard deviation for a set of sample data
2. Estimate an interval for the true mean from a set of sample data
3. Set up and conduct a statistical test for the mean

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
MTH 265 Objective 1 Calculate the variance and standard deviation of a set of sample data.	Rubric based assessment of related common final exam problems 1) Calculate variance and standard deviation for a set of sample data. *For the mallard ducks and Canada geese the following percentages of successful nests were obtained in a study:*	70% of students learning at a rubric level of 2 or higher	Online Campus Level 4 142/177 80.23% Level 3 5/177 2.82% Level 2 26/177 14.7% Level 1 4/177 2.26% Level 0 - 0%	**Observations/Changes:** 92.7% (164/177) performed at Level 2 or higher. Lower than the previous data of 100% due to classes being online during the pandemic. Our recommendation is to create a EdPuzzle video explaining variance and standard deviation. https://edpuzzle.com/media/6140eca35d6e1a4190720925 .

	x: Percentage success for mallard duck nests *56 85 52 13 39* *y: Percentage success for Canada goose nests* *24 53 60 69 18* *Compute the variance and standard deviation for x and y and their corresponding coefficient of variation to compare and identify which set of data is more consistent.*			
<u>MTH 265 Objective 2</u> Estimate an interval for the true mean from a set of sample data.	Rubric based assessment of related common final exam problems 2) Estimate an interval for the true mean from a set of sample data.	70% of students learning at a rubric level of 2 or higher	Online Campus Level 4 150/177 84.75% Level 3 1/177 0.56% Level 2 20/177 11.30% Level 1 3/177 1.7% Level 0 3/177 1.7%	**Observations/Changes:** 88.136% (156/177) performed at Level 2 or higher. Lower than the previous data of 99.3% due to classes being online during the pandemic. Our recommendation is to create a study guide to better prepare students for the SLOs assessment. Students can also complete the guided exercise in

	For this problem, carry at least four digits after the decimal in your calculations. Ans wers may vary slightly due to rounding. *In a combined study of northern pike, cutthroat trout, rainbow trout, and lake trout, it was found that 26 out of 855 fish died when caught and released using barbless hooks on flies and lures. All hooks were removed from the fish. Let p represent the proportion of all pike and trout that die (i.e., p is the mortality rate) wen caught and released using barbless hooks. Find a 99% confidence interval for p. (Round your final*			the textbook. The study guide will be made available at the beginning of the semester. No classes were available on-site due to the pandemic. **Study Guide** Please refer to these examples in the textbook to help you complete the SLOs Assessment. Assessment of Objective 1: Section 3.2, textbook page 107, Example 6 and pages 111-112, Example 7. Assessment of Objective 2: Section 8.2, textbook pages 390, Example 5. Assessment of Objective 3: Section 9.2, textbook pages 449-450, Example 5. MTH265 SLOs Study Guide Problems.pdf

	answers to three decimal places.)			
MTH 265 Objective 3 Set up and conduct a statistical test for the mean.	Rubric based assessment of related common final exam problems 3) Set up and conduct a statistical test for the mean. *Let x be a random variable that represents hemoglobin count (HC) in grams per 100 milliliters of whole blood. Then x has a distribution that is approximately normal, with population mean of about 14 for healthy adult women. Suppose that a female patient has taken 10 laboratory blood tests during the past year. The HC data sent to the patient's doctor are*	70% of students learning at a rubric level of 2 or higher	Online Campus Level 4 147/177 83.1% Level 3 - 0% Level 2 18/177 10.2% Level 1 6/177 3.4% Level 0 6/177 3.4%	**Observations/Changes:** 93.2% (165/177) performed at Level 2 or higher. Lower than the previous data of 98.7% due to classes being online during the pandemic. Our recommendation is to create a study guide to better prepare students for the SLOs assessment. The study guide will be made available at the beginning of the semester. No classes were available on-site due to the pandemic. **Study Guide** Please refer to these examples in the textbook to help you complete the SLOs Assessment. Assessment of Objective 1: Section 3.2, textbook page 107, Example 6 and pages 111-112, Example 7. Assessment of Objective 2: Section 8.2, textbook pages 390, Example 5. Assessment of Objective 3: Section 9.2, textbook pages 449-450, Example 5. MTH265 SLOs Study Guide Problems.pdf

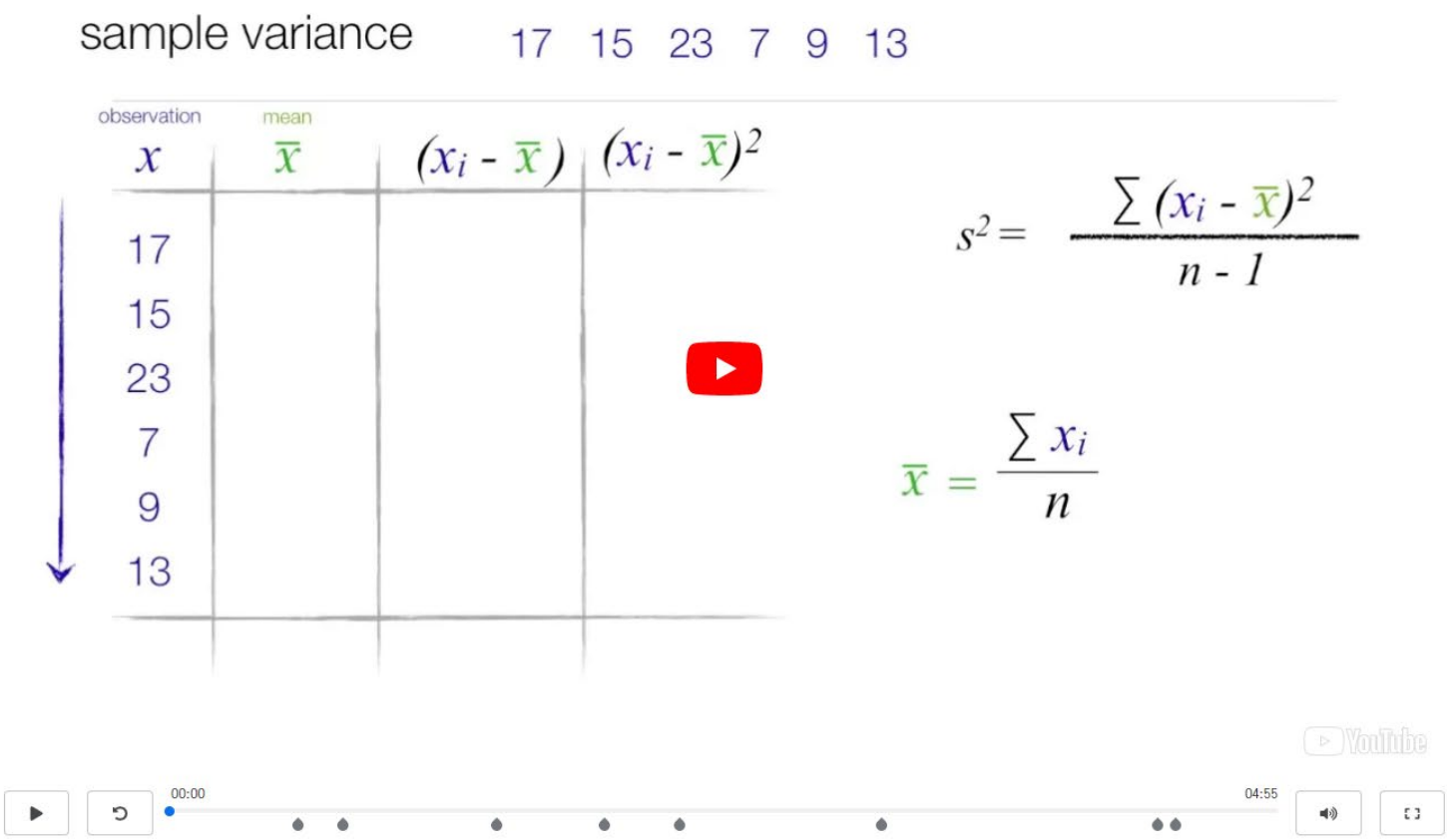
	15 18 16 *19 14 12 14* *17 15 11* *Using α=0.01, does this information indicate the population average HC for this patient is higher than 14?*			

Evidence for SLO 1

edpuzzle

SLOs Assessment Objective 1 Note for Variance and Standard Deviation

SU Moore



September 10, 2021

Evidence for SLO 2 and SLO 3

SLOs Assessment Study Guide

EXAMPLE 6

Sample Standard Deviation (Defining Formula)

Big Blossom Greenhouse was commissioned to develop an extra large rose for the Rose Bowl Parade. A random sample of blossoms from Hybrid A bushes yielded the following diameters (in inches) for mature peak blooms.

2 3 3 8 10 10

Use the defining formula to find the sample variance and standard deviation.

EXAMPLE 7

Coefficient of Variation

The Trading Post on Grand Mesa is a small, family-run store in a remote part of Colorado. The Grand Mesa region contains many good fishing lakes, so the Trading Post sells spinners (a type of fishing lure). The store has a very limited selection of spinners. In fact, the Trading Post has only eight different types of spinners for sale. The prices (in dollars) are

2.10 1.95 2.60 2.00 1.85 2.25 2.15 2.25

Since the Trading Post has only eight different kinds of spinners for sale, we consider the eight data values to be the *population*.

(a) Use a calculator with appropriate statistics keys to verify that for the Trading Post data, $\mu \approx \$2.14$ and $\sigma \approx \$0.22$.

SOLUTION: Since the computation formulas for $\bar{x}$ and μ are identical, most calculators provide the value of $\bar{x}$ only. Use the output of this key for μ. The computation formulas for the sample standard deviation s and the population standard deviation s are slightly different. Be sure that you use the key for σ (sometimes designated as σ_n or σ_x).

(b) Compute the *CV* of prices for the Trading Post and comment on the meaning of the result.

EXAMPLE 5

Confidence Interval for μ When σ Is Unknown

Suppose an archaeologist discovers seven fossil skeletons from a previously unknown species of miniature horse. Reconstructions of the skeletons of these seven miniature horses show the shoulder heights (in centimeters) to be

45.3 47.1 44.2 46.8 46.5 45.5 47.6

For these sample data, the mean is $\bar{x} \approx 46.14$ and the sample standard deviation is $s \approx 1.19$. Let μ be the mean shoulder height (in centimeters) for this entire species of miniature horse, and assume that the population of shoulder heights is approximately normal.

Find a 99% confidence interval for μ, the mean shoulder height of the entire population of such horses.

EXAMPLE 5

Critical Region Method of Testing μ

Consider Example 3 regarding sunspots. Let x be a random variable representing the number of sunspots observed in a 4-week period. A random sample of 40 such periods from Spanish colonial times gave the number of sunspots per period. The raw data are given in Example 3. The sample mean is $\bar{x} \approx 47.0$. Previous studies indicate that for this period, $\sigma = 35$. It is thought that for thousands of years, the mean number of sunspots per 4-week period was about $\mu = 41$. Do the data indicate that the mean sunspot activity during the Spanish colonial period was higher than 41? Use $\alpha = 0.05$.

September 10, 2021

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2020 – Summer 2021

Department Outcomes

- Provide freshman and sophomore-level courses in Chemistry. Mathematics, Physics, Physical Sciences and Astronomy, with emphasis on critical thinking and analytical ability that are transferable to public institutions of higher learning.
- Offer an appropriate remedial mathematics program accommodating various skill levels.
- Develop and provide courses relevant to the career and professional degree programs of the college.

Evaluated Course Objectives

The student will demonstrate his/her knowledge of physical science using writing skills with correct grammar, spelling and punctuation by being able to:

1. Describe and differentiate between comets, meteors and asteroids.
2. Describe different kinds of weather fronts and their associated characteristics.
3. List the three types of rocks and describe their formation.

Instructional Program Outcomes & Assessment Plan – PHS 111

Physical Science 111 Course Level Outcomes Assessment Rubric

For Exam and Quiz Questions

Level 4: Student provides a complete and correct response that is well organized, with no errors.

Level 3: Student provides a complete response that is well organized, but contains minor errors.

Level 2: Student demonstrates understanding of methods required to produce a correct response, but lacks expected organization and/or contains errors deemed more significant.

Level 1: Student attempts a response, but demonstrates little understanding of subject required to produce a correct response with expected organization.

Level 0: Student does not attempt a response.

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
PHS 111 Objective 1 Describe and differentiate between comets, meteors and asteroids	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 3 or higher	**Online Campus** Level 4 94/111 84.7% Level 3 7/111 6.3% Level 2 7/111 6.3% Level 1 0/111 0% Level 0 3/111 2.7%	**Observations/Changes:** Annual Campus-wide total at rubric level 3 or higher: 91.0% There was an increase in the rate of success of 15 % compared to 76% for 2019 – 2020, indicating success in current instructional methods. The criteria for success are met. Note that only Internet courses are reported for this course since on-campus courses were unavailable due to the pandemic. For the 2021 – 2022 year, we plan to introduce links to videos online that illustrate plainly the differences between these entities. Total = 111

<u>PHS 111 Objective 2</u> Describe different kinds of weather fronts and their associated characteristics.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 3 or higher	**Online Campus** Level 4 81/111 73.0% Level 3 15/111 13.5% Level 2 8/111 7.2% Level 1 2/111 1.8% Level 0 5/111 4.5%	**Observations/Changes:** Annual Campus-wide total at rubric level 3 or higher: 86.5% There was an increase in the rate of success of 16.7% compared to 68.9% for 2019 – 2020, indicating success in current instructional methods. The criteria for success are met. Note that only Internet courses are reported for this course since on-campus courses were unavailable due to the pandemic. For the 2021 – 2022 year, we plan to introduce videos online that illustrate the development and effects of different weather fronts. Total = 111

PHS 111 Objective 3 List the three types of rocks and describe their formation.	Rubric based assessment of related common final exam and/or midterm exam questions.	70% of students learning at a rubric level of 3 or higher	***Data collected during SPR21 and SU21.** **Jefferson Campus** Level 4 0% Level 3 0% Level 2 0% Level 1 0% Level 0 0% **Shelby Campus** Level 4 0% Level 3 0% Level 2 0% Level 1 0% Level 0 0% **Clanton Campus** Level 4 0% Level 3 0% Level 2 0% Level 1 0% Level 0 0% **Pell City Campus** Level 4 0% Level 3 0% Level 2 0% Level 1 0% Level 0 0% **Online Campus** Level 4 0% Level 3 0% Level 2 0% Level 1 0% Level 0 0%	Annual Campus-wide total at rubric level 3 or higher: Unfortunately, this question was inadvertently left off of the final and midterm exams. Only Internet courses were offered for this course since on-campus courses were unavailable due to the pandemic. Prior to this situation these major exams were given on campus with paper exams. For the 2021 – 2022 year, we plan to a) ensure this question is included on major exams, and b) introduce a learning exercise focused on the rock cycle to help cement student understanding of rock formation and metamorphosis.

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2020 – Summer 2021

Department Outcomes

- Provide freshman and sophomore-level courses in Chemistry. Mathematics, Physics, Physical Sciences and Astronomy, with emphasis on critical thinking and analytical ability that are transferable to public institutions of higher learning.
- Offer an appropriate remedial mathematics program accommodating various skill levels.
- Develop and provide courses relevant to the career and professional degree programs of the college.

Evaluated Course Objectives

The student will demonstrate his/her knowledge of physical science using writing skills with correct grammar, spelling and punctuation by being able to:

1. Calculate the formula weight of a compound.
2. Calculate the %-age composition of a compound.
3. Compound the speed of a falling object given the time and initial speed.

Instructional Program Outcomes & Assessment Plan – PHS 112

Physical Science 112 Course Level Outcomes Assessment Rubric

For Exam and Quiz Questions

Level 4: Student provides a complete and correct response that is well organized, with no errors.

Level 3: Student provides a complete response that is well organized, but contains minor errors.

Level 2: Student demonstrates understanding of methods required to produce a correct response, but lacks expected organization and/or contains errors deemed more significant.

Level 1: Student attempts a response, but demonstrates little understanding of subject required to produce a correct response with expected organization.

Level 0: Student does not attempt a response.

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
PHS 112 Objective 1 Calculate the formula weight of a compound.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 3 or higher	**Online Campus** Level 4 36/64 56.3% Level 3 10/64 15.6% Level 2 7/64 10.9% Level 1 0/64 0% Level 0 11/64 17.2%	**Observations/Changes:** Annual Campus-wide total at rubric level 3 or higher: 71.9% There was an increase in the rate of success of 3.3% compared to 68.6% for 2019 – 2020, indicating minimal improvement for success in current instructional methods. The criteria for success are met. Note that only Internet courses are reported for this course since on-campus courses were unavailable due to the pandemic. For the 2021 – 2022 year, we plan to introduce videos that illustrate how to solve formula weight problems. Total = 64

PHS 112 Objective 2 Calculate the %-age composition of a compound.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 3 or higher	**Online Campus** Level 4 26/64 40.6% Level 3 8/64 12.5% Level 2 11/64 17.2% Level 1 2/64 3.1% Level 0 17/64 26.6%	**Observations/Changes:** Annual Campus-wide total at rubric level 3 or higher: 53.1% There was an increase in the rate of success of 4.5% compared to 48.6% for 2019 – 2020, indicating a small improvement of success in current instructional methods. The criteria for success are not met. However, around 10 of 64 students reported the correct answer, but did not show their work. Note that only Internet courses are reported for this course since on-campus courses were unavailable due to the pandemic. For the 2021 – 2022 year, we plan to stress the importance of following exam instructions. To help students learn steps for calculating the %-age composition, we plan to introduce practice problems for this and other calculations. This should help their test performance on problems like this one. Total = 64

PHS 112 Objective 3 Compute the speed of a falling object given the time and initial speed.	Rubric based assessment of related common final exam and/or midterm exam questions.	70% of students learning at a rubric level of 3 or higher	**Online Campus** Level 4 23/64 35.9% Level 3 5/64 7.8% Level 2 19/64 29.7% Level 1 5/64 7.8% Level 0 12/64 18.8%	**Observations/Changes:** Annual Campus-wide total at rubric level 3 or higher: 43.7% There was a decrease in the rate of success of 4.9% compared to 48.6% for 2019 – 2020, indicating success in current instructional methods. The criteria for success are not met. Over 25% of students reported the correct answer, but did not show their work for this problem. Note that only Internet courses are reported for this course since on-campus courses were unavailable due to the pandemic. For the 2021 – 2022 year, we plan to introduce an exercise to help students learn the formula we use when solving this problem. We also plan to stress the importance of showing all calculations when directed to in an exam. Total = 64

Assessment Record

Program: Mathematics, Engineering and Physical Science **Assessment period:** Fall 2020 - Summer 2021

Program or Department Mission:

The Department of Mathematics/Engineering/Physical Sciences offers a broad range of courses that service the career programs of the college and that will transfer to baccalaureate degree granting institutions. The department also offers developmental mathematics courses to prepare students for college level mathematics.

Course Student Learning Outcomes & Assessment Plan – PHY 201

Physics Course Level Outcomes Assessment Rubric

Level 3: Attempted Problem and Solved Correctly (full credit)
Level 2: Attempted Problem and Did Not Solve Correctly, Some Understanding of Problem Solution (at least half credit)
Level 1: Failed to Show Understanding of Problem Solution (less than half credit)
Level 0: Did Not Attempt Problem

Departmental Level Student Learning Outcomes

1. Students will acquire content knowledge of the physical sciences and mathematics.
2. Students will develop problem solving and critical thinking skills
3. Students will be prepared to use mathematics in other disciplines

Course Objective assessed

The student will demonstrate fundamental skills of physics and mathematics to solve problems by his /her ability to:

1. Understand Newton's laws and attendant concepts will apply these in appropriate situations.
2. Understand energy and momentum and be able to apply these concepts to describing the behavior of system of particles.
3. Understand and be able to apply principles relating to the macroscopic properties of matter. (State and apply Archimedes' Principle and Bernoulli's relation in problem situations.

Instructional Program Outcomes & Assessment Plan

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
PHY 201 Objective 1: Understand Newton's laws and attendant concepts will apply these in appropriate situations.	Rubric based assessment of related final exam problems Note that no specific problems were listed for this objective from the SLOs completed by this instructor.	At least 70% of students will produce solutions at rubric level 2 or higher.	Internet Campus (3 Problems) Level 3 43/45 96% Level 2 1/45 2% Level 1 0/45 0% Level 0 1/45 2%	**Observations/Changes:** For these problems (44/45) 98% of students performed at level 2 or higher. The student performance was up from 73% last year. We suggest that concentration on other topics might be useful but we might be able to offer some more challenging problems on this topic in the homework. See Addendum A.

PHY 201 Objective 2: Understand energy and momentum and be able to apply these concepts to describing the behavior of system of particles.	Rubric based assessment of related final exam problems. Note that no specific problems were listed for this objective.	At least 70% of students will produce solutions at rubric level 2 or higher.	Internet Campus (3 Problems) Level 3 39/45 87% Level 2 2/45 4% Level 1 3/45 7% Level 0 1/45 2%	**Observations/Changes:** For these problems (41/45) 91% of students performed at level 2 or higher. The student performance was down from 100% last year. We suggest that concentration on other topics might be useful but we might be able to offer some more challenging problems on this topic in the homework that incorporate both energy and momentum principles. See Addendum B.

PHY 201 Objective 3: Understand and be able to apply principles relating to the macroscopic properties of matter. (State and apply Archimedes' Principle and Bernoulli's relation in problem situations.	Rubric based assessment of related final exam problems. Note that no specific problems were listed for this objective from the SLOs.	At least 70% of students will produce solutions at rubric level 2 or higher.	Internet Campus (4 Problems) Level 3 53/60 89% Level 2 2/60 3% Level 1 2/60 3% Level 0 3/60 5%	**Observations/Changes:** For these problems (55/60) 92% of students performed at level 2 or higher. The student performance was up from 67% last year. We suggest that concentration on other topics might be useful but we might be able to offer some more challenging problems on this topic in the practice problems and lecture. See Addendum C.
Plan submission date: 8/21/2020			**Submitted by: Department of Mathematics, Engineering and Physical Sciences, Robert Wallace**	

Addendum A
We will include questions similar to the following in the homework:

A string directed at a 30. 0 ° angle above the horizontal is attached to a 100. 0 kg box on a horizontal surface. The coefficient of static friction between the box and the surface is 0. 400. Find (a) the normal force on the box, (b) the maximum tension that can be applied before the box just starts to slide, and (c) the static friction at that moment.

Addendum B
We will include questions similar to the following in the homework:

A 1. 25 kg mass with an initial speed of 4. 00 m/s traveling due east collides head-on in an elastic collision with a 5. 00 kg mass having an initial speed of 1. 50 m/s traveling due west. Find (a) the final velocity of the small mass, (b) the final velocity of the large mass, and (c) the change in kinetic energy of the smaller mass.

Addendum C
We will include questions similar to the following in the practice problems:

Water is flowing under a pressure of 5.00x10^5 Pa and with a fluid speed of 10. 0 m/s through a pipe that has a radius of 0. 120 m and is located 50. 0 m above ground level. The water continues to flow through a series of pipes that do not branch until it reaches a pipe at ground level that has a radius of 0. 100 m. Compute (a) the mass flow rate at ground level, (b) the volume flow rate at ground level, (c) the fluid speed at ground level, and (d) the pressure at ground level.

Assessment Record

Program: Mathematics, Engineering and Physical Science **Assessment period:** Fall 2020 - Summer 2021

Program or Department Mission:

The Department of Mathematics/Engineering/Physical Sciences offers a broad range of courses that service the career programs of the college and that will transfer to baccalaureate degree granting institutions. The department also offers developmental mathematics courses to prepare students for college level mathematics.

Course Student Learning Outcomes & Assessment Plan – PHY 213S

Physics Course Level Outcomes Assessment Rubric

Level 3: Attempted Problem and Solved Correctly (full credit)
Level 2: Attempted Problem and Did Not Solve Correctly, Some Understanding of Problem Solution (at least half credit)
Level 1: Failed to Show Understanding of Problem Solution (less than half credit)
Level 0: Did Not Attempt Problem

Departmental Level Student Learning Outcomes

1. Students will acquire content knowledge of the physical sciences and mathematics.
2. Students will develop problem solving and critical thinking skills
3. Students will be prepared to use mathematics in other disciplines

Course Objectives assessed

The student will demonstrate fundamental skills of physics and mathematics to solve problems by his /her ability to:

1. Solve projectile motion problems.
2. State and apply Newton's second law
3. Calculate potential energy in the gravitational field.

Instructional Program Outcomes & Assessment Plan

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
PHY 213S Objective 1 Solve projectile motion problems.	Rubric based assessment of a final exam problem related to objective 1	At least 70% of students will produce solutions at rubric level 2 or higher.	Jefferson Campus (Prob 1) Level 3 38/52 73% Level 2 0/52 0% Level 1 0/52 0% Level 0 14/52 27%	For problem 1 (38/52) 73% of students performed at level 2 or higher. The student performance was down slightly from 73% for prob 1 last year. We suggest that a requirement of writing the kinematic formulas before any projectile motion problems. See Addendum A. There were several students in my recent traditional classes like this one, who had become used to multiple choice style testing and had forgotten how to actually to work out problems on paper from start to finish and generally did not practice working out the practice problems, thinking that they would get another test where they could make a good guess at the correct provided answer. These students generally had a very difficult time readjusting in the beginning. As a result, there was there was a significant gap in performance between students who actually worked the practice problems and students who simply read the solutions, despite the instructions. However, as the course progressed the students tended to do much better as they realized that the expectations were non-trivial.

PHY 213S Objective 2 State and Apply Newton's second law.	Rubric based assessment of a final exam problem that meets objective 2	At least 70% of students will produce solutions at rubric level 2 or higher.	Jefferson Campus (Prob 2) Level 3 44/52 84% Level 2 3/52 6% Level 1 0/52 0% Level 0 5/52 10% Internet Campus (Prob 3) Level 3 34/52 65% Level 2 11/52 21% Level 1 2/52 4% Level 0 5/52 10%	For problem 2 (47/52) 90% of students and for problem 3 (45/52) 86% of students performed at level 2 or higher. The student performance was for both problems from 82% for prob 2 and 82% for prob 3 last year. We suggest that concentration on other topics might be provide so additional lab work on this topic to further reinforce understanding of this material. See Addendum B.

PHY 213S Objective 3 Calculate potential energy in the gravitational field.	Rubric based assessment of a final exam problem that illustrates objective 3	At least 70% of students will produce solutions at rubric level 2 or higher.	Jefferson Campus (Prob 4) Level 3 46/52 88% Level 2 0/52 0% Level 1 0/52 0% Level 0 6/52 12% Internet Campus (Prob 5) Level 3 38/52 73% Level 2 5/52 10% Level 1 2/52 4% Level 0 7/52 13%	For problem 4 (46/52) 88% of students and for problem 5 (43/52) 83% of students performed at level 2 or higher. The student performance was up for both problems from 70% for prob 4 and 69% for prob 5 last year. We suggest that concentration on other topics might be useful but we might be able to offer some more challenging problems on this topic in the homework. See Addendum C.
			Submitted by: Department of Mathematics, Engineering and Physical Sciences, Robert Wallace	

Addendum A

We will include questions similar to the following in the practice problems:

A projectile is launched from a height of 50. 0 m above the ground with an initial speed of 175 m/s at an angle of the 55. 0 ° above the horizontal. Find (a) the maximum height of the object, (b) the maximum horizontal distance traveled, and (c) the speed of the object when it hits the ground. Write down all of the kinematic formulas before you start.

Addendum B

We will include questions similar to the following in the homework problem that might incorporate more related topics with Newton's Laws:

Suppose that a 0. 250 kg object lies 0. 200 m from the center of a turntable that is spinning at 0. 500 rev/s just before the object begins to slide. Compute (a) the tangential speed of the object, (b) the centripetal acceleration of the object, (c) the static friction between the object and the turntable, and (d) the coefficient of static friction between the object and the turntable.

Addendum C

We will include questions similar to the following in the homework problems that might incorporate more advanced use of fundamental principles:

A rod of uniform mass density lies on the x-axis with its left end at the origin. The rod is 2. 00 m long and has a total mass of 50. 0 kg. Compute (a) the gravitational force that the rod exerts on a 10. 0 kg point mass located on the x-axis 25. 0 m to the right of the origin and (b) the gravitational potential of the point mass due to the rod.

Course Objectives Assessed and Related Example Problems

The student will demonstrate fundamental skills of physics and mathematics to solve problems by his /her ability to:

1. Solve projectile motion problems.

   Example Problem 1
   A projectile is launched from a height of 25.0 m above the ground with an initial speed of 150.0 m/s at an angle of the 60.0° above the horizontal. Find (a) the maximum height of the object, (b) the maximum horizontal distance traveled, and (c) the speed of the object when it hits the ground.

2. State and apply Newton's second law

   Example Problem 2
   A string directed at a 60.0° angle above the horizontal is attached to a 10.0 kg box on a horizontal surface and the string is pulled with a tension of 50.0 N. The coefficient of kinetic friction between the box and the surface is 0.150. Find (a) the normal force on the box, (b) the kinetic friction, and (c) the acceleration of the box.

3. Calculate potential energy in the gravitational field.

   Example Problem 3
   A 20.0 kg mass slides 100.0 m down a 30.0° incline plane before friction brings the object to rest at the bottom. The initial velocity of the mass is 8.00 m/s. Compute (a) the initial gravitational potential energy of the mass assuming that the potential is zero at ground level and compute (b) the initial kinetic energy of the mass, and (c) the work done by friction?

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2020 – Summer 2021

Program or Department Mission:
The Department of Mathematics/Engineering/Physical Sciences offers a broad range of courses that service the career programs of the college and that will transfer to baccalaureate degree granting institutions.

Instructional Program Outcomes & Assessment Plan – PHY 214S

Physics Course Level Outcomes Assessment Rubric

Level 3: Attempted Problem and Solved Correctly (full credit)
Level 2: Attempted Problem and Did Not Solve Correctly, Some Understanding of Problem Solution (at least half credit)
Level 1: Did Not Attempt Problem or Failed to Show Understanding of Problem Solution (less than half credit)

Evaluated Course Objectives
The General Educational Objective is met through the course objectives which require use of mathematical concepts, notations, and manipulations necessary in students' field of study. Student mastery of the specific course objectives that follow will be evaluated by analyzing solutions for appropriate problems from the comprehensive final exam. The final exam will not be a multiple-choice exam. Students are required to show all of their work and will be graded on the quality of their technique, notation, and accuracy. The rubric above was used to evaluate the problems during the previous year including fall of 2020 through summer 2021.

The student will demonstrate knowledge of electromagnetic theory by his/her ability to:

1. Solve problems that involve electric fields.
2. Solve problems that involve magnetic fields.
3. Solve problems that involve electric circuits.

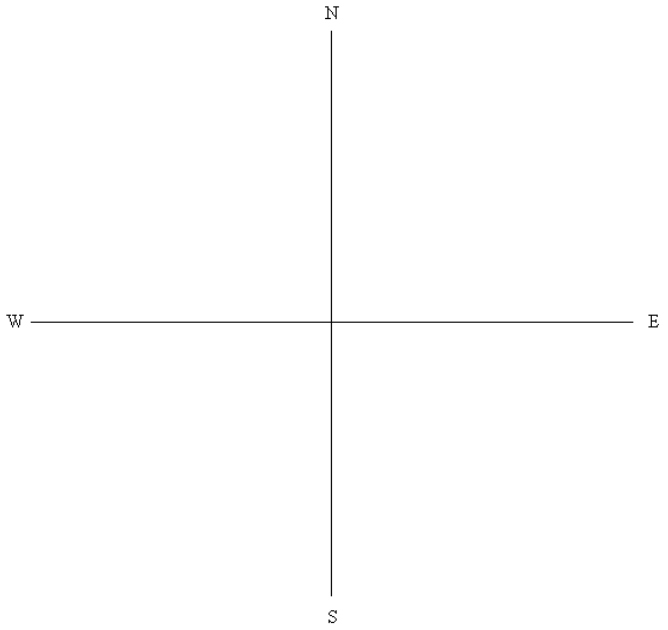
Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
PHY 214S Objective 1 Solve problems that involve electric fields.	Rubric based assessment of a final exam problem related to objective 1	70% of students learning at a rubric level of 2 or higher	Internet Campus Level 3 16/21 76% Level 2 0/21 0% Level 1 5/21 24%	**Observations/Changes:** 76% (16/21) performed at Level 2 or higher. Down from 100% last year. The overall percentage of students that scored at level 2 or higher decreased. Our recommendation is to add additional review on vector addition in lab exercises as this seemed to be the most common cause of difficulty. See Addendum A.
PHY 214S Objective 2 Solve problems that involve magnetic fields.	Rubric based assessment of a final exam problem that illustrates objective 2	70% of students learning at a rubric level of 2 or higher	Internet Campus Level 3 12/21 57% Level 2 8/21 38% Level 1 1/21 5%	**Observations/Changes:** 95% (20/21) performed at Level 2 or higher. Down from 100% last year. The overall percentage of students that scored at level 2 or higher increased this academic year. Our recommendation is to add additional review on vector cross products in the homework as this seemed to be the most common cause of difficulty. See Addendum B.

PHY 214S Objective 3 Solve problems that involve electric circuits.	Rubric based assessment of a final exam problem that falls under objective 3	70% of students learning at a rubric level of 2 or higher	Internet Campus Level 3 12/21 57% Level 2 8/21 38% Level 1 1/21 5%	**Observations/Changes:** 95% (20/21) performed at Level 2 or higher. Down from 100% last year. The overall percentage of students that scored at level 2 or higher decreased during this academic year. Our recommendation is to add additional review on the solution of systems of equations in during lecture as this seemed one place where students often made mistakes. See Addendum C.

Addendum A

We will include a lab where students have to work carefully through a vector addition problem such as the following:

Use the head-to-tail method to solve the following displacement problem. An ant travels 5.50 cm due north, then travels 4.20 cm due west, then travels 8.00 cm 60º south of east, then travels 4.80 cm 30º north of west, and then finally travels 7.00 cm due south. Using the ruler and the protractor on the N-S-E-W diagram, sketch each displacement in order in the head-to-tail configuration that we discussed in class. Then sketch the resultant vector displacement (which is the vector sum) and determine the magnitude and the direction of the resultant using the ruler and the protractor.



Magnitude of the displacement _____

Direction of the displacement _____

Addendum B

We will include questions similar to the following in the homework problem that provides practice in the computation of cross-products similar to the following:

Suppose that an infinitely long wire lying along the x-axis carries a current of I = 25.0 A in the positive x-direction and suppose that a charge of q = 2.50 C is located a distance D = 1.25 m above the wire in the xy-plane and has a velocity of v = 5.00 m/s in the positive x-direction as illustrated below. Calculate (a) the magnitude of the magnetic induction due to the wire at the position of the charge, (b) the direction of the magnetic induction due to the wire at the position of the charge, (c) the magnitude of magnetic force on the charge, and (d) the direction of the magnetic force on the charge. (Diagram not shown here.)

Addendum C

We will include questions similar to the following in the lecture that provides practice in the setting up the required system of equations and of solving the system similar to the following:

Compute (a) the current I1, (b) the current I2, and (c) the current I3 through the indicated segments of the circuit. Also compute (d) the total power delivered to the resistors and (e) the total power supplied by the batteries where E1 = 6.00 V, E2 = 4.00 V, R1 = 2.00 Ω, R2 = 3.00 Ω, R3 = 5.00 Ω, R4 = 2.50 Ω, and R5 = 4.25 Ω. (Diagram not shown here.)

Evaluated Course Objectives and Related Example Problems

The General Educational Objective is met through the course objectives which require use of mathematical concepts, notations, and manipulations necessary in students' field of study. Student mastery of the specific course objectives that follow will be evaluated by analyzing solutions for appropriate problems from the comprehensive final exam. The final exam will not be a multiple-choice exam. Students are required to show all of their work and will be graded on the quality of their technique, notation, and accuracy. The rubric above was used to evaluate the problems during the previous year including fall of 2020 through summer 2021.

The student will demonstrate knowledge of electromagnetic theory by his/her ability to:

1. Solve problems that involve electric fields.

   Example Problem 1

   Point charges of 2.50 C and 8.75 C are located on the positive *x*-axis at positions of *x* = 15.0 m and *x* = 25.0 m, respectively. Compute (a) the magnitude and (b) the direction of the electric field at the origin, and (c) the magnitude and (d) the direction of the electric force on a point charge of 4.00 C located at the origin.

2. Solve problems that involve magnetic fields.

   Example Problem 2

   Suppose that an infinitely long wire lying along the *x*-axis carries a current of 50.0 A in the positive *x*-direction and suppose that a charge of 5.50 C is located 2.75 m above the wire in the *xy*-plane and has a velocity of 4.00 m/s in the negative *x*-direction. Calculate (a) the magnitude of the magnetic field due to the wire at the position of the charge, (b) the direction of the magnetic field due to the wire at the position of the charge, (c) the magnitude of magnetic force on the charge, and (d) the direction of the magnetic force on the charge.

3. Solve problems that involve electric circuits.

   Example Problem 3

   Compute (a) the equivalent resistance of the circuit Req, (b) the current I1, (c) the current I2, and (d) the current I3 where *R*1 = 2.50 Ω, *R*2 = 4.25 Ω, *R*3 = 2.00 Ω, *R*4 = 5.25 Ω, *R*5 = 2.25 Ω, *R*6 = 2.50 Ω, and *E* = 16.0 V.