Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2019 – Summer 2020

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

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 The student will demonstrate knowledge of astronomy by his/her ability to 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 common final exam problem that fits the description given in objective 1	70% of students learning at a rubric level of 3	Jefferson Campus Level 3 97/105 92% Level 2 17/105 8% Level 1 0/105 0% Shelby Campus Level 3 94/117 80% Level 2 16/117 14% Level 1 7/117 6%	86% (191/222) performed at Level 3 or higher. Up from 81% last year. The overall percentage of students that scored at level 3 increased this academic year. Our recommendation is to continue adding discussion questions on the relative sizes of objects in our universe in the chapter review.

				Our recommendation from last year was to continue add discussion questions on the relative sizes of objects in our universe in the chapter review, see Addendum 1.
AST 220 Objective 2 The student will demonstrate knowledge of astronomy by his/her ability to 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.	Rubric based assessment of a related common final exam problem that fits the description given in objective 2	70% of students learning at a rubric level of 3	Jefferson Campus Level 3 86/105 82% Level 2 19/105 18% Level 1 0/105 0% Shelby Campus Level 3 92/117 79% Level 2 18/117 15% Level 1 7/117 6%	80% (178/222) performed at Level 3 or higher. Up from 79% 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. Our recommendation from last year was to continue adding discussion questions the timing of events since the Big Bang in the chapter review, see Addendum 2.

AST 220 Objective 3 The student will demonstrate knowledge of astronomy by his/her ability to 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 common final exam problem that fits the description given in objective 3	70% of students learning at a rubric level of 3	Jefferson Campus Level 3 90/105 86% Level 2 15/105 14% Level 1 0/105 0% Shelby Campus Level 3 89/117 76% Level 2 21/117 18% Level 1 7/117 6%	81% (179/222) performed at Level 3 or higher. Up from 78% last year. The overall percentage of students that scored at level 3 increased this academic year. Our recommendation is to continue to include additional demonstrations of the basic scientific principles in lab to help further increase understanding. Our recommendation last year was to continue to include additional discussions/demonstrations of the basic scientific principles in lab to help further increase understanding, see Addendum 3.

Ast 220 Addendum Fall 2019 – Summer 2020

Addendum 1: An example question: Be able to describe our solar system if it were reduced in size by a factor of 10
billion so that the sun is about the size of a grapefruit.

Addendum 2: An example question: Be able to identify the approximate times of key events in cosmic and human history
if the entire life of the universe were reduced to a year.

Addendum 3: An example question: Describe the path that the earth makes around the sun during one year.

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2019 – Summer 2020

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Instructional Program Outcomes & Assessment Plan – CHM 104

Chemistry Course Level Outcomes Assessment Rubric

Level 4: Student provides a correct response that is well organized
Level 3: Student provides a partially correct response containing well over half of the facts expected in a Level 4 response
Level 2: Student provides partially correct response containing less than one half of the facts expected in a Level 4
Level 1: Student attempts a solution, provides an incorrect response
Level 0: Student does not attempt a solution.

Evaluated Course Objectives

The student will demonstrate knowledge of mathematics by his/her ability to
1. Make conversions between Fahrenheit, Celsius and Kelvin temperature scales.
2. Calculate density, mass, or volume of an object or substance from the given data.
3. Apply the combined gas law to find the volume of a gas when both the temperature and pressure change.

<table>
<tr><th>Intended Outcomes</th><th>Means of Assessment</th><th>Criteria for Success</th><th>Summary & Analysis of Assessment Evidence</th><th>Use of Results</th></tr>
<tr>
<td>CHM 104 Objective 1

The student will demonstrate knowledge of mathematics by his/her ability to make conversions between Fahrenheit, Celsius and Kelvin temperature scales.</td>
<td>Rubric based assessment of related common final exam problems</td>
<td>70% of students learning at a rubric level of 3 or higher</td>
<td>
<table>
<tr><td colspan="2">Internet</td></tr>
<tr><td>Level 4</td><td>57</td></tr>
<tr><td>Level 3</td><td>2</td></tr>
<tr><td>Level 2</td><td>4</td></tr>
<tr><td>Level 1</td><td>2</td></tr>
<tr><td>Level 0</td><td>7</td></tr>
<tr><td colspan="2">N = 72</td></tr>
<tr><td colspan="2">Shelby Campus</td></tr>
<tr><td>Level 4</td><td></td></tr>
<tr><td>Level 3</td><td></td></tr>
<tr><td>Level 2</td><td></td></tr>
<tr><td>Level 1</td><td></td></tr>
<tr><td>Level 0</td><td></td></tr>
</table>
N =
Internet – 81.9%
Shelby Campus –
Overall – % Success
</td>
<td>Changes/Observations-

Overall success is 81.9%.

We plan to incorporate more homework problems related to temperature conversions to solidify student understanding and success in temperature conversions.</td>
</tr>
</table>

<table>
<tr>
<td>CHM 104 Objective 2

The student will demonstrate knowledge of mathematics by his/her ability to calculate density, mass, or volume of an object or substance from the given data.</td>
<td>Rubric based assessment of related common final exam problems</td>
<td>70% of students learning at a rubric level of 3 or higher</td>
<td>
<table>
<tr><td colspan="2">Internet</td></tr>
<tr><td>Level 4</td><td>52</td></tr>
<tr><td>Level 3</td><td>18</td></tr>
<tr><td>Level 2</td><td>5</td></tr>
<tr><td>Level 1</td><td>6</td></tr>
<tr><td>Level 0</td><td>3</td></tr>
<tr><td colspan="2">N = 74</td></tr>
<tr><td colspan="2">Shelby Campus</td></tr>
<tr><td>Level 4</td><td></td></tr>
<tr><td>Level 3</td><td></td></tr>
<tr><td>Level 2</td><td></td></tr>
<tr><td>Level 1</td><td></td></tr>
<tr><td>Level 0</td><td></td></tr>
</table>
N = 84
Internet – 83.3%
Shelby Campus – %
Overall – % Success
</td>
<td>Changes/Observations-

Overall success is 83.3%.

While student success is at an acceptable level, it could be better.

We plan to incorporate more homework problems related to density calculations to solidify student understanding and success in density calculations.</td>
</tr>
<tr>
<td>CHM 104 Objective 3

The student will demonstrate knowledge of mathematics by his/her ability to apply the combined gas law to find the volume of a gas when both the temperature and pressure change.</td>
<td>Rubric based assessment of related common final exam problems</td>
<td>70% of students learning at a rubric level of 3 or higher</td>
<td>
<table>
<tr><td colspan="2">Internet</td></tr>
<tr><td>Level 4</td><td>50</td></tr>
<tr><td>Level 3</td><td>9</td></tr>
<tr><td>Level 2</td><td>3</td></tr>
<tr><td>Level 1</td><td>8</td></tr>
<tr><td>Level 0</td><td>9</td></tr>
<tr><td colspan="2">N = 79</td></tr>
<tr><td colspan="2">Shelby Campus</td></tr>
<tr><td>Level 4</td><td></td></tr>
<tr><td>Level 3</td><td></td></tr>
<tr><td>Level 2</td><td></td></tr>
<tr><td>Level 1</td><td></td></tr>
<tr><td>Level 0</td><td></td></tr>
</table>
N =
Internet – 74.7%
</td>
<td>Changes/Observations-

Overall success is 74.7%.

We plan to incorporate more homework problems related to combined gas law applications to solidify student understanding and success in calculations involving the combined gas law.</td>
</tr>
</table>

Plan submission date: September 24, 2020	**Submitted by: Ann Lyons**

Chemistry Course Level Outcomes Assessment Rubric

Level 4: Student provides a correct response that is well organized
Level 3: Student provides a partially correct response containing well over half of the facts expected in a Level 4 response
Level 2: Student provides partially correct response containing less than one half of the facts expected in a Level 4
Level 1: Student attempts a solution, provides an incorrect response
Level 0: Student does not attempt a solution.

Evidence for SLO 1

I. Below is a problem from the Cengage OWL Homework program on Temperature Conversions that students in CHM 104 actually completed:

In winter, a heated home in the Northeast might be maintained at a temperature of 73 °F. What is this temperature on the Celsius and Kelvin scales?

Temperature = _____ °C

Temperature = _____ K

Feedback Area

Correct

Analyze

The Fahrenheit temperature is given, and you are asked to find the Celsius and Kelvin temperatures.

Given:

Wanted:

Identify

To convert to Celsius, use the equation:

After that use the following equation to convert to Kelvin:

Evidence for SLO 2:

I. Below is a problem from the Cengage OWL Homework program on Density Calculations that students in CHM 104 actually completed:

A general chemistry student found a chunk of metal in the basement of a friend's house. To figure out what it was, she used the ideas just developed in class about density.

She measured the mass of the metal to be 120 grams. Then she dropped the metal into a measuring cup and found that it displaced 16.4 mL of water.

Calculate the density of the metal.

Density = _____ g/mL

This metal is most likely fill in the blank 2_____.

See the following table for densities.

Substance	Density (g/mL)
Water	1.00
Aluminum	2.72
Chromium	7.25
Nickel	8.91
Copper	8.94
Silver	10.50
Lead	11.34
Mercury	13.60

Gold	19.28
Tungsten	19.38
Platinum	21.46

Evidence for SLO 3

I. edwdfBelow are some problems from the Cengage OWL Homework program on the Combined Gas Law problem that students in CHM 104 actually completed:

A sample of a gas occupies a volume of 2.62 liters at 25 °C and 1.00 atm. What will be the volume at 50.0 °C and 2.00 atm?

- 1.42 liters
- 2.62 liters
- 5.68 liters
- 4.83 liters
- 10.5 liters

What is the pressure exerted by **2.44** g Xe gas at **22.0** °C in a **640**-mL flask?

- **6.88** atm
- **92.3** atm

- **0.703** atm
- **0.0524** atm
- **0.000703** atm

The lid is tightly sealed on a rigid flask containing **2.90** L O_2 at **21** °C and **0.810** atm. If the flask is heated to **60** °C, what is the pressure in the flask?

- **0.715** atm
- **1.83** atm
- **0.283** atm
- **0.917** atm
- **2.31** atm

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2019 – Summer 2020

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	**98% schoolwide performed at level 2 or higher. (121/123)** **Jefferson Campus** Level 4 (15/20) 75% Level 3 (5/20) 25% Level 2 (0/20) 0% Level 1 (0/20) 0% Level 0 (0/20) 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.

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	**89% schoolwide performed at level 2 or higher. (109/123)** **Jefferson Campus** Level 4 (8/20) 40% Level 3 (3/20) 15% Level 2 (3/20) 15% Level 1 (3/20) 15% Level 0 (3/20) 15%	**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	**91% schoolwide performed at level 2 or higher. (112/123)** **Jefferson Campus** Level 4 (11/20) 55% Level 3 (5/20) 25% Level 2 (2/20) 10% Level 1 (2/20) 10% Level 0 (0/20) 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: August 28th, 2020	**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).

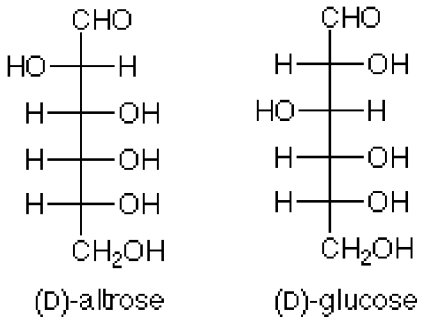
CHM 105 SLO 1

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.

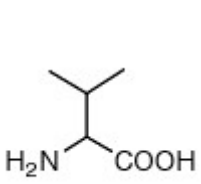
CHM 105 SLO 2

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

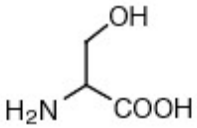


CHM 105 SLO 3

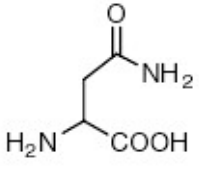
Draw the structure of the tri-peptide Val-Ser-Asn that forms from the following three amino acids



Valine (Val, V)



Serine (Ser, S)



Asparagine (Asn, N)

Examples of Corresponding Homework Problems

SLO 1 Isomers

On a piece of scratch paper draw structural formulas for all of the constitutional isomers that would be named as a **dichloroethane**. The number of compounds is [ ] .

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

12-147. Give the IUPAC names for the eight isomeric halogenated hydrocarbons that have the molecular formula $C_5H_{11}Cl$.

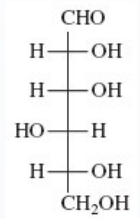
Answer

12-148. Give the IUPAC names for the nine isomeric halogenated hydrocarbons that have the molecular formula $C_4H_8Cl_2$.

SLO 2 Haworth Drawings

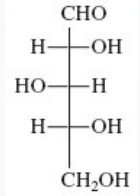
18-79. Draw Haworth projection formulas for the α-anomer of monosaccharides with each of the following Fischer projection formulas.

a.



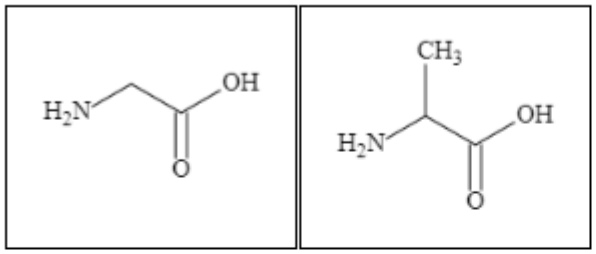
Answer

b.



SLO 3 Peptides

Draw the structure of the tripeptide **Gly-Ala-Gly**, which contains two molecules of glycine (Gly) and one molecule of alanine (Ala). Make sure you combine the amino acids in the correct order.



Glycine (Gly)

Alanine (Ala)

- You do not have to consider stereochemistry.
- By convention, the amide bond in the peptides should be formed in the order that the amino acids are written. Also by convention, the amine end (N terminal) of an amino acid is always written on the left and the acid end (C terminal) is written on the right.

Assessment Record

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Instructional Program Outcomes & Assessment Plan – CHM111

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.

Evaluated Course Objectives

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

1. Carry out calculations relating density, specific gravity, mass, and volume to one another
2. Determine the empirical formula of compound, given the mass percentages of the elements or the analytical data from which these can be calculated, and determine the molecular formula of that compound, given an approximated molecular mass.
3. Given a reaction involving species in solution, relate the volumes or concentrations of two reactant species to the mass of solid precipitated.
4. Use the ideal gas law, determining the moles of a gas sample given its pressure, volume and temperature.
5. Draw the Lewis structure of a molecule or ion and predict its geometry.
6. Draw valid resonance structures including formal charges.
7. Use freezing point depression data to determine the molar mass of a substance.

Intended Outcomes	Means of Assessment	Criteria for Success	Summary and Analysis of Assessment Evidence	Use of Results
SLO 1: Carry out calculations relating density, specific gravity, mass, and volume to one another	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**98% schoolwide performed at level 2 or higher. (121/123)** **Jefferson Campus** Level 4 (29/37) 78.4% Level 3 (6/37) 16.2% Level 2 (1/37) 2.7% Level 1 (1/37) 2.7% Level 0 (0/37) 0.0% **Shelby Campus** Level 4 (79/86) 87.8% Level 3 (2/86) 6.5% Level 2 (4/86) 4.1% Level 1 (1/86) 1.6% Level 0 (0/86) 0.0%	**Observations/Changes:** CHM 111 instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice to improve performance carrying out calculations involving density. CHM 111 instructors will include a corresponding laboratory activity to provide hands-on activities and further opportunities for the students to practice the calculations

SLO 2: Determine the empirical formula of compound, given the mass percentages of the elements or the analytical data from which these can be calculated, and determine the molecular formula of that compound, given an approximated molecular mass.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**89% schoolwide performed at level 2 or higher. (109/123)** **Jefferson Campus** Level 4 (15/37) 40.5% Level 3 (15/37) 40.5% Level 2 (3/37) 8.1% Level 1 (0/37) 0.0% Level 0 (4/37) 10.8% **Shelby Campus** Level 4 (35/86) 40.7% Level 3 (25/86) 32.5% Level 2 (16/86) 15.4% Level 1 (7/86) 5.7% Level 0 (3/86) 5.7%	**Observations/Changes:** CHM 111 instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice to improve performance determining empirical and molecular formulae from combustion data.

SLO 3: Relate the volumes or concentrations of two reactant species to the mass of solid precipitated	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**91% schoolwide performed at level 2 or higher. (112/123)** **Jefferson Campus** Level 4 (26/37) 70.3% Level 3 (5/37) 13.5% Level 2 (6/37) 16.2% Level 1 (0/37) 0.0% Level 0 (0/37) 0.0% **Shelby Campus** Level 4 (41/86) 54.5% Level 3 (17/86) 17.9% Level 2 (17/86) 18.7% Level 1 (9/86) 7.3% Level 0 (2/86) 1.6%	**Observations/Changes:** CHM 111 instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice to improve performance relating volumes, concentrations and masses precipitated.

SLO 4: Use the ideal gas law, determining the moles of a gas sample given its pressure, volume and temperature	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**95% schoolwide performed at level 2 or higher. (117/123)** **Jefferson Campus** Level 4 (33/37) 89.2% Level 3 (0/37) 0.0% Level 2 (4/37) 10.8% Level 1 (0/37) 0.0% Level 0 (0/37) 0.0% **Shelby Campus** Level 4 (67/86) 81.3% Level 3 (9/86) 7.3% Level 2 (4/86) 6.5% Level 1 (4/86) 3.3% Level 0 (2/86) 1.6%	**Observations/Changes:** CHM 111 instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice to improve performance carrying out calculations involving gas laws.

SLO 5: Draw the Lewis structure of a molecule or ion and predict its geometry.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**98% schoolwide performed at level 2 or higher. (117/123)** **Jefferson Campus** Level 4 (35/37) 94.6% Level 3 (1/37) 2.7% Level 2 (1/37) 2.7% Level 1 (0/37) 0.0% Level 0 (0/37) 0.0% **Shelby Campus** Level 4 (65/86) 81.3% Level 3 (11/86) 9.8% Level 2 (8/86) 7.3% Level 1 (0/86) 0.0% Level 0 (2/86) 1.6%	**Observations/Changes** CHM 111 instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice to improve performance in drawing Lewis structures and determining geometries from chemical formulae.
SLO 6: Draw valid resonance structures including formal charges	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**90% schoolwide performed at level 2 or higher. (111/123)** **Jefferson Campus** Level 4 (26/37) 70.3% Level 3 (6/37) 16.2% Level 2 (1/37) 2.7% Level 1 (2/37) 5.4% Level 0 (2/37) 5.4% **Shelby Campus** Level 4 (49/86) 61.0% Level 3 (18/86) 19.5% Level 2 (11/86) 9.8% Level 1 (4/86) 4.9% Level 0 (4/86) 4.9%	**Observations/Changes:** CHM 111 instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice to improve performance drawing resonance structures and calculating formal charges.

SLO 7: The student will demonstrate his/her understanding of chemistry by being able to use freezing point depression data to determine the molar mass of a substance	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**81% schoolwide performed at level 2 or higher. (100/123)** **Jefferson Campus** Level 4 (29/37) 78.4% Level 3 (5/37) 13.5% Level 2 (2/37) 5.4% Level 1 (1/37) 2.7% Level 0 (0/37) 0.0% **Shelby Campus** Level 4 (22/86) 41.5% Level 3 (24/86) 23.6% Level 2 (18/86) 16.3% Level 1 (8/86) 7.3% Level 0 (14/86) 11.4%	**Observations/Changes:** CHM 111 instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice to improve performance carrying out calculations involving density CHM 111 instructors will include a corresponding laboratory activity to provide hands-on activities and further opportunities for the students to practice the calculations
Plan submission date: August 28th, 2020			**Submitted by: Lisa Nagy**	

References

CHM 111 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 111 SLO Common Final Exam Problems:

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

CHM 111 SLO 1

A sample of metal weighing **32.8** grams was placed in a graduated cylinder containing 25.00 ml of water. The water level rose to **28.12** ml. What is the density of the metal?

CHM 111 SLO 2

A **4.582** g sample of an organic compound containing only carbon, hydrogen, and **nitrogen** is subjected to combustion analysis. **12.429** grams of carbon dioxide and **3.559** g of water are isolated. The molar mass of the compound is between **150** and **180** g/mol. What are the empirical and molecular formulas of the compound?

CHM 111 SLO 3

When aqueous solutions of silver nitrate ($AgNO_3$) and potassium chromate (K_2CrO_3) are mixed, the blood-red precipitate silver chromate (Ag_2CrO_3) is formed. If **10.0 mL** of **0.25** *M* aqueous silver nitrate is mixed with **15.0** mL of **0.14** *M* aqueous potassium chromate, what mass of sliver chromate forms?

CHM 111 SLO 4

How many moles of gas are in a gas sample occupying **0.658** L at **0.598** atm and **32 °**C?

CHM 111 SLO 5

Draw a Lewis structure and state the geometry for the molecule **SF_4**.

CHM 111 SLO 6

Draw **two** resonance structures of **ozone, O_3**, showing all lone pairs and formal charges

CHM 111 SLO 7

What is the molar mass (g/mol) of a nonpolar molecular compound if **2.55** grams dissolved in **50.0** grams of **cyclohexane** begins to freeze at **-1.36 °C**? The freezing point of pure **cyclohexane** is **6.55 °C** and the freezing point depression constant, Kfp, is **20.2** °C/m

Examples of Corresponding Homework Problems

SLO 1 Density

1.

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

A general chemistry student found a chunk of metal in the basement of a friend's house. To figure out what it was, **he** used the ideas just developed in class about density.

First **he** measured the mass of the metal to be **120.0** grams. Then **he** dropped the metal into a measuring cup and found that it displaced **16.4** mL of water.

Calculate the density of the metal.
Density = [ ] g / mL

Use the table below to decide the identity of the metal. This metal is most likely [ ] .

Densities of Some Common Substances

Substance	Density (g/mL)
Water	1.00
Aluminum	2.72
Chromium	7.25
Nickel	8.91
Copper	8.94
Silver	10.50
Lead	11.34
Mercury	13.60
Gold	19.28
Tungsten	19.38
Platinum	21.46

Previous Next

2.

A mineral sample has a mass of **59.8** g and a volume of **8.6** cm^3. Which is it?

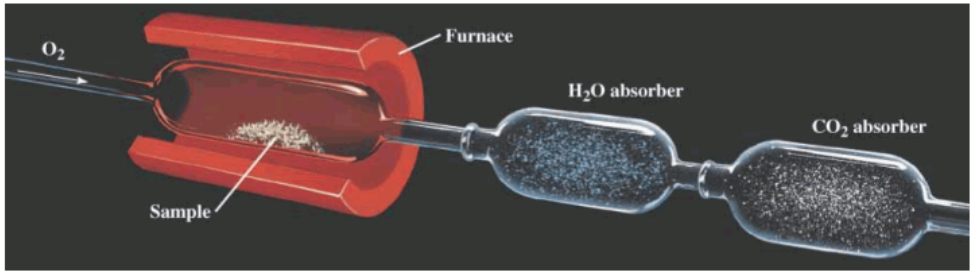
- cassiterite (density = 6.99 g/cm^3)
- cinnabar (density = 8.10 g/cm^3)
- sphalerite (density = 4.00 g/cm^3)

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

SLO 2 Combustion Analysis

1.

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



A **4.801** gram sample of an organic compound containing C, H and O is analyzed by combustion analysis and **6.091** grams of CO_2 and **1.663** grams of H_2O are produced.

In a separate experiment, the molecular weight is found to be **104.1** amu. Determine the empirical formula and the molecular formula of the organic compound.

Enter the elements in the order C, H, O

empirical formula =

molecular formula =

2.

When 2.56 g of a compound containing only carbon, hydrogen, and oxygen is burned completely, **3.84** g of CO_2 and **1.05** g of H_2O are produced. What is the empirical formula of the compound?

(Enter the elements in the order: C, H, O.)

The empirical formula is

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

SLO 3 Limiting Reagent

1.

For the following reaction, **0.660** grams of **hydrogen gas** are allowed to react with **12.6** grams of **ethylene (C_2H_4)** .

hydrogen (**g**) + **ethylene** (C_2H_4) (**g**) $\longrightarrow$ **ethane** (C_2H_6) (**g**)

What is the maximum amount of **ethane** (C_2H_6) that can be formed? [ ] grams

What is the **FORMULA** for the limiting reagent? [ ]

What amount of the excess reagent remains after the reaction is complete? [ ] grams

2.

Calculate the number of milliliters of **0.530** M **NaOH** required to precipitate all of the Cu^{2+} ions in **197** mL of **0.537** M $CuSO_4$ solution as $Cu(OH)_2$. The equation for the reaction is:

$CuSO_4(aq) + 2NaOH(aq) \longrightarrow Cu(OH)_2(s) + Na_2SO_4(aq)$

[ ] mL **NaOH**

[SLO 4 Gas Laws]

A sample of **neon** gas collected at a pressure of **0.539** atm and a temperature of **20.0** °C is found to occupy a volume of **20.6** liters. How many moles of **Ne** gas are in the sample? _____ mol

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

SIMULATION Ideal Gas Law

Pressure
1000 mmHg

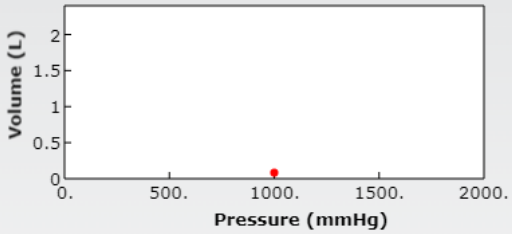
Mass
100 mg

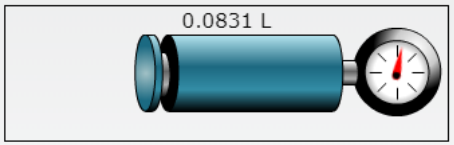
Temperature
100 °C

Gases
- N_2
- O_2
- Ar
- CO_2
- Xe

Plot Volume vs.
- Pressure
- Mass
- Temperature

Calculate | Clear





The behavior of gases near room temperature and 1 atm pressure can be described using four main properties: amount, pressure, volume, and temperature. In this simulation the mass, pressure, and temperature can be varied. The corresponding volume is displayed above the syringe. In creation of a graph using this simulation, volume is on the y-axis and the parameter plotted on the x-axis can be chosen from pressure, mass, or temperature. Through this exercise you will see how such experiments led to the now familiar gas laws.

Next (Introduction)

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

SLO 5 Lewis Structure

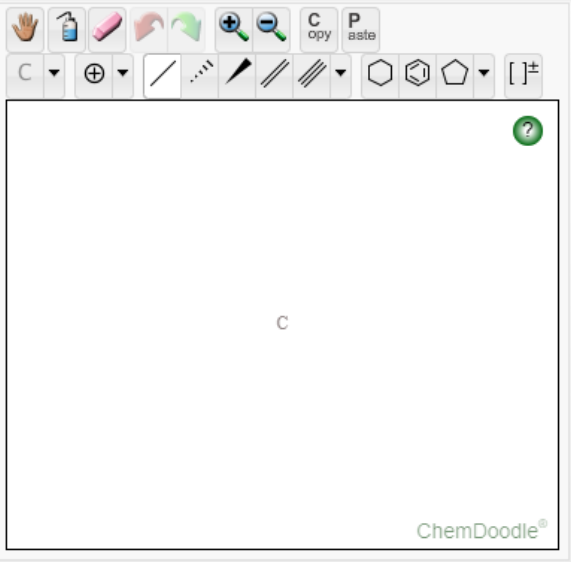
This question has multiple parts. Work all the parts to get the most points.

a

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

Draw the Lewis structure for ICl_4^- in the window below and then answer the questions that follow.

- Do not include overall ion charges or formal charges in your drawing.



b What is the **electron-pair** geometry for **I** in ICl_4^- ?

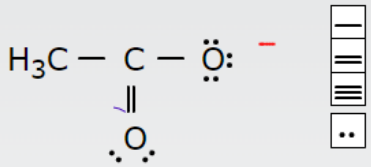
c What is the the shape (molecular geometry) of ICl_4^-?

SLO 6 Resonance

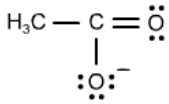
1.

EXERCISE Resonance Structures I

Clear



Below is the Lewis structure of $CH_3CO_2^-$, which has one other resonance structure.



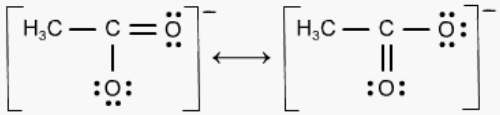
Complete the resonance structure by dragging bonds and electron lone pairs to their appropriate positions.

Then click **Check**.

Check Next (3 of 3)

Correct

The two resonance structures of the acetate ion are:

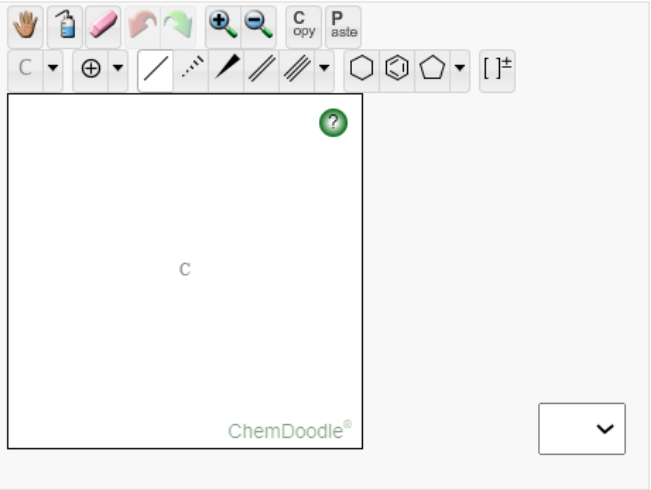


2.

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

Draw all resonance structures for the **sulfur dioxide** molecule, SO_2.

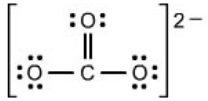
- Explicitly draw all H atoms.
- Include all valence lone pairs in your answer.
- Do not include overall ion charges or formal charges in your drawing.
- Do not draw double bonds to oxygen unless they are needed for the central atom to obey the octet rule.
- Draw one structure per sketcher. Add additional sketchers by selecting ↔ in the drop-down menu



3.

TUTOR **Formal Charge**

Determine the formal charge for the left oxygen atom, the central carbon atom and the top oxygen atom in this structure.



O on left: _____

central C: _____

O on top: _____

Submit Show Approach Show Tutor Steps

SLO 7 MW from Freezing Point Depression

Boiling Point Elevation/Freezing Point Depression

$$\Delta T = m K$$

where, for freezing point depression:

$$\Delta T = T(\text{pure solvent}) - T(\text{solution})$$

and for boiling point elevation:

$$\Delta T = T(\text{solution}) - T(\text{pure solvent})$$

$\boldsymbol{m}$ = (# moles solute / Kg solvent)
$\boldsymbol{K_b}$ = boiling point elevation constant.
$\boldsymbol{K_f}$ = freezing point depression constant.

K_b and K_f depend only on the SOLVENT. Below are some common values. Use these values for the calculations that follow.

Solvent	Formula	K_b(°C / m)	K_f(°C / m)
Water	H_2O	0.512	1.86
Ethanol	CH_3CH_2OH	1.22	1.99
Chloroform	$CHCl_3$	3.67	
Benzene	C_6H_6	2.53	5.12
Diethyl ether	$CH_3CH_2OCH_2CH_3$	2.02	

Safrole is contained in oil of sassafras and was once used to flavor root beer. A 2.39-mg sample of safrole was dissolved in 103.0 mg of diphenyl ether. The solution had a melting point of 25.70°C. Calculate the molecular weight of safrole. The freezing point of pure diphenyl ether is 26.84°C, and the freezing-point-depression constant, K_f, is 8.00°C/m.

Molecular weight = [ ] amu

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

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2019 – Summer 2020

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 – CHM112

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:

1. 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.
2. Offer an appropriate remedial mathematics program accommodating various skill levels.
3. 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. Use Le Chatelier's Principle to predict the direction in which a system at equilibrium will shift (if it does) when stresses are applied.
2. Predict ΔS (change in entropy) for many kinds of common changes, both chemical and physical.
3. Determine the percent ionization of a weak mono-protic acid or weak base, given the concentration and Ka or Kb
4. For a given redox reaction, use the Nernst equation to calculate the voltage E of a cell, given E°, and the concentrations of all other species.

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

SLO 1: Use Le Chatelier's Principle to predict the direction in which a system at equilibrium will shift (if it does) when stresses are applied.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**90% schoolwide performed at level 2 or higher. (69/77)** **Jefferson Campus** Level 4 (11/17) 64.7% Level 3 (2/17) 11.8% Level 2 (2/17) 11.8% Level 1 (2/17) 11.8% Level 0 (0/17) 0.0% **Shelby Campus** Level 4 (29/60) 51.9% Level 3 (19/60) 27.3% Level 2 (6/60) 10.4% Level 1 (6/60) 10.4% Level 0 (0/60) 0.0%	**Observations/Changes:** CHM 112 instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice to improve performance predicting equilibrium changes. CHM 112 instructors will include a corresponding laboratory activity to provide hands-on activities and further opportunities for the students to practice the concept.

SLO 2: Predict ΔS (change in entropy) for many kinds of common changes, both chemical and physical.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**91% schoolwide performed at level 2 or higher. (70/77)** **Jefferson Campus** Level 4 (15/17) 88.2% Level 3 (1/17) 5.9% Level 2 (0/17) 0.0% Level 1 (1/17) 5.9% Level 0 (0/17) 0.0% **Shelby Campus** Level 4 (35/60) 64.9% Level 3 (17/60) 23.4% Level 2 (2/60) 2.6% Level 1 (6/60) 9.1% Level 0 (0/60) 0.0%	**Observations/Changes:** CHM 112 instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice to improve performance in predicting changes in entropy.

SLO 3: Determine the percent ionization of a weak mono-protic acid or weak base, given the concentration and Ka or Kb	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**87% schoolwide performed at level 2 or higher. (67/77)** **Jefferson Campus** Level 4 (12/17) 70.6% Level 3 (0/17) 0.0% Level 2 (1/17) 5.9% Level 1 (2/17) 11.8% Level 0 (2/17) 11.8% **Shelby Campus** Level 4 (37/60) 63.6% Level 3 (13/60) 16.9% Level 2 (4/60) 6.5% Level 1 (3/60) 6.5% Level 0 (3/60) 6.5%	**Observations/Changes:** CHM 112 instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice to improve performance calculating weak acid titration problems.

SLO 4: Use the Nernst equation to calculate the voltage E of a cell, given E°, and the concentrations of all other species.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**95% schoolwide performed at level 2 or higher. (67/77)** **Jefferson Campus** Level 4 (12/17) 70.6% Level 3 (0/17) 0.0% Level 2 (0/17) 0.0% Level 1 (1/17) 5.9% Level 0 (4/17) 23.5% **Shelby Campus** Level 4 (36/60) 62.3% Level 3 (17/60) 22.1% Level 2 (2/60) 2.6% Level 1 (3/60) 5.2% Level 0 (2/60) 7.8%	**Observations/Changes:** CHM 112 instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice to improve performance carrying out calculations involving the Nernst Equation

Plan submission date: August 28th, 2020	**Submitted by: Lisa Nagy**

References

CHM 112 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 112 SLO Common Final Exam Problems:

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

CHM 112 SLO 1

The reaction

$N_2O_3(g) \leftrightharpoons NO(g) + NO_2(g)$

has ΔH_r of **+**40.5 kJ/mol How will the following changes affect the equilibrium?

Shift to left (reactants), right (products), or no change

a) Adding more $N_2O_3(g)$_____
b) Adding more $NO_2(g)$_____
c) Increasing the volume of the reaction flask_____
d) Lowering the temperature_____
e) Adding a catalyst_____

CHM 112 SLO 2

Predict the sign of $\Delta S°$ for the following reactions:

a. $NaCl(s) \rightarrow NaCl(aq)$
b. $4\ Fe(s) + 3\ O_2(g) \rightarrow 2\ Fe_2O_3(s)$
c. $H_2O(l) \rightarrow H_2O(s)$

CHM 112 SLO 3

A weak acid, (HA), has an acid dissociation constant of $2.50 \cdot 10^{-6}$. A 25.00 ml sample with a concentration of 0.250 M is titrated with 0.150 M NaOH.

a) What is the pH of the original 0.250 M sample of HA?
b) What is the percent ionization of the 0.250 M acid?

CHM 112 SLO 4

The following questions refer to a voltaic cell containing:
Zinc and iron electrodes, aqueous zinc nitrate, aqueous iron (III) nitrate, and a potassium nitrate salt bridge.

Fe^{3+} (aq) + $3e^-$ → Fe (s) E°= -0.040 V

Zn^{2+}(aq) + $2e^-$ → Zn(s) E°= -0.763 V

Calculate the correct cell potential *E* (not zero) at 298K given 0.500 M iron (III) nitrate and 2.00×10^{-3} M zinc nitrate in the half cells.

Examples of Corresponding Homework Problems

SLO 1 Equilibrium

1.

Consider the following system at equilibrium where ΔH° = **108** kJ, and K_c = $\mathbf{1.29\times10^{-2}}$, at **600** K:

$\mathbf{COCl_2}(g) \rightleftharpoons \mathbf{CO}(g) + \mathbf{Cl_2}(g)$

If the **TEMPERATURE** on the equilibrium system is suddenly **increased**:

The value of K_c [ ]
A. Increases
B. Decreases
C. Remains the same

The value of Q_c [ ]
A. Is greater than K_c
B. Is equal to K_c
C. Is less than K_c

The reaction must: [ ]
A. Run in the forward direction to restablish equilibrium.
B. Run in the reverse direction to restablish equilibrium.
C. Remain the same. Already at equilibrium.

The concentration of Cl_2 will: [ ]
A. Increase.
B. Decrease.
C. Remain the same.

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

2.

Consider the following system at equilibrium where K_c = $\mathbf{1.29\times10^{-2}}$ and ΔH° = **108** kJ/mol at **600** K.

$\mathbf{COCl_2}$ (g) $\rightleftharpoons$ **CO** (g) + $\mathbf{Cl_2}$ (g)

The production of **CO** (g) is favored by:

Indicate True **(T)** or False **(F)** for each of the following:

[ ] **1. increasing** the temperature.
[ ] **2. decreasing** the pressure (by changing the volume).
[ ] **3. increasing** the volume.
[ ] **4. removing $COCl_2$** .
[ ] **5. adding Cl_2** .

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

SLO 2 Entropy

1.

INTERACTIVE EXAMPLE **Predicting the Sign of the Entropy Change of a Reaction**

a) The following equation represents the essential change that takes place during the fermentation of glucose (grape sugar) to ethanol (ethyl alcohol).

$C_6H_{12}O_6(s) \rightarrow 2C_2H_5OH(l) + 2CO_2(g)$

Is $\Delta S°$ positive, negative, or can the sign not be determined?

b) Is $\Delta S°$ positive, negative, or can the sign not be determined for the preparation of urea from NH_3 and CO_2?

$2NH_3(g) + CO_2(g) \rightarrow NH_2CONH_2(aq) + H_2O(l)$

c) Is $\Delta S°$ positive, negative, or can the sign not be determined for the following reaction?

$CO(g) + H_2O(g) \rightarrow CO_2(g) + H_2(g)$

Submit Show Tutor Steps

Submit Answer Retry Entire Group 9 more group attempts remaining

2.

Without doing a calculation, predict whether the entropy change will be positive or negative when each of the following reactions occurs in the direction it is written.

a. $\mathrm{HCl}(g) + \mathrm{NH_3}(g) \rightarrow \mathrm{NH_4Cl}(s)$

- positive
- negative

b. $\mathrm{C_2H_4}(g) + \mathrm{H_2}(g) \rightarrow \mathrm{C_2H_6}(g)$

- positive
- negative

c. $2\mathrm{SO_2}(g) + \mathrm{O_2}(g) \rightarrow 2\mathrm{SO_3}(g)$

- positive
- negative

d. $\mathrm{CH_3OH}(l) + \frac{3}{2}\mathrm{O_2}(g) \rightarrow \mathrm{CO_2}(g) + 2\mathrm{H_2O}(g)$

- positive
- negative

Submit Answer Retry Entire Group 9 more group attempts remaining

SLO 3 Weak Acid Titration

1.

Calculate the **percent ionization** of a **0.587** M solution of **acetic acid**.

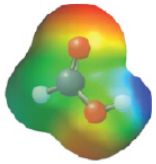
% Ionization = [ ] %

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

2.

Formic acid, $\mathrm{HCHO_2}$, is used to make methyl formate (a fumigant for dried fruit) and ethyl formate (an artificial rum flavor). What is the pH of a **0.47** *M* solution of formic acid? What is the degree of ionization of $\mathrm{HCHO_2}$ in this solution?

$$K_a(\mathrm{HCHO_2}) = 1.7 \times 10^{-4}$$



pH = [ ]

Degree of ionization = [ ]

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

SLO 4 Nernst Equation

1.Tutorial

VISUALIZATION **Cell Potential: Dependence on Concentration**

$$E = E^{o} - \frac{RT}{nF} \ln Q$$

$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$

$E^{o} = +1.10$ V

Show Annotation

The potential of an electrochemical cell is primarily controlled by the nature of the oxidizing and reducing agents. Other factors such as temperature and reactant concentration play a smaller role in determining cell potential. These effects are described by the Nernst Equation. This module examines an experiment designed to test the effect of changing reactant concentration on cell potential. The cell is based on the following reaction:

$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$

$E^{o} = +1.10$ V

Watch the video and answer the questions that follow.

Next (Introduction)

2. Calculation problem

What is the calculated value of the cell potential at 298K for an electrochemical cell with the following reaction, when the $\mathbf{Pb^{2+}}$ concentration is $\mathbf{9.40\times10^{-4}}$ M and the $\mathbf{Mg^{2+}}$ concentration is **1.07** M ?

$\mathbf{Pb^{2+}(aq) + Mg(s) \longrightarrow Pb(s) + Mg^{2+}(aq)}$

Answer: [ ] V

The cell reaction as written above is spontaneous for the concentrations given: [ ]

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

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2019 – Summer 2020

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 221

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:

1. 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.
2. Offer an appropriate remedial mathematics program accommodating various skill levels.
3. 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. Carry out calculations relating density, specific gravity, mass, and volume to one another
2. Determine the empirical formula of compound, given the mass percentages of the elements or the analytical data from which these can be calculated, and determine the molecular formula of that compound, given an approximated molecular mass.
3. Given a reaction involving species in solution, relate the volumes or concentrations of two reactant species to the mass of solid precipitated.
4. Use the ideal gas law, determining the moles of a gas sample given its pressure, volume and temperature.
5. Draw the Lewis structure of a molecule or ion and predict its geometry.
6. Draw valid resonance structures including formal charges.
7. Use freezing point depression data to determine the molar mass of a substance.

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

SLO 1: Locate chirality centers, assign priorities to substituents, and assign R, S designations to chirality centers.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**100% schoolwide performed at level 2 or higher. (6/6)** **Jefferson Campus** Level 4 (4/6) 66.7% Level 3 (2/6) 33.3% Level 2 (0/6) 0.0% Level 1 (0/6) 0.0% Level 0 (0/6) 0.0%	**Observations/Changes:** CHM 221 instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice to improve performance assigning configurations of chiral centers.

SLO 2: Propose structures for compounds, given their NMR, IR, and mass spectra.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**83.3% schoolwide performed at level 2 or higher. (5/6)** **Jefferson Campus** Level 4 (3/6) 50.0% Level 3 (2/6) 33.3% Level 2 (0/6) 0.0% Level 1 (1/6) 16.7% Level 0 (0/6) 0.0%	**Observations/Changes:** CHM 221 instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice to improve performance determining organic structures from spectral data.

SLO 3: Calculate the degree of unsaturation of any compound, including those containing N, O, and halogens.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**100% schoolwide performed at level 2 or higher. (6/6)** **Jefferson Campus** Level 4 (3/6) 50.0% Level 3 (3/6) 50.0% Level 2 (0/6) 0.0% Level 1 (0/6) 0.0% Level 0 (0/6) 0.0%	**Observations/Changes:** CHM 221 instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice to improve performance calculation degrees of unsaturation.

Plan submission date: August 28th, 2020	**Submitted by: Lisa Nagy**

References

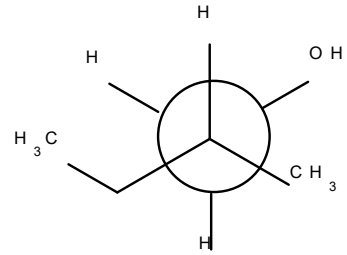
CHM 221 SLO Rubric:

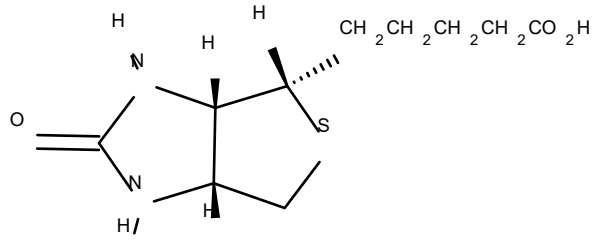
Level 4: Student provides a complete and correct solution process that is well organized, with no errors. Level 3: Student provides a complete solution process that is well organized but contains minor errors. Level 2: Student demonstrates understanding of methods required to produce a correct solution, 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 221 SLO Common Final Exam Problems:

CHM 221 SLO 1: Stereochemistry

Label the R/S configurations of the stereocenters in the following molecules. Some may have more than one chiral center. Indicate if the compounds are optically active.

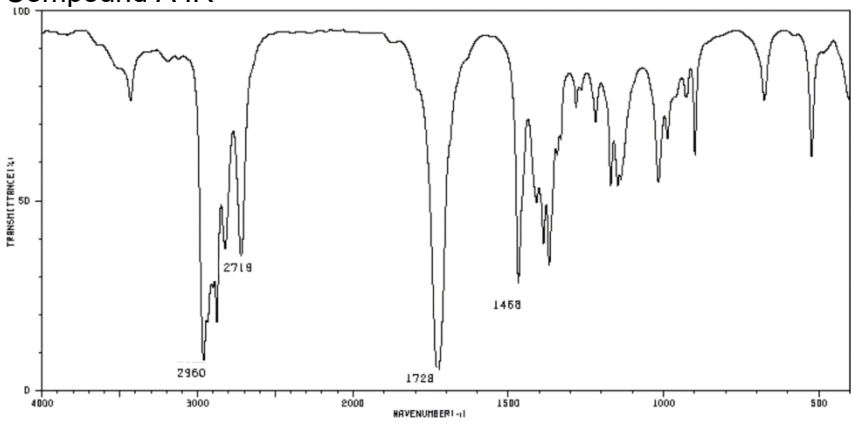




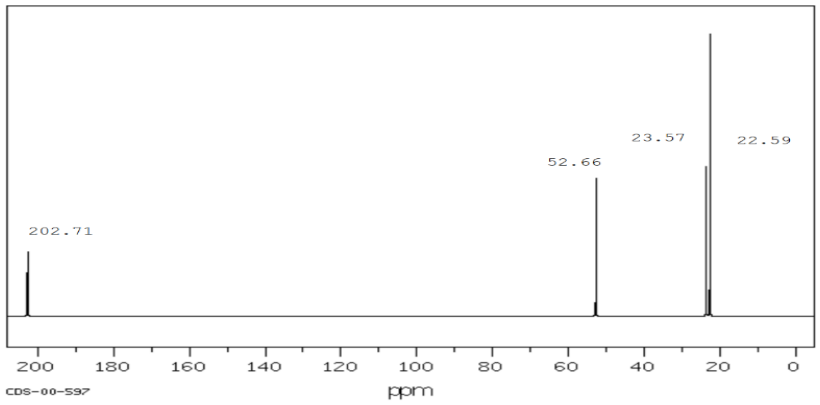
CHM 221 SLO 2: Structure Determination

Compounds A and B are isomers, with a molar mass of 86. Identify the two compounds. Discuss the IR and NMR spectra to explain your reasoning. Explain the splitting.

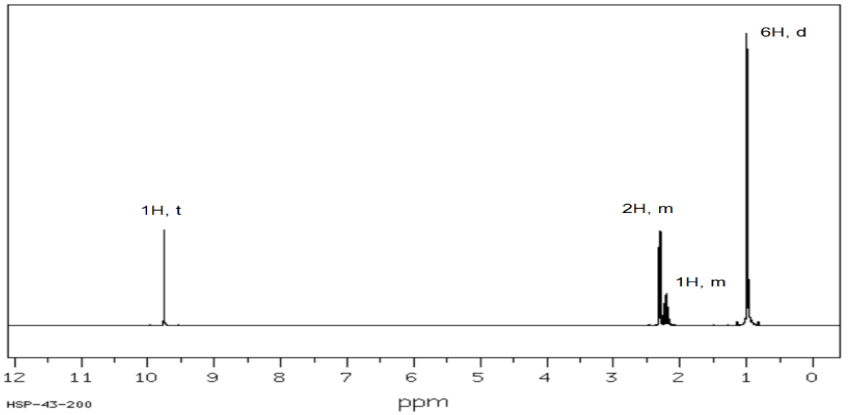
Compound A IR



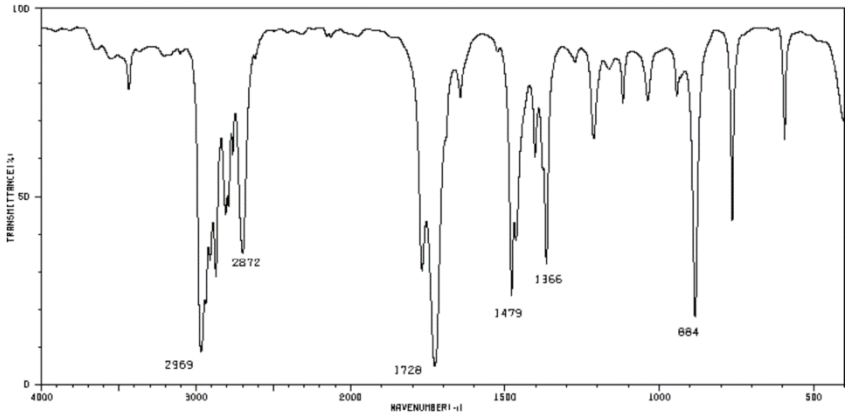
Compound A ^{1}H-NMR



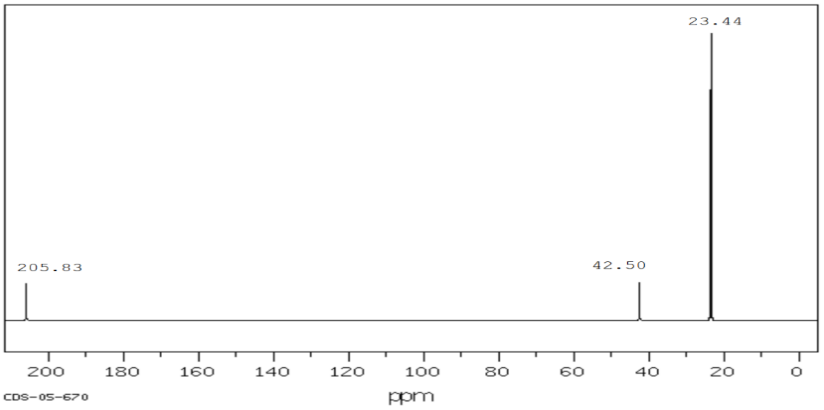
Compound A ^{13}C-NMR



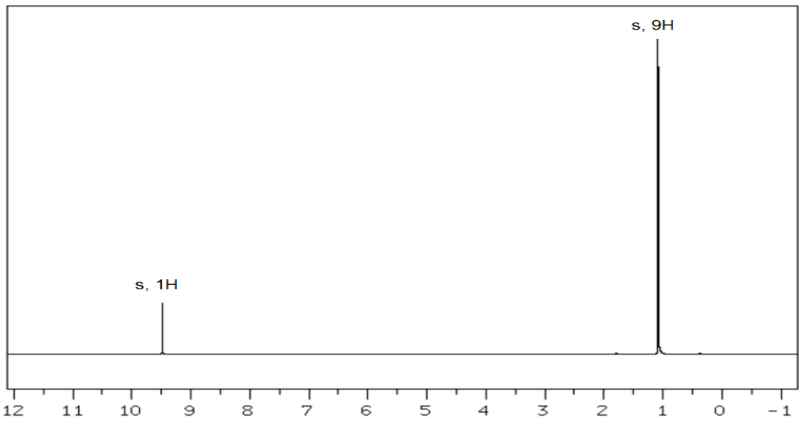
Compound B IR



Compound B ^{1}H-NMR



Compound B ^{13}C-NMR



[CHM 221 SLO 3: Degree of Unsaturation]

Calculate the degree of unsaturation in each formula below. Show your calculations

Caffeine $C_8H_{10}N_4O_2$

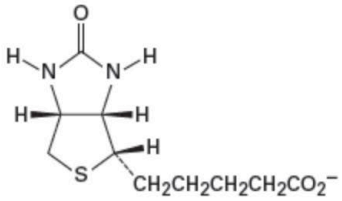
Resveratrol, $C_{14}H_{12}O_3$

Examples of Corresponding Homework Problems

SLO 1 Stereochemistry

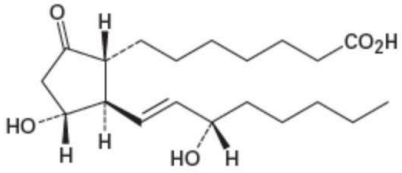
1. 5-45 Assign *R* or *S* configuration to each chirality center in the following biological molecules:

a.



Biotin

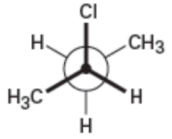
b.



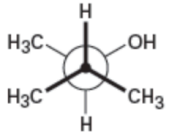
Prostaglandin E_1

2. 5-49 Assign *R* or *S* stereochemistry to the chirality centers in the following Newman projections:

a.

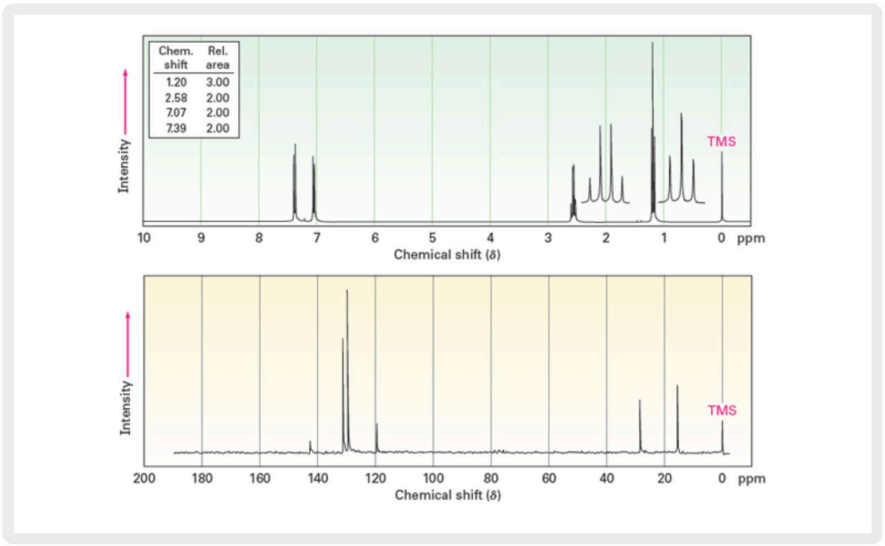


b.



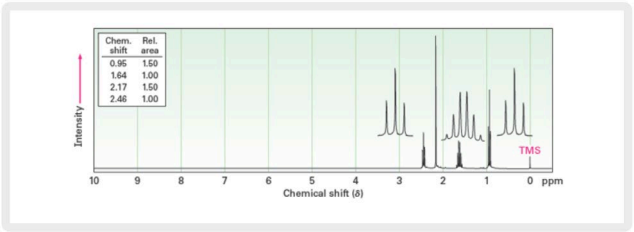
SLO 2 Structure Determination

13-57 The ^{1}H and ^{13}C NMR spectra of compound **A**, C_8H_9Br, are shown. Propose a structure for **A**, and assign peaks in the spectra to your structure.

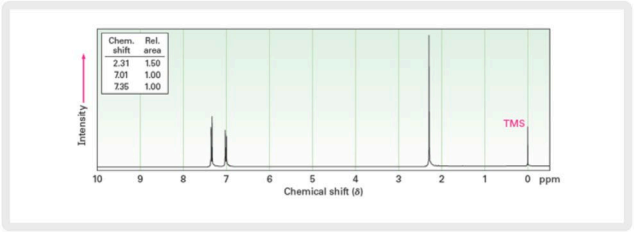


13-58 Propose structures for the three compounds whose ^{1}H NMR spectra are shown.

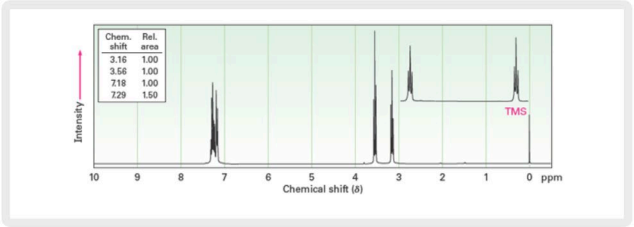
a. $C_5H_{10}O$



b. C_7H_7Br



c. C_8H_9Br



1.

SLO 3 Calculating Degree Unsaturation

7-34 Calculate the degree of unsaturation in the following formulas, and draw five possible structures for each:

a. $C_{10}H_{16}$

b. C_8H_8O

c. $C_7H_{10}Cl_2$

d. $C_{10}H_{16}O_2$

e. $C_5H_9NO_2$

f. $C_8H_{10}ClNO$

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2019-Summer 2020

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 The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations by being able to solve linear equations, including literal, by applying the	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: 193/200 = 96.5%** **Jefferson Campus** Level 4 49/66 74.2% Level 3 6/66 9.1% Level 2 8/66 12.1% Level 1 3/66 4.5% Level 0 0/66 0% **Shelby Campus** Level 4 46/73 63% Level 3 16/73 21.9% Level 2 7/73 9.6% Level 1 3/73 4.1% Level 0 1/73 1.4%	It should be noted that online testing is not proctored, while on-campus tests are proctored. This is the first year data has been collected from an online section of 098, so we will be able to make comparisons moving forward. **For the 2020-21 year,** the department recommends reinforcing the student learning of this objective by including helpful video tutorials, such as, the one listed below: "Solving Linear Equations in one variable" https://www.youtube.com/watch?v=Rshof3oFGwE

properties of equality			**<u>Clanton Campus</u>** Level 4 18/21 85.7% Level 3 3/21 14.3% Level 2 0/21 0% Level 1 0/21 0% Level 0 0/21 0% **<u>Online</u>** Level 4 38/40 95% Level 3 0/40 0% Level 2 2/40 5% Level 1 0/40 0% Level 0 0/40 0% **<u>Overall Performance</u>** Level 4 151/200 5.5% Level 3 25/200 12.5% Level 2 17/200 8.5% Level 1 6/200 3% Level 0 1/200 0.5%	

Assessment of Objective 2 The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations by being able to evaluate algebraic expressions using given numerical values.	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: 191/200 = 95.5%** **Jefferson Campus** Level 4 33/66 50% Level 3 20/66 30.3% Level 2 5/66 7.6% Level 1 4/66 6.1% Level 0 4/66 6.1% **Shelby Campus** Level 4 47/73 64.4% Level 3 11/73 15.1% Level 2 14/73 19.1% Level 1 1/73 1.4% Level 0 0/73 0% **Clanton Campus** Level 4 19/21 90.4% Level 3 1/21 4.8% Level 2 1/21 4.8% Level 1 0/21 0% Level 0 0/21 0% **Online** Level 4 34/40 85% Level 3 0/40 0% Level 2 6/40 15% Level 1 0/40 0% Level 0 0/40 0%	**For the 2020-21 year,** the department recommends reinforcing the student learning of this objective by including helpful video tutorials, such as, the one listed below: "Evaluating Algebraic Expressions" https://www.youtube.com/watch?v=fZDWcU0i0o4

			<u>Overall Performance</u> Level 4 133/200 66.5% Level 3 32/200 16% Level 2 26/200 13% Level 1 5/200 2.5% Level 0 4/20 2%	

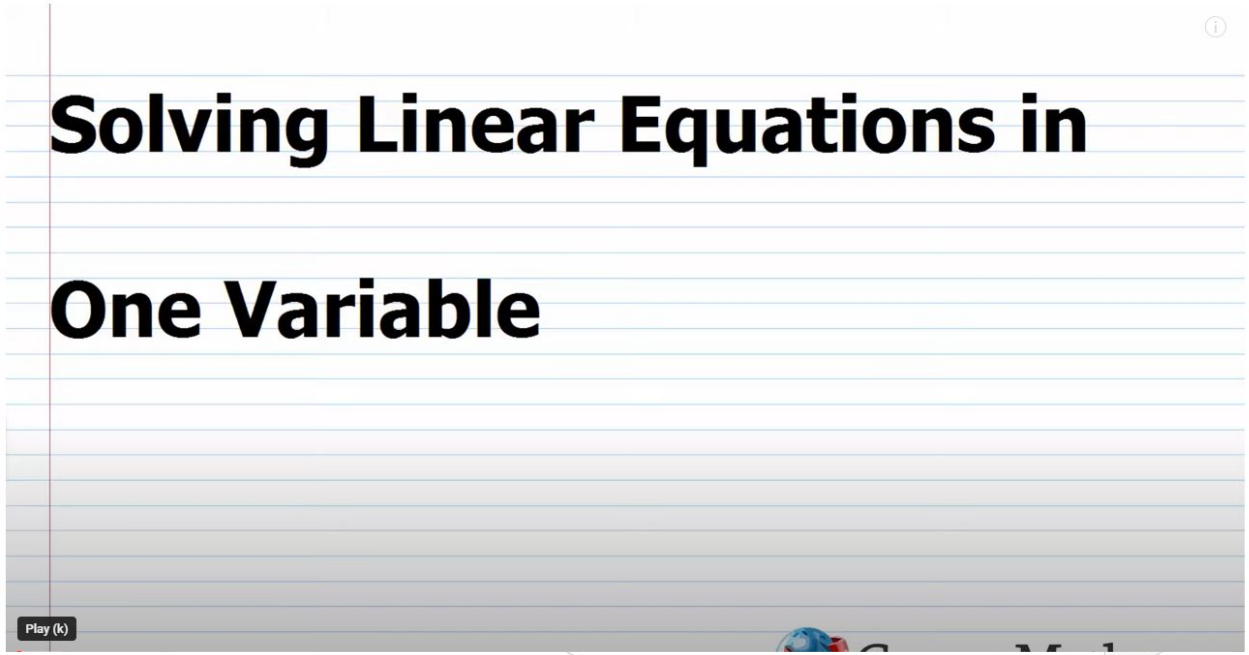
Assessment of Objective 3 The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations by being able to graph a linear equation.	Rubric-based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**Annual campus-wide total at rubric level 2 or higher: 165/200 = 82.5%** **Jefferson Campus** Level 4 34/66 51.5% Level 3 8/66 12.1% Level 2 5/66 7.6% Level 1 11/66 16.7% Level 0 8/66 12.1% **Shelby Campus** Level 4 37/73 50.7% Level 3 9/73 12.3% Level 2 14/73 19.2% Level 1 9/73 12.3% Level 0 4/73 5.5% **Clanton Campus** Level 4 17/21 80.9% Level 3 2/21 9.5% Level 2 1/21 4.8% Level 1 1/21 4.8% Level 0 0/21 0% **Online** Level 4 32/40 80% Level 3 0/40 0% Level 2 6/40 15% Level 1 0/40 0% Level 0 2/40 5%	**For the 2020-21 year,** the department recommends reinforcing the student learning of this objective by including helpful video tutorials, such as, the one listed below: "Graphing Equations in Slope-Intercept Form" https://www.youtube.com/watch?v=vGNSMUKEQ9c

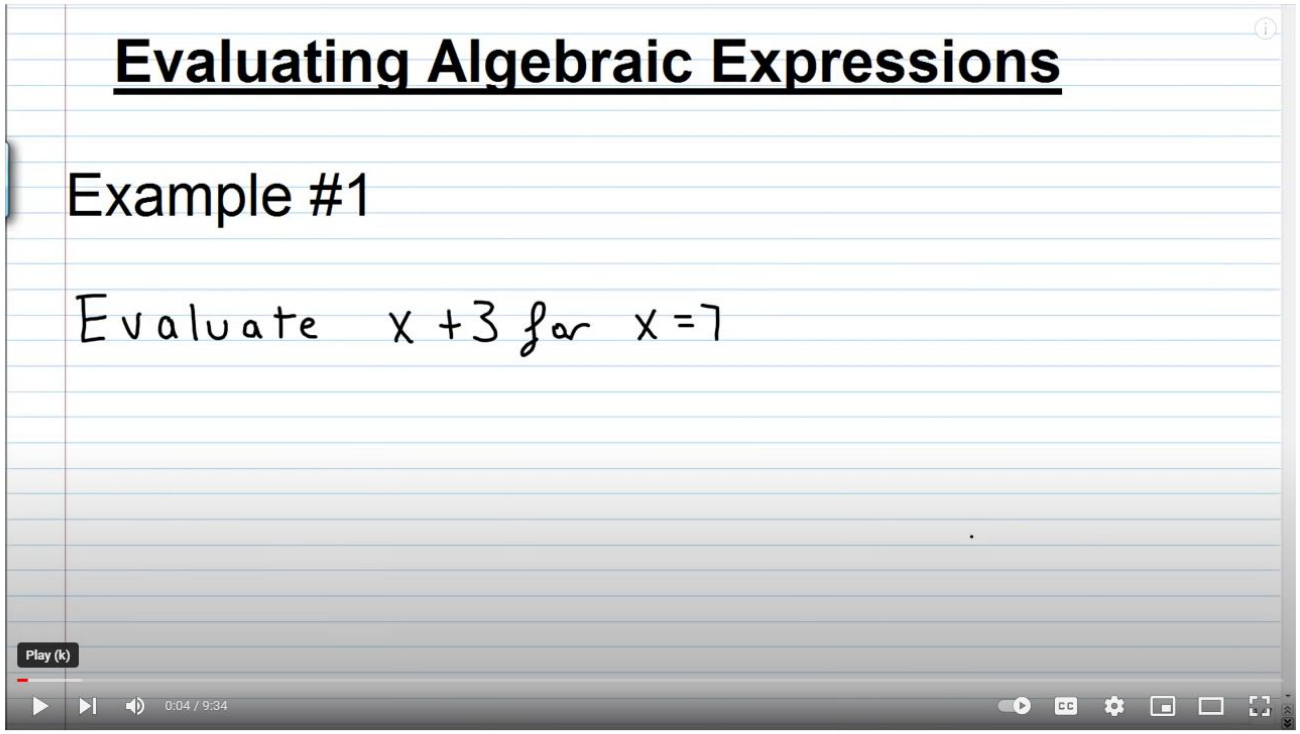
			<u>Overall Performance</u> Level 4 120/200 60% Level 3 19/200 9.5% Level 2 26/200 13% Level 1 21/200 10.5% Level 0 14/200 7%	

Assessment of Objectve 4 The student will demonstrate his/her understanding of algebraic manipulations, interpretations, and computations by writing the equation of a line given appropriate information.	Rubric-based 70% of students learning assessment of related at a rubric level of 2 or common final higher exam problems	**Annual campus-wide total at rubric level 2 or higher: 120/200 = 60%** **Jefferson Campus** Level 4 11/66 16.7% Level 3 6/66 9.1% Level 2 9/66 13.6% Level 1 20/66 31.3% Level 0 20/66 31.3% **Shelby Campus** Level 4 18/73 24.6% Level 3 13/73 17.8% Level 2 11/73 15.1% Level 1 13/73 17.8% Level 0 18/7 24.7% **Clanton Campus** Level 4 8/21 38.1% Level 3 4/21 19% Level 2 6/21 28.6% Level 1 2/21 9.5% Level 0 1/21 4.8% **Online** Level 4 25/40 62.5% Level 3 0/40 0% Level 2 9/40 22.5% Level 1 0/40 0% Level 0 6/40 15%	**For the 2020-21 year,** the department recommends reinforcing the student learning of this objective by including helpful video tutorials, such as, the one listed below: "Point-Slope to Slope-Intercept Form" https://www.youtube.com/watch?v=9CBTjQOJ57Y

Plan submission date:	**September 15, 2020** **Submitted by:**	**<u>Overall Performance</u>** Level 4 62/200 31% Level 3 23/200 11.5% Level 2 35/200 17.5% Level 1 35/200 17.5% Level 0 45/200 2.5% **Nanette Easterling**	

Evidence for SLO 1 and SLO 2





Evaluating Algebraic Expressions

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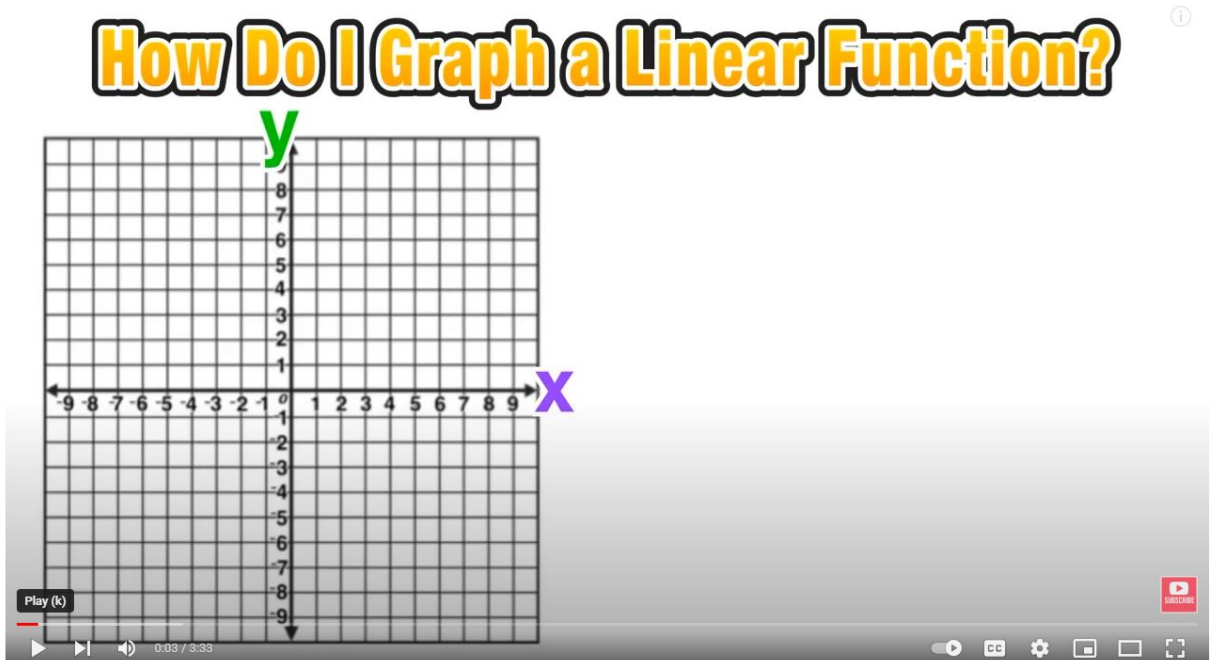
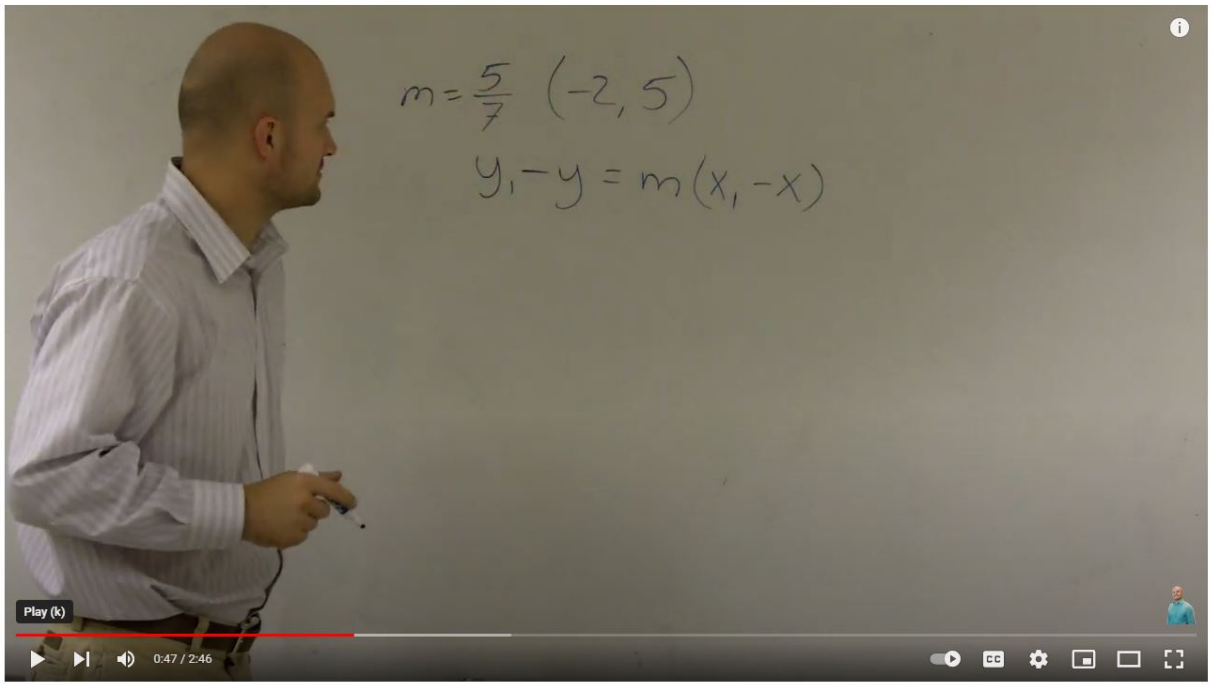
Evidence for SLO 3 and SLO 4





Using point slope form find the equation of a line given the slope and a point

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Assessment Record

Program: Math-MTH 100 **Assessment period:** 2019-20

Program or Department Mission:

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	70% of students learning at a rubric level of 2 or higher	**Annual campus-wide total at rubric level 2 or higher: 547/637=85.9%** **Jefferson Campus** Level 4 39/141 27.7% Level 3 38/141 27.0% Level 2 31/141 22.0% Level 1 17/141 12.1% Level 0 16/141 11.3% **Shelby Campus** Level 4 70/133 52.6% Level 3 15/133 11.3% Level 2 11/133 8.3% Level 1 21/133 15.8% Level 0 16/133 12.0%	**Observations/Changes:** MTH 100 instructors will use an additional review to be implemented prior to the final exam to further increase understanding of this objective. Students will be given a review and the instructor will discuss this concept with the students before the final exam is given.

			Clanton Campus Level 4 44/78 56.4% Level 3 13/78 16.7% Level 2 14/78 17.9% Level 1 7/78 9.0% Level 0 0/78 0.0% **Pell City** Level 4 64/96 66.7% Level 3 18/96 18.8% Level 2 3/96 3.1% Level 1 11/96 11.5% Level 0 0/96 0.0% **Online** Level 4 148/189 78.3% Level 3 0/189 0.0% Level 2 39/189 20.6% Level 1 0/189 0.0% Level 0 2/189 1.1%	
SLO 2: Factor a trinomial.	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: 549/637 = 86.2%** **Jefferson Campus** Level 4 53/141 37.6% Level 3 35/141 24.8% Level 2 23/141 16.3% Level 1 21/141 14.9% Level 0 9/141 6.4% **Shelby Campus** Level 4 78/133 58.6% Level 3 8/133 6.0% Level 2 4/133 3.0% Level 1 32/133 24.1% Level 0 11/133 8.3% **Clanton Campus** Level 4 38/78 48.7%	**Observations/Changes:** MTH 100 instructors recommend that additional review be implemented prior to the final exam to further increase understanding of this objective. Students will be given a review and the instructor will discuss this concept with the students before the final exam is given.

			Level 3 8/78 9.1% Level 2 25/78 32.1% Level 1 7/78 9.0% Level 0 0/78 0.0% **Pell City** Level 4 65/96 67.7% Level 3 9/96 9.4% Level 2 14/96 14.6% Level 1 8/96 8.3% Level 0 0/96 0.0% **Online** Level 4 167/189 88.4% Level 3 0/189 0.0% Level 2 22/189 11.6% Level 1 0/189 0.0% Level 0 0/189 0.0%	
SLO 3: Perform operations with rational expressions	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: 463/637 = 72.7%** **Jefferson Campus** Level 4 39/141 27.7% Level 3 30/141 21.3% Level 2 27/141 19.1% Level 1 23/141 16.3% Level 0 22/141 15.6% **Shelby Campus** Level 4 31/133 23.3% Level 3 13/133 9.8% Level 2 12/133 9.0% Level 1 50/133 37.6% Level 0 27/133 20.3% **Clanton Campus** Level 4 19/78 24.4% Level 3 16/78 20.5% Level 2 27/78 34.6%	**Observations/Changes:** MTH 100 instructors will provide an additional review prior to the final exam to further increase understanding of this objective. Students will be given a review and the instructor will discuss this concept with the students before the final exam is given.

			Level 1 12/78 15.4% Level 0 4/78 5.1% **Pell City** Level 4 25/96 26.0% Level 3 25/96 26.0% Level 2 14/96 14.6% Level 1 32/96 33.3% Level 0 0/96 0.0% **Online** Level 4 130/189 68.8% Level 3 0/189 0.0% Level 2 55/189 29.1% Level 1 0/189 0.0% Level 0 4/189 2.1%	
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	**Annual campus-wide total at rubric level 2 or higher: 520/637 = 81.6%** **Jefferson Campus** Level 4 50/141 35.5% Level 3 30/141 21.3% Level 2 21/141 14.9% Level 1 17/141 12.1% Level 0 23/141 16.3% **Shelby Campus** Level 4 15/133 11.3% Level 3 47/133 35.3% Level 2 25/133 18.8% Level 1 36/133 27.1% Level 0 10/133 7.5% **Clanton Campus** Level 4 19/78 24.4% Level 3 39/78 50.0% Level 2 11/78 14.1% Level 1 7/78 9.0% Level 0 2/78 2.6%	**Observations/Changes:** MTH 100 instructors will implement an additional review prior to the final exam to further increase understanding of this objective. Students will be given a review and the instructor will discuss this concept with the students before the final exam is given.

			Pell City Level 4 30/96 31.3% Level 3 32/96 33.3% Level 2 13/96 13.5% Level 1 21/96 21.9% Level 0 0/96 0.0% **Online** Level 4 132/189 69.8% Level 3 0/189 0.0% Level 2 56/189 29.6% Level 1 0/189 0.0% Level 0 1/189 0.5%	
SLO 5: Apply rules of exponents to quantities involving integer exponents.	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: 568/637 = 89.2%** **Jefferson Campus** Level 4 53/141 37.6% Level 3 35/141 24.8% Level 2 21/141 14.9% Level 1 14/141 9.9% Level 0 18/141 12.8% **Shelby Campus** Level 4 58/133 43.6% Level 3 36/133 27.1% Level 2 19/133 14.3% Level 1 14/133 10.5% Level 0 6/133 4.5% **Clanton Campus** Level 4 43/78 55.1% Level 3 22/78 28.2% Level 2 9/78 11.5% Level 1 4/78 5.1% Level 0 0/78 0.0% **Pell City**	**Observations/Changes:** MTH 100 instructors recommend that an additional review be implemented prior to the final exam to further increase understanding of this objective. Students will be given a review and the instructor will discuss this concept with the students before the final exam is given.

			Level 4 57/96 59.4% Level 3 16/96 16.7% Level 2 13/96 13.5% Level 1 10/96 10.4% Level 0 0/96 0.0% **Online** Level 4 138/189 73.0% Level 3 0/189 0.0% Level 2 48/189 25.4% Level 1 0/189 0.0% Level 0 3/189 1.6%	
Plan submission date:			**Submitted by:**	

Evidence for SLO 1 and SLO 2

22. 0/1 points kmbialg7 9.4.074.nva [5044561]

Simplify.

$\sqrt{8} + \sqrt{98}$

✱ Objective 1

✱ $9\sqrt{2}$

23. 0/1 points kmbialg7 9.4.116.nva [5044418]

Simplify. Assume that all variables represent positive numbers.

$\sqrt{64y^2z} - \sqrt{49y^2z}$

✱ $y\sqrt{z}$

18. 0/1 points kmbialg7 5.4.034.nva [5042255]

Factor.

$20x^2 - 51x + 27$

✱ Objective 2

✱ $(4x - 3)(5x - 9)$

19. 0/1 points kmbialg7 5.5.044.mi.nva [5042407]

Factor.

$x^3 - 343y^3$

✱ $(x - 7y)(x^2 + 7xy + 49y^2)$

20. 0/1 points kmbialg7 5.7.020.nva [5042821]

Solve. (Enter your answers as a comma-separated list.)

$x^2 + x - 56 = 0$

$x =$

✱ $-8, 7$

Evidence for SLO 3, SLO4, SLO 5

29. 0/1 points kmbialg7 6.4.047.nva [5043018]

Simplify the complex fraction. Assume no division by 0.

$$\frac{\frac{7}{x}+\frac{4x}{y}}{\frac{6}{x}}$$

$\frac{4x^2+7y}{6y}$

✱ Objective 3

30. 0/1 points kmbialg7 6.5.025.nva [5043023]

Solve the equation and check the solution.

$$\frac{x}{x+4}+6=\frac{4x}{x+4}$$

$x =$ -8

28. 0/1 points kmbialg7 10.2.025.nva [5040163]

Solve the equation using the quadratic formula. (Enter your answers as a comma-separated list.)

$$5x^2+2x-1=0$$

$x =$ $\frac{-1-\sqrt{6}}{5}, \frac{-1+\sqrt{6}}{5}$

✱ Objective 4

5. 0/1 points kmbialg7 4.1.127.nva [5041410]

Simplify. Assume no division by zero.

$$\frac{26(r^6s^3)^4}{6(rs^3)^3}$$

$\frac{13r^{21}s^3}{3}$

✱ Objective 5

6. 0/1 points kmbialg7 4.2.033.nva [5041387]

Simplify and write the result without negative exponents. Assume no variable is 0.

$$a^{-6}$$

$\frac{1}{a^6}$

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2019– Summer 2020

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 Demonstrate understanding of concepts, develop competent skills, and demonstrate applications by his/her ability to perform basic algebraic operations on matrices	Rubric based assessment of related common final exam problems **Example**: 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	**92.5% of the students assessed performed at Level 2 or higher. (87/94)** Jefferson Campus Level 4 13/25 52.0% Level 3 5/25 20.0% Level 2 3/25 12.0% Level 1 4/25 16.0% Level 0 0/25 0.0% Clanton Campus Level 4 5/9 55.6% Level 3 3/9 33.3% Level 2 1/9 11.1% Level 1 0/9 0% Level 0 0/9 0% Online Level 4 51/60 85.0% Level 3 2/60 3.0% Level 2 4/60 6.0% Level 1 2/60 3.0% Level 0 2/60 3.0%	**Observations/Changes:** MTH 110 instructors will continue current instructional methods to include in-class lectures and practice problems for on-campus sections and PowerPoint lessons as well as numerous written and video examples for online sections. Example: Matrices

MTH 110 Objective 2 Demonstrate understanding of concepts, develop competent skills, and demonstrate applications by his/her ability to use Venn diagram to solve a problem	Rubric based assessment of related common final exam problems Problem: Use Venn diagram to solve a problem. **Example:** 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	**82.9% of the students assessed performed at Level 2 or higher. (78/94)** Jefferson Campus Level 4 8/25 32.0% Level 3 9/25 36.0% Level 2 4/25 16.0% Level 1 3/25 12.0% Level 0 1/25 4.0% Clanton Campus Level 4 7/9 77.8% Level 3 0/9 0% Level 2 1/9 11.1% Level 1 1/9 11.1% Level 0 0/9 0% Online Level 4 44/60 73.4% Level 3 0/60 0.0% Level 2 5/60 8.3% Level 1 6/60 10.0% Level 0 5/60 8.3%	**Observations/Changes:** MTH 110 instructors will continue current instructional methods to include in-class lectures and practice problems for on-campus sections and PowerPoint lessons as well as numerous written and video examples for online sections. Example: Venn Diagrams
MTH 110 Objective 3 Demonstrate understanding of concepts, develop competent skills,	Rubric based assessment of related common final exam problems Problem: Use Bayes' Theorem to solve a problem.	70% of students learning at a rubric level of 2 or higher	**71.2% of the students assessed performed at Level 2 or higher. (67/94)** Jefferson Campus Level 4 8/25 32.0% Level 3 7/25 28.0% Level 2 5/25 20.0%	**Observations/Changes:** MTH 110 instructors will review practice/examples and videos implemented in the online classes. Example:

<table>
<tr>
<td>and demonstrate applications by his/her ability to use Bayes' Theorem to solve a problem</td>
<td>Example: 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?</td>
<td></td>
<td>Level 1 4/25 16.0%
Level 0 1/25 4.0%

Clanton Campus
Level 4 5/9 55.6%
Level 3 1/9 11.1%
Level 2 3/9 33.3%
Level 1 0/9 0.0%
Level 0 0/9 0.0%

Online
Level 4 13/60 21.7%
Level 3 3/60 5.0%
Level 2 22/60 36.6%
Level 1 13/60 21.7%
Level 0 9/60 15.0%</td>
<td>Bayes' Theorem</td>
</tr>
<tr>
<td><u>MTH 110
Objective 4</u>
Demonstrate understanding of concepts, develop competent skills, and demonstrate applications by his/her ability to 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.

Example: 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>86.1% of the students assessed performed at Level 2 or higher. (81/94)

Jefferson Campus
Level 4 8/25 32.0%
Level 3 7/25 28.0%
Level 2 7/25 28.0%
Level 1 2/25 8.0%
Level 0 1/25 4.0%

Clanton Campus
Level 4 1/9 11.1%
Level 3 2/9 22.3%
Level 2 3/9 33.3%
Level 1 3/9 33.3%
Level 0 0/9 0%</td>
<td>Observations/Changes: MTH 110 instructors will continue current instructional methods to include in-class lectures and practice problems for on-campus sections and PowerPoint lessons as well as numerous written and video examples for online sections. Example:

Variance and Standard Deviation</td>
</tr>
</table>

			Online Level 4 30/60 50.0% Level 3 2/60 3.3% Level 2 21/60 35.0% Level 1 5/60 8.4% Level 0 2/60 3.3%	
Plan submission date: September 14, 2020			**Submitted by: Vicki Adams Updated by : Sam White**	

Evidence to Support SLO 1

2.4Matrices

Using Matrices to Represent Data

2.4 Self-Check Exercises

1. Perform the indicated operations:

$$\begin{bmatrix} 1 & 3 & 2 \\ -1 & 4 & 7 \end{bmatrix} - 3\begin{bmatrix} 2 & 1 & 0 \\ 1 & 3 & 4 \end{bmatrix}$$

2. Solve the following matrix equation for x, y, and z:

$$\begin{bmatrix} x & 3 \\ z & 2 \end{bmatrix} + \begin{bmatrix} 2-y & z \\ 2-z & -x \end{bmatrix} = \begin{bmatrix} 3 & 7 \\ 2 & 0 \end{bmatrix}$$

3. GASOLINE SALES Jack owns two gas stations, one downtown and the other in the Wilshire district. Over two consecutive days, his gas stations recorded gasoline sales represented by the following matrices:

$$A = \begin{array}{c} \\ \text{Downtown} \\ \text{Wilshire} \end{array} \begin{array}{c} \begin{array}{ccc} \text{Regular} & \text{Regular plus} & \text{Premium} \end{array} \\ \begin{bmatrix} 1200 & 750 & 650 \\ 1100 & 850 & 600 \end{bmatrix} \end{array}$$

and

$$B = \begin{matrix} \\ \text{Downtown} \\ \text{Wilshire} \end{matrix} \begin{matrix} \text{Regular} & \text{Regular plus} & \text{Premium} \\ \end{matrix} \begin{bmatrix} 1250 & 825 & 550 \\ 1150 & 750 & 750 \end{bmatrix}$$

Find a matrix representing the total sales of the two gas stations over the 2-day period.

6.1 Venn Diagrams Sets and Set Operations

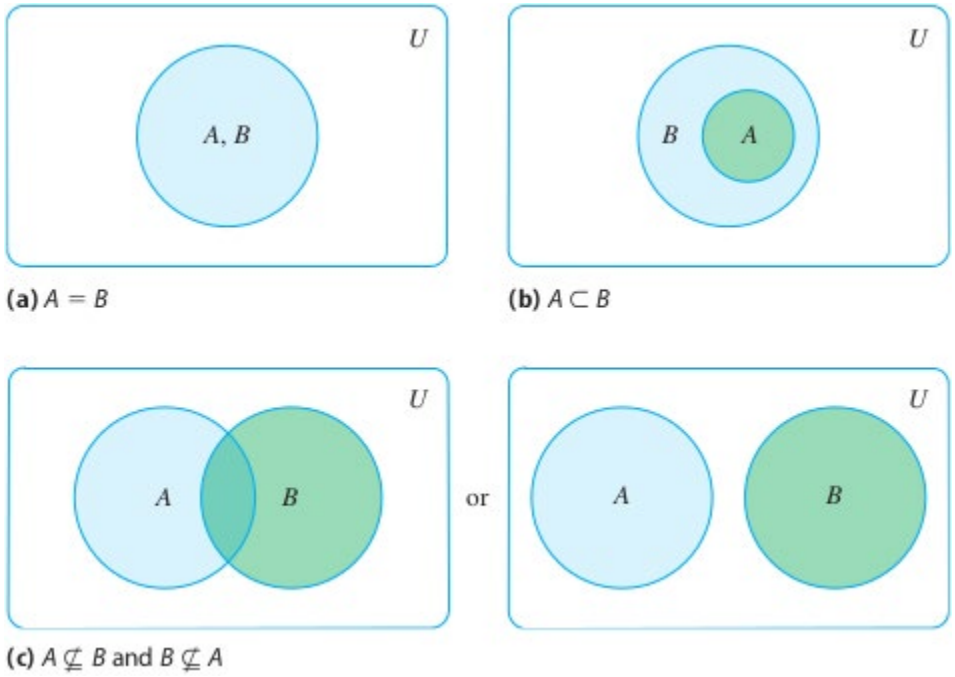
We can use Venn diagrams to obtain a visual representation of sets. Venn diagrams are of considerable help in understanding the concepts introduced earlier as well as in solving problems involving sets. The universal set U is represented by a rectangle, and subsets of U are represented by regions lying inside the rectangle.

Example 6 Use Venn diagrams to illustrate the following statements:

1. The sets A and B are equal.
2. The set A is a proper subset of the set B.
3. The sets A and B are not subsets of each other.

Solution The respective Venn diagrams are shown in Figure 1a, 1b, and 1c.

Figure 1



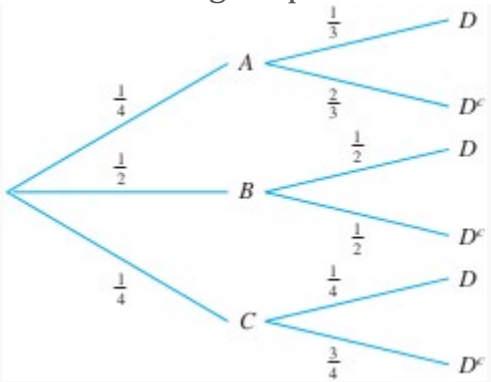
(a) $A = B$ (b) $A \subset B$

(c) $A \not\subseteq B$ and $B \not\subseteq A$

Evidence to support SLO 3

7.6 Bayes' Theorem Self-Check Exercises

1. The accompanying tree diagram represents a two-stage experiment. Use the diagram to find .



Answer

Using the probabilities given in the tree diagram and Bayes' Theorem, we have

2. **POLITICS** In a recent presidential election, it was estimated that the probability that the Republican candidate would be elected was and therefore the probability that the Democratic candidate would be elected was (the two Independent candidates were given little chance of being elected). It was also estimated that if the Republican candidate were elected, then the probability that research for a new manned bomber would continue was . But if the Democratic candidate were successful, then the probability that the research would continue was . Research was terminated shortly after the successful presidential candidate took office. What is the probability that the Republican candidate won that election?

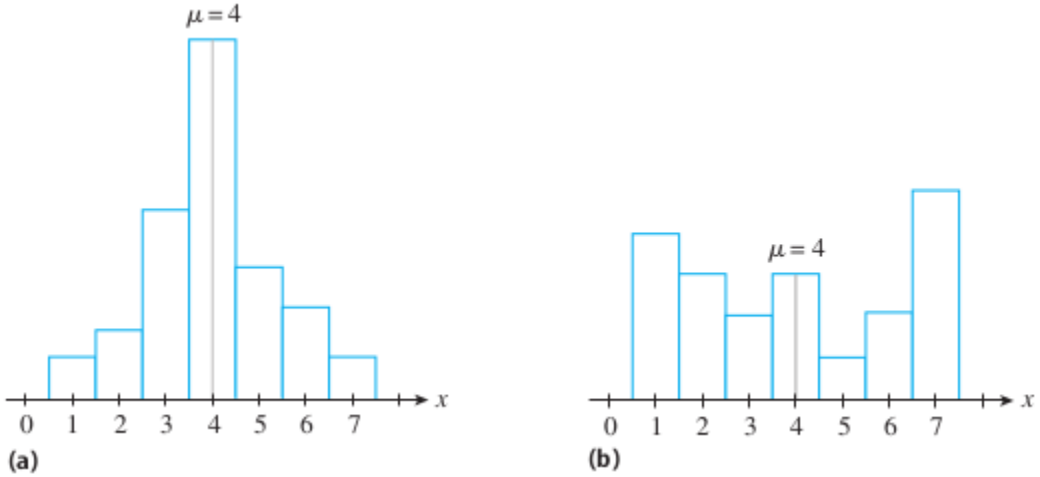
Evidence to Support SLO 4

8.3 Variance and Standard Deviation

Variance

The mean, or expected value, of a random variable enables us to express an important property of the probability distribution associated with the random variable in terms of a single number. But the knowledge of the location, or central tendency, of a probability distribution alone is usually not enough to give a reasonably accurate picture of the probability distribution. Consider, for example, the two probability distributions whose histograms appear in Figure 9. Both distributions have the same expected value, or mean, of (the Greek letter is read "mu"). Note that the probability distribution with the histogram shown in Figure 9a is closely concentrated about its mean , whereas the one with the histogram shown in Figure 9b is widely dispersed or spread about its mean.

Figure 9 The Histograms of Two Probability Distributions



As another example, suppose that Olivia has ten packages of Brand *A* potato chips and ten packages of Brand *B* potato chips. After carefully measuring the weights of each package, she obtains the following results:

Weight in Ounces

Brand *A*	16.1	16	15.8	16	15.9	16.1	15.9	16	16	16.2
Brand *B*	16.3	15.7	15.8	16.2	15.9	16.1	15.7	16.2	16	16.1

In Example 3, we verify that the mean weights for each of the two brands is ounces. However, a cursory examination of the data now shows that the weights of the Brand *B* packages exhibit much greater dispersion about the mean than do those of Brand *A*.

One measure of the degree of dispersion, or spread, of a probability distribution about its mean is given by the variance of the random variable associated with the probability distribution. A probability distribution with a small spread about its mean will have a small variance, whereas one with a larger spread will have a larger variance. Thus, the variance of the random variable associated with the probability distribution whose histogram appears in Figure 9a is smaller than the variance of the random variable associated with the probability distribution whose histogram is shown in Figure 9b (see Example 1). Also, as we will see in Example 3, the variance of the random variable associated with the weights of the Brand *A* potato chips is smaller than that of the random variable associated with the weights of the Brand *B* potato chips.

We now define the variance of a random variable.

Variance of a Random Variable

Suppose a random variable has the probability distribution

	…
	…

and expected value

Then the **variance** of the random variable is

(5)

Let's look a little closer at Equation (5). First, note that the number

Assessment Record

Program: Math-MTH 112 **Assessment period:** 2019-20

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 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	**80.7% schoolwide performed at level 2 or higher. (351/435)** **Jefferson Campus** Level 4 13/19 68.4% Level 3 0/19 0.0% Level 2 1/19 5.3% Level 1 5/19 26.3% Level 0 0/19 0.0% **Shelby Campus** Level 4 125/157 79.6% Level 3 14/157 8.9% Level 2 5/157 3.2% Level 1 11/157 7.0%	**Observations/Changes:** MTH 112 instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice to improve performance on finding the inverse of a function.

			Level 0 2/157 1.3% **Clanton Campus** Level 4 24/37 64.9% Level 3 2/37 5.4% Level 2 3/37 8.1% Level 1 8/37 21.6% Level 0 0/37 0.0%	
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	**78.6% schoolwide performed at level 2 or higher. (342/435)** **Jefferson Campus** Level 4 6/19 31.6% Level 3 1/19 5.3% Level 2 7/19 36.8% Level 1 4/19 21.1% Level 0 1/19 5.3% **Shelby Campus** Level 4 85/157 54.1% Level 3 17/157 10.8% Level 2 27/157 17.2% Level 1 26/157 16.6% Level 0 2/157 1.3% **Clanton Campus** Level 4 17/37 45.9% Level 3 0/37 0.0% Level 2 7/37 18.9% Level 1 13/37 35.1% Level 0 0/37 0.0%	**Observations/Changes:** MTH 112 instructors will include corresponding homework problems as part of the students' grade to encourage students' participation and additional practice to improve performance when using properties of exponents/logarithms to solve problems.
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	**80.2% schoolwide performed at level 2 or higher. (349/435)** **Jefferson Campus** Level 4 3/19 15.8% Level 3 4/19 21.1%	**Observations/Changes:** Instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice.

			Level 2 4/19 21.1% Level 1 4/19 21.1% Level 0 4/19 21.1% **Shelby Campus** Level 4 93/157 59.2% Level 3 20/157 12.7% Level 2 25/157 15.9% Level 1 15/157 9.6% Level 0 4/157 2.5% **Clanton Campus** Level 4 18/37 48.6% Level 3 1/37 2.7% Level 2 9/37 24.3% Level 1 7/37 18.9% Level 0 0/37 0.0% **Pell City** Level 4 36/59 61.0% Level 3 8/59 13.6% Level 2 2/59 3.4% Level 1 11/59 18.6% Level 0 2/59 3.4% **Online** Level 4 5/47 10.6% Level 3 7/47 14.9% Level 2 8/47 17.0% Level 1 14/47 29.8% Level 0 13/47 27.7%	
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	**89.4% schoolwide performed at level 2 or higher. (389/435)** **Jefferson Campus** Level 4 11/19 57.9% Level 3 1/19 5.3% Level 2 2/19 10.5% Level 1 4/19 21.1%	**Observations/Changes:** Instructors will include corresponding homework problems as part of the students' grade to encourage participation and additional practice on graph transformations of basic functions.

			Level 0 1/19 5.3% **Shelby Campus** Level 4 105/157 66.9% Level 3 28/157 17.8% Level 2 19/157 12.1% Level 1 5/157 3.2% Level 0 0/157 0.0% **Clanton Campus** Level 4 24/37 64.9% Level 3 2/37 5.4% Level 2 2/37 5.4% Level 1 7/37 18.9% Level 0 2/37 5.4% **Pell City** Level 4 40/59 67.8% Level 3 9/59 15.3% Level 2 2/59 3.4% Level 1 7/59 11.9% Level 0 1/59 1.7% **Online** Level 4 10/47 21.3% Level 3 16/47 34.0% Level 2 11/47 23.4% Level 1 3/47 6.4% Level 0 7/47 14.9%	
Plan submission date:			**Submitted by:**	

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.

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:

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

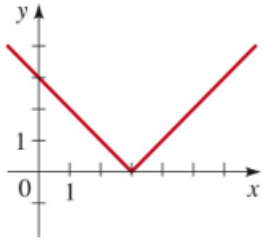
Assessment of Objective 3 - Find the zeros of a polynomial function

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 $g(x) = -f(x - 2) + 1$.



Homework will be graded regularly and is due every Tuesday at 11:59 pm Central Time for the lessons covered in class the previous week. If a student is absent during the week, homework for that week is still due on Tuesday at 11:59 pm. The due date for each homework assignment is posted in WebAssign.

Exam	Points	
Chapter 2 Exam	100	
Chapter 3 Exam	100	
Chapter 4 Exam	100	
Chapter 2 Homework	25	(2.8) Objective 1, (2.6) Objective 4
Chapter 3 Homework	25	(3.4) Objective 3
Chapter 4 Homework	25	(4.5) Objective 2
Chapter 10 Homework	25	
Final Exam (Comprehensive)	125	
	525 Points Possible	

COURSE OUTLINE

This schedule is tentative and subject to change

Section	Topic
2.1	Functions
2.2	Graphs of Functions
2.3	Getting Information from the Graph of a Function
2.4	Average Rate of Change of a Function
2.6	Transformations of Functions
2.7	Combining Functions
2.8	One-to-One Functions and Their Inverses
Exam	**Chapter 2 Exam**
3.1	Quadratic Functions and Models
3.2	Polynomial Functions and Their Graphs
3.3	Dividing Polynomials
3.4	Real Zeros of Polynomials
1.6	Complex Numbers
3.5	Complex Zeros and the Fundamental Theorem of Algebra
3.6	Rational Functions
Exam	**Chapter 3 Exam**
4.1, 4.2	Exponential Functions, The Natural Exponential Function
4.3	Logarithmic Functions
4.4	Laws of Logarithms
4.5	Exponential and Logarithmic Equations
4.6	Modeling with Exponential Functions
4.7	Logarithmic Scales
Exam	**Chapter 4 Exam**
1.8	Inequalities
10.1	Systems of Linear Equations in Two Variables
10.2	Systems of Linear Equations in Several Variables
10.8	Systems of Nonlinear Equations
10.9	Systems of Inequalities
Exam	**Comprehensive Final Exam**

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2019-Summer 2020

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	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. (112/123)** Jefferson Level 4: 1/9 = 11.1% Level 3: 2/9 = 22.2% Level 2: 2/9 = 22.2% Level 1: 3/9 = 33.4% Level 0: 1/9 = 11.1% Clanton Level 4: 8/15 = 53.3% Level 3: 1/15 = 6.7% Level 2: 2/15 = 13.3% Level 1: 3/15 = 20.0% Level 0: 1/15 = 6.7% Shelby Level 4: 81/99 = 81.8% Level 3: 10/99 = 10.1% Level 2: 5/99 = 5.1% Level 1: 0/99 = 0.0% Level 0: 3/99 = 3.0%	**Observations/Changes:** MTH 113 instructors will continue with this question with follow-up discussions of appropriate proctoring for online classes. Online Proctoring

MTH 113 Objective 2 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	**96.7% of the students assessed performed at level 2 or higher. (119/123)** Jefferson Level 4: 2/9 = 22.3% Level 3: 3/9 = 33.3% Level 2: 3/9 = 33.3% Level 1: 1/9 = 11.1% Level 0: 0/9 = 0.0% Clanton Level 4: 12/15 = 80.0% Level 3: 0/15 = 0.0% Level 2: 2/15 = 13.3% Level 1: 1/15 = 6.7% Level 0: 0/15 = 0.0% Shelby Level 4: 80/99 = 80.8% Level 3: 4/99 = 4.04% Level 2: 13/99 = 13.13% Level 1: 0/99 = 0.0% Level 0: 2/99 = 2.03%	**Observations/Changes:** MTH 113 instructors will continue with this question with follow-up discussions of appropriate proctoring for online classes. Online Proctoring

MTH 113 Objective 3 Perform algebraic operations on vectors.	Rubric based assessment of related common test problems **Problem:** Given vectors a = ⟨-6,-1⟩ and b = ⟨2,-4⟩. Find 7a and a + b.	70% of students learning at a rubric level of 2 or higher	**96.7% of the students assessed performed at level 2 or higher. (119/123)** Jefferson Level 4: 1/9 = 11.1% Level 3: 2/9 = 22.2% Level 2: 2/9 = 22.2% Level 1: 1/9 =11.1% Level 0: 3/9 = 33.4% Clanton Level 4: 14/15 = 93.3% Level 3: 1/15 = 6.7% Level 2: 0/15 = 0.0% Level 1: 0/15 = 0.0% Level 0: 0/15 = 0.0% Shelby Level 4: 95/99 = 96.0% Level 3: 1/99 = 1.0% Level 2: 3/99 = 3.0% Level 1: 0/99 = 0.0% Level 0: 0/99 = 0.0%	**Observations/Changes:** MTH 113 instructors will continue with this question with follow-up discussions of appropriate proctoring for online classes. Online Proctoring

MTH 113 Objective 4 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 your answer in standard form.	70% of students learning at a rubric level of 2 or higher	**91.9% of the students assessed performed at level 2 or higher. (113/123)** Jefferson Level 4: 1/9 = 11.1% Level 3: 2/9 = 22.2% Level 2: 2/9 = 22.2% Level 1: 1/9 = 11.1% Level 0: 3/9 = 33.4% Clanton Level 4: 3/15 = 20.0% Level 3: 2/15 = 13.3% Level 2: 6/15 = 40.1% Level 1: 2/15 = 13.3% Level 0: 2/15 = 13.3% Shelby Level 4: 55/99 = 55.6% Level 3: 28/99 = 28.3% Level 2: 14/99 = 14.1% Level 1: 0/99 = 0.0% Level 0: 2/99 = 2.0%	**Observations/Changes:** MTH 113 instructors will continue with this question with follow-up discussions of appropriate proctoring for online classes. Online Proctoring

MTH 113 Objective 5 Convert an equation from polar form to rectangular form.	Rubric based assessment of related common final exam problems **Problem:** Convert the equation $r = 6\cos\theta$ to rectangular form.	70% of students learning at a rubric level of 2 or higher	**90.2% of the students assessed performed at level 2 or higher. (111/123)** Jefferson Level 4: 2/9 = 22.2% Level 3: 3/9 = 33.4% Level 2: 2/9 = 22.2% Level 1: 1/9 = 11.1% Level 0: 1/9 = 11.1% Clanton Level 4: 7/15 = 46.8% Level 3: 2/15 = 13.3% Level 2: 2/15 = 13.3% Level 1: 2/15 = 13.3% Level 0: 2/15 = 13.3% Shelby Level 4: 58/99 = 58.9% Level 3: 10/99 = 10.1% Level 2: 25/99 = 25.0% Level 1: 1/99 = 1.0% Level 0: 5/99 = 5.0%	**Observations/Changes:** MTH 113 instructors will continue with this question with follow-up discussions of appropriate proctoring for online classes. Online Proctoring
Plan submission date: September 14, 2020			**Submitted by: Louise Fall**	

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.

Online Proctoring

From: Alan Davis **Sent:** Tuesday, March 17, 2020 9:49 PM **Subject:** How Are You Doing? - Moving To Online Instruction

Hi, Everyone. I am interested to know how the move to online instruction is going in your area. I know that a lot of faculty collaboration is happening in departments and programs. Are you detecting any trends that we need to discuss? Is there anything that is working well in your area that could be helpful to others? Do you have suggestions for how we can communicate effectively while we work through these unique circumstances?

The challenges we face present a great opportunity for us to work and learn together.

I look forward to hearing from you.

Alan

From: Alan Davis **Sent:** Thursday, March 19, 2020 7:16 PM **Subject:** Online Tests - Moving To Online Instruction

I hope everyone is well this evening. The attached Word document is a guide from ACCS that contains suggestions for faculty working with students who do not have reliable Internet service. Please notify me if students are contacting you with this concern.

Questions about testing online are on the rise, with special interest in proctoring tools. Keith and Danielle acquired Respondus LockDown Brower and Respondus Monitor (AI webcam proctoring), which Colin added to our Blackboard Tools this afternoon. These tools can enhance online test security, but they are new and must be understood before they are applied. I would like to hear from anyone who has experience using them.

If we work together then we should be able to quickly learn the benefits and limitations of these tools. Please use the following resources to start the process.

The attached pdf is a 3 page Quick Start Guide for both tools.

https://web.respondus.com/webinars/ opens a registration page for free webinars. I am registered to participate tomorrow morning at 8:00am.

LockDown Browser (Must Be Used To Launch Respondus Monitor)
Main Page - https://web.respondus.com/he/lockdownbrowser/
Resources Page - https://web.respondus.com/he/lockdownbrowser/resources/ (Blackboard Learn Original is our LMS)

Respondus Monitor (Webcam Proctoring For LockDown Browser)
Main Page - https://web.respondus.com/he/monitor/
Resources Page - https://web.respondus.com/he/monitor/resources/ (Blackboard Learn Original is our LMS)

Resources for instructors learning to create tests in Blackboard are available at http://www.jeffersonstate.edu/resources-for-instructors-de/

Please use feedback you are receiving to let me know how we can help students and faculty in your area.

Alan

From: Alan Davis **Sent:** Friday, March 20, 2020 1:41 PM **Subject:** Proctored Tests Update - Moving To Online Instruction

Students moving from on-campus classes to alternative forms of instruction have completed proctored tests in most courses. In many courses, take-home tests and assignments that are not proctored can be used to fulfill remaining spring-semester requirements. Departments and programs should decide if an additional proctored test is required to complete the spring semester.

Respondus LockDown Browser and Monitor are proctoring tools that can be applied to tests delivered in Blackboard. However, **these proctoring tools cannot be applied to tests delivered through most publisher-provided platforms** (Cengage, Pearson, …). This remains true even when students use Blackboard integration to access the publisher's testing platform. I normally use PLATO to administer tests in MTH 098. If it is determined that students must complete a proctored test to complete my spring semester course then I will create the test in Blackboard so I can use the Respondus proctoring tools.
If you must administer a proctored test to complete the spring semester, then please attempt to create the test in Blackboard. **This should be attempted as soon as possible** so you can identify areas of difficulty. If you encounter difficulty creating a test in Blackboard, then **quickly contact me and helpdesk@jeffersonstate.edu** to make us aware of the specific problems you are experiencing.
I look forward to hearing from you, and I am glad to answer questions.

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2019 – Summer 2020

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

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

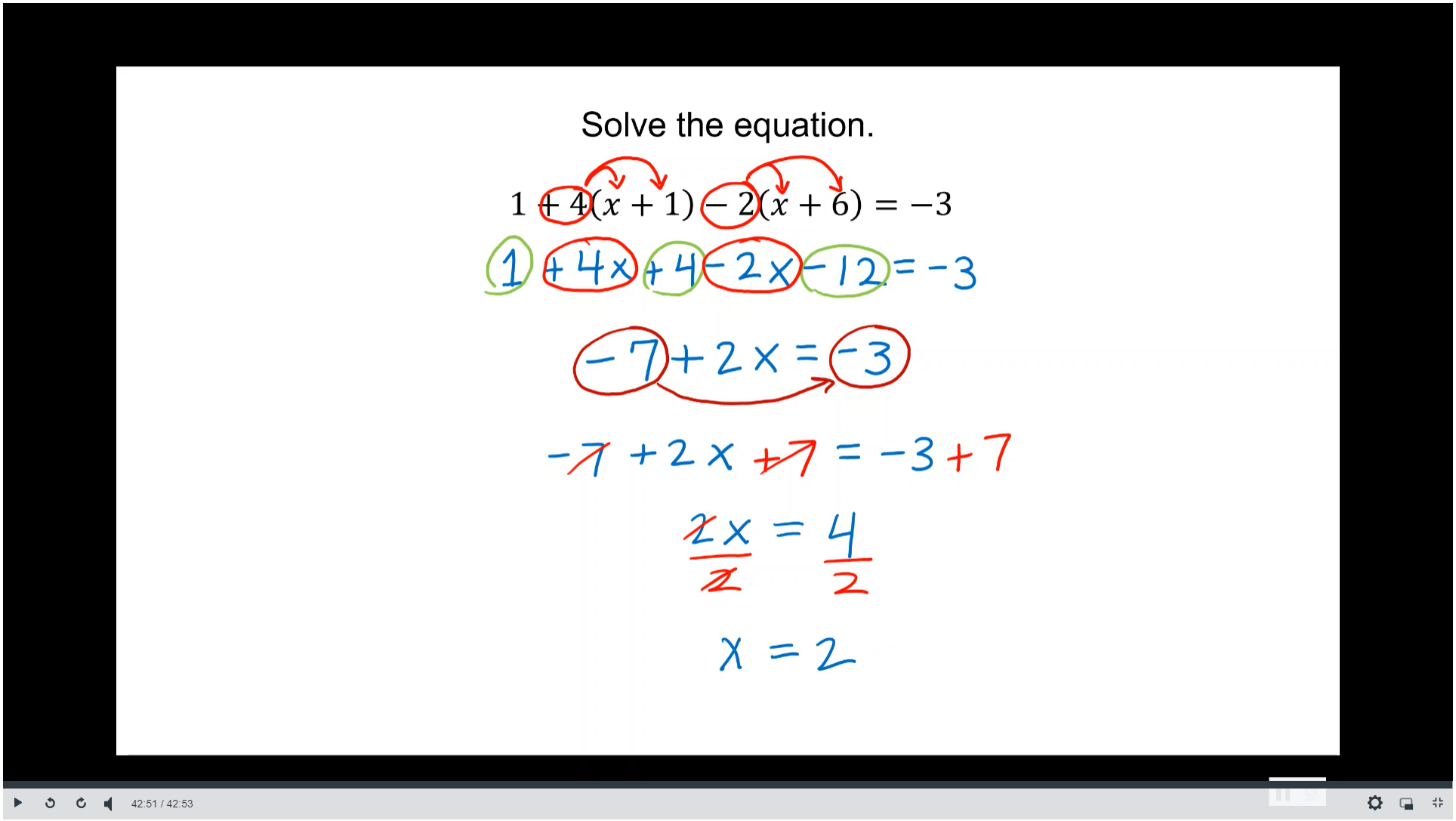
The student will demonstrate knowledge of functions and their graphs by his/her ability to

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 related common final exam problems	70% of students learning at a rubric level of 2 or higher	**Jefferson Campus** Level 4 10/23 43.5% Level 3 0/23 0% Level 2 9/23 39.1% Level 1 0/23 0% Level 0 4/23 17.4% **Shelby Campus** Level 4 12/17 70.59% Level 3 0/17 0% Level 2 5/17 29.41% Level 1 0/17 0% Level 0 0/17 0% **Online** Level 4 30/38 78.95% Level 3 0/38 0% Level 2 7/38 18.42% Level 1 0/38 0% Level 0 1/38 2.63% **Overall Performance** Level 4 52/78 66.67% Level 3 0/78 0% Level 2 21/78 26.92% Level 1 0/78 0% Level 0 5/78 6.41%	**Observations/Changes:** To increase student success rates on this SLO, the MTH 116 instructors will create and assign a tutorial video detailing the process of solving linear equations in one variable.

Assessment of Objective 2 Calculate the volume of a solid object or container	Rubric-based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**Jefferson Campus** Level 4 7/23 30.43% Level 3 0/23 0% Level 2 10/23 43.48% Level 1 0/23 0% Level 0 6/23 26.09% **Shelby Campus** Level 4 15/17 88.24% Level 3 0/17 0% Level 2 2/17 11.76% Level 1 0/17 0% Level 0 0/17 0% **Online** Level 4 8/38 21.05% Level 3 0/38 0% Level 2 26/38 68.42% Level 1 0/38 0% Level 0 4/38 10.53% **Overall Performance** Level 4 30/78 38.46% Level 3 0/78 0% Level 2 38/78 48.72% Level 1 0/78 0% Level 0 10/78 12.82%	Instructors will reinforce student learning of this objective by creating and assigning a video tutorial that emphasizes the different formulas and methods to calculate the volume of different objects.

Assessment of Objective 3 Calculate percentage.	Rubric-based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	**Jefferson Campus** Level 4 10/23 43.48% Level 3 0/23 0% Level 2 8/23 34.78% Level 1 0/23 0% Level 0 5/23 21.74% **Shelby Campus** Level 4 14/17 82.35% Level 3 0/17 0% Level 2 3/17 17.65% Level 1 0/17 0% Level 0 0/17 0% **Online** Level 4 16/38 42.10% Level 3 0/38 0% Level 2 18/38 47.37% Level 1 0/38 0% Level 0 4/38 10.53% **Overall Performance** Level 4 40/78 51.28% Level 3 0/78 0% Level 2 29/78 37.18% Level 1 0/78 0% Level 0 9/78 11.54%	**Observations/Changes:** MTH 116 instructors will reinforce student learning of this objective by creating a tutorial video that specifically outlines the processes required to solve different types of percentage application problems.
Plan submission date: 8/27/2020	**Submitted by: J. Holley**			It should be noted that the above represented data from SLO1, SLO2, and SLO3 does not contain data from Spring 2020. Due to the pandemic, this data was not gathered and\or calculated.

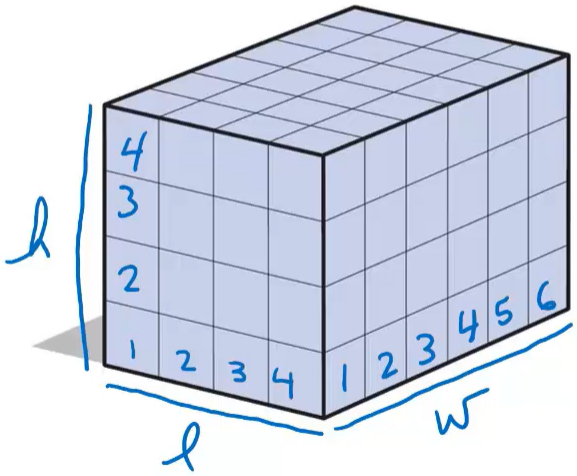

Solve the equation.
$1 + 4(x + 1) - 2(x + 6) = -3$
$1 + 4x + 4 - 2x - 12 = -3$
$-7 + 2x = -3$
$-7 + 2x + 7 = -3 + 7$
$\frac{2x}{2} = \frac{4}{2}$
$x = 2$
42:51 / 42:53

Press Esc to exit full screen

Volume of Cubes and Rectangular Parallelepipeds

$$V = lwh$$

Find the volume of the box below



$V = l\,w\,h$

$= 4(6)(4)$

$= 96$

u

9:28 / 43:50

A sales person has total sales of 101,748.96 for the year so far. If this represents 18% of her sales goal for the year, how much must she sell to meet her goal?

18% of her sales goal is $101,748.96

$$\frac{P}{100} = \frac{A}{W}$$

$$\frac{18}{100} = \frac{101,748.96}{W}$$

$$18W = 10174896$$

$$W = 565,272$$

1:08:49 / 1:08:52

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 Notes: Course is not offered at unlisted campuses	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	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%	**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

			Level 2 3/97 3.1% Level 1 0/97 0.0% Level 0 4/97 4.1%	by watching an extra lecture/PowerPoint, such as Example 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. Example Addendum A: https://www.wikihow.com/Find-the-Equation-of-a-Tangent-Line
MTH 120 Objective 2 Solve a related rates problem	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: 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. Example: https://youtu.be/kQF9pOqmS0U

MTH 120 Objective 3 Find the absolute extrema of a given function	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: 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: https://www.youtube.com/watch?v=JIQTPlBs154 https://www.youtube.com/watch?v=JXVGPEOQCb8
MTH 120 Objective 4 Solve an initial value problem	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: 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%	**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

			Online Level 4 88/97 90.7% Level 3 0/97 0.0% Level 2 4/97 4.1% Level 1 0/97 0.0% Level 0 5/97 5.2%	
MTH 120 Objective 5 Determine the Consumers' and Producers' Surplus	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: 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.
Plan submission date: June 23, 2022			**Submitted by: Sam White** **Updated by: Vicki Adams**	

Evidence to support SLO 1

MATHEMATICS » CALCULUS

How to Find the Equation of a Tangent Line

Co-authored by Jake Adams

Last Updated: May 14, 2021 References Approved

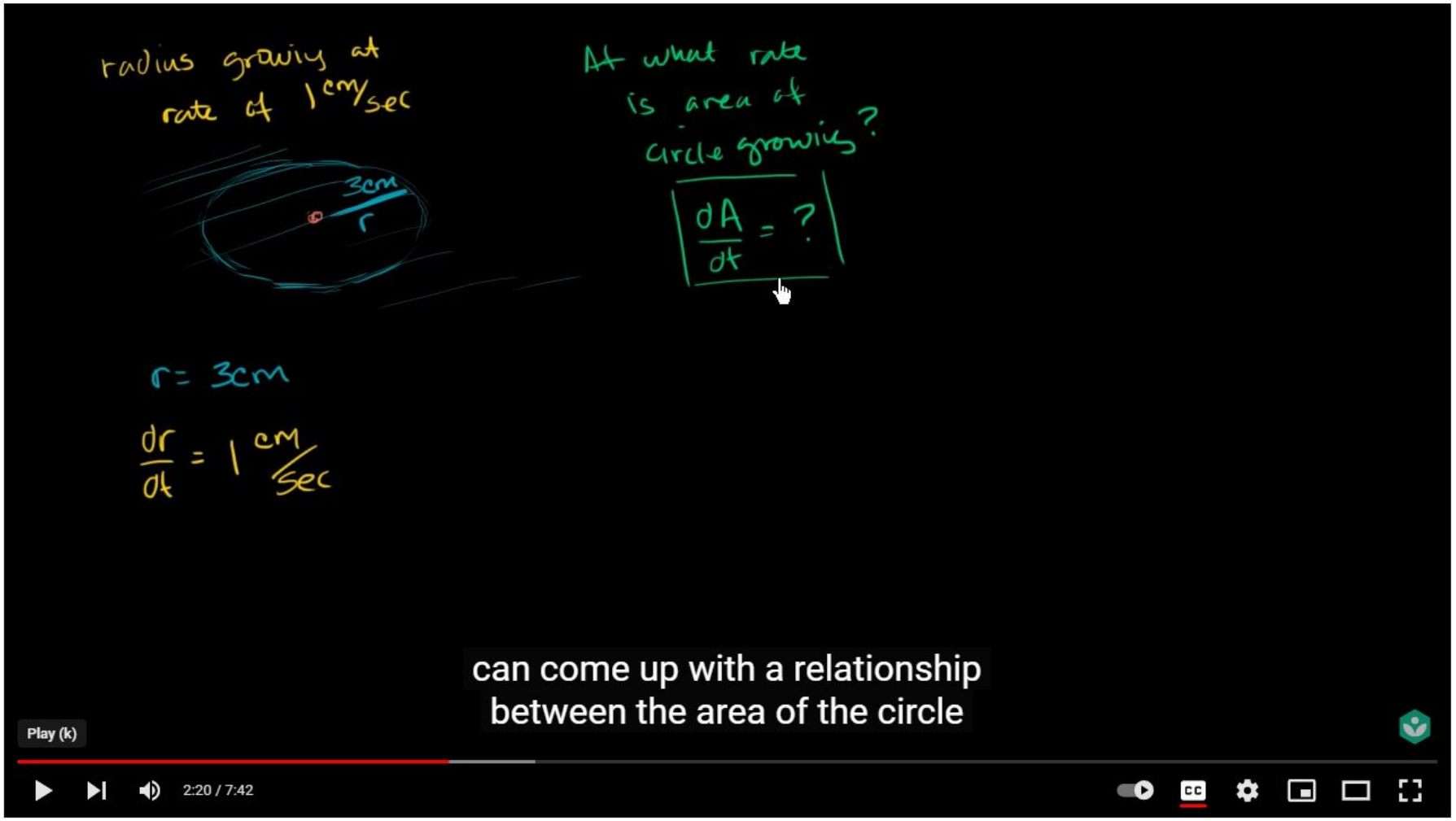
Unlike a straight line, a curve's slope constantly changes as you move along the graph. Calculus introduces students to the idea that each point on this graph could be described with a slope, or an "instantaneous rate of change." The tangent line is a straight line with that slope, passing through that exact point on the graph. To find the equation for the tangent, you'll need to know how to take the derivative of the original equation.

Download Article

METHODS

OTHER SECTIONS

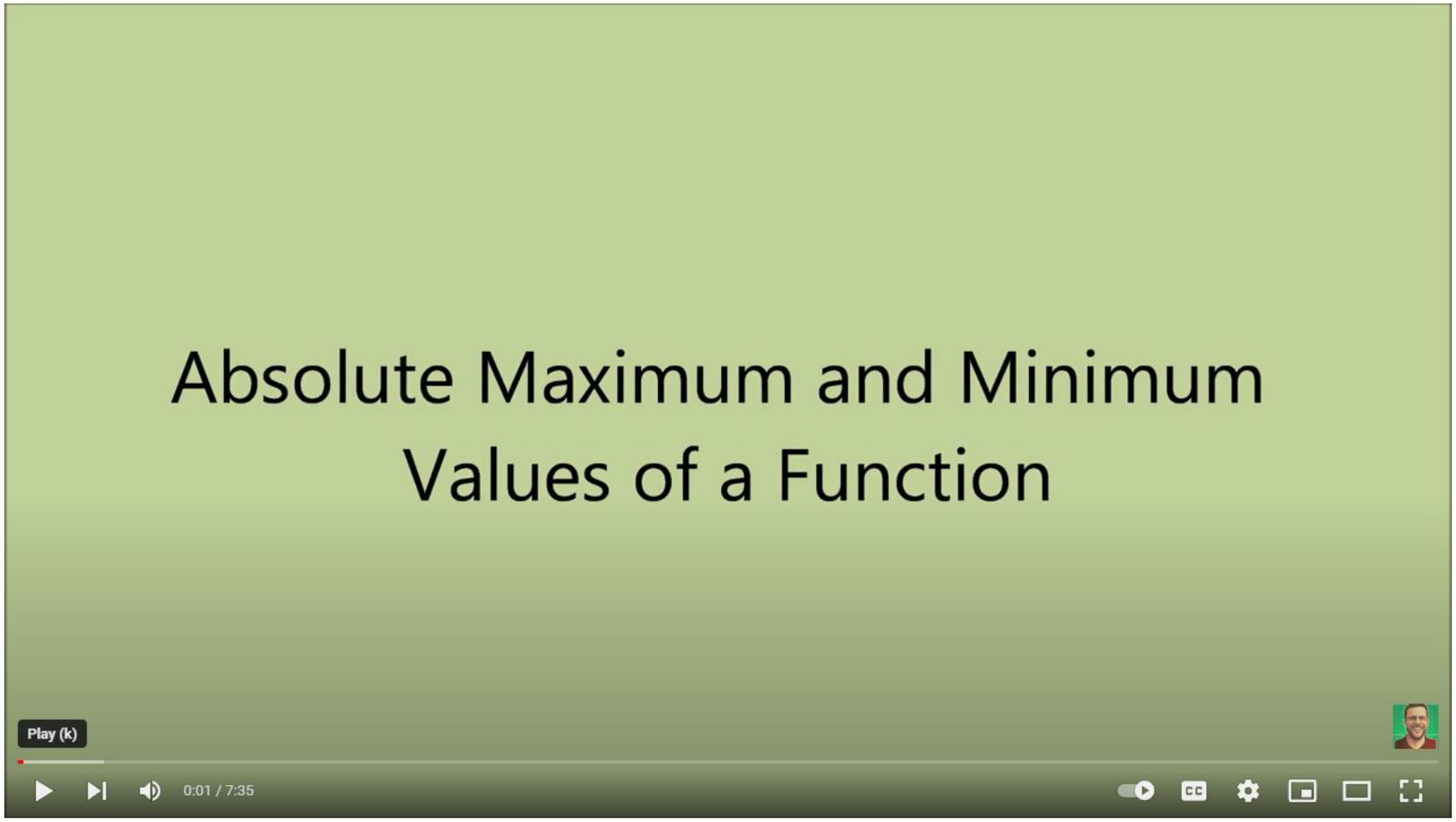
Evidence to support SLO 2



Related rates intro | Applications of derivatives | AP Calculus AB | Khan Academy

Fundraiser

Evidence to support SLO 3



Absolute Maximum and Minimum Values of a Function - Calculus I

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Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment Period:** FALL 2019 – SUMMER 2020

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

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	Jefferson Campus Level 4 6/17 35.4% Level 3 5/17 29.4% Level 2 3/17 17.6% Level 1 3/17 17.6% Level 0 0/17 0.0% Shelby Campus Level 4 108/125 86.4% Level 3 2/125 1.6% Level 2 13/125 10.4% Level 1 0/125 0.0% Level 0 2/125 1.6%	**Observations/Changes:** MTH 125S instructors recommend reinforcing student learning of this objective by using the following link to access organized steps along with practice problems. It is good for students to view another approach. Steps to Finding Limits
MTH 125S Objective 2 Demonstrate knowledge of the	Rubric based assessment of related	70% of students learning at a rubric level of 2 or higher	Jefferson Campus Level 4 5/17 29.4% Level 3 5/17 29.4% Level 2 4/17 23.5% Level 1 2/17 5.9% Level 0 1/17 0.0%	**Observations/Changes:** MTH 125S instructors recommend reinforcing student learning of this

methods presented in this course by his/her ability to compute the derivative of a function.	common final exam problems		Shelby Campus Level 4 116/125 92.8% Level 3 4/125 3.2% Level 2 3/125 2.4% Level 1 0/125 0.0% Level 0 2/125 1.6%	objective by using this website to organize and practice the intricacies of the power rule of derivatives with the following link. Organizing Power Rule

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	Jefferson Campus Level 4 5/17 42.1% Level 3 6/17 31.6% Level 2 4/17 15.8% Level 1 1/17 10.5% Level 0 1/17 0.0% Shelby Campus Level 4 105/125 84.0% Level 3 11/125 8.8% Level 2 6/125 4.8% Level 1 3/125 2.4% Level 0 0/125 0.0%	**Observations/Changes:** MTH 125S instructors recommend reinforcing student learning of this objective by using the following link to access a video to organize the types of integrals. It is good for students to view another approach. Organizing Integrals

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.

Finding Limits In Calculus – Follow These Steps

If you've been asked to find a limit by your teacher, there are a range of different methods that you can use. It's much simpler than it sounds and at the end of this guide, we have a nifty strategy that you can follow so that you'll always know which method to use and when.

Contents [hide]

Finding limits isn't easy, and a lot of people struggle with it. If this is you, don't worry, by the end of this

https://calcworkshop.com/derivatives/power-rule/

Top 25 Excel Formu... Excel functions (alp... Abbreviations | Oxf... The Integrated Post... College Navigator -... What is a Relational... SQLite Foreign Key... Trademark Fine Art... Amazon.com: 3 Pie... Tempur-Pedic TP90... Office Supplies, Tec... Staff Resource Libra...

Power Rule

How To w/ 9+ Step-by-Step Examples!

// Last Updated: February 15, 2021 - Watch Video //

Wouldn't it be nice to be able to calculate the slope of the tangent quickly and easily?

Thankfully we have the power rule to simplify our work tremendously, for it allows us to take derivatives of functions without needing to labor over the formal limit definition.

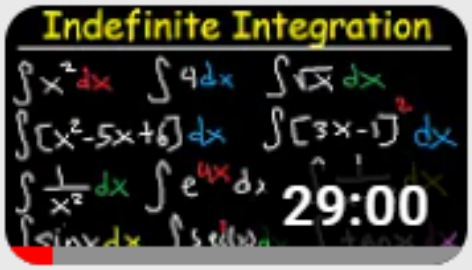
Jenn, Founder Calcworkshop®, 15+ Years Experience (Licensed & Certified Teacher)

What Is The Power Rule

Okay, so what is the power rule, and how do we use it?

The **power rule** is used to find the slope of polynomial functions and any other function that contains an exponent with a real number. In other words, it helps to take the derivative of a variable raised to a power (exponent).

The Steps



Indefinite Integral - Basic Integration Rules,...

The Organic Chemistry Tutor

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment Period:** FALL 2019 – SUMMER 2020

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

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

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

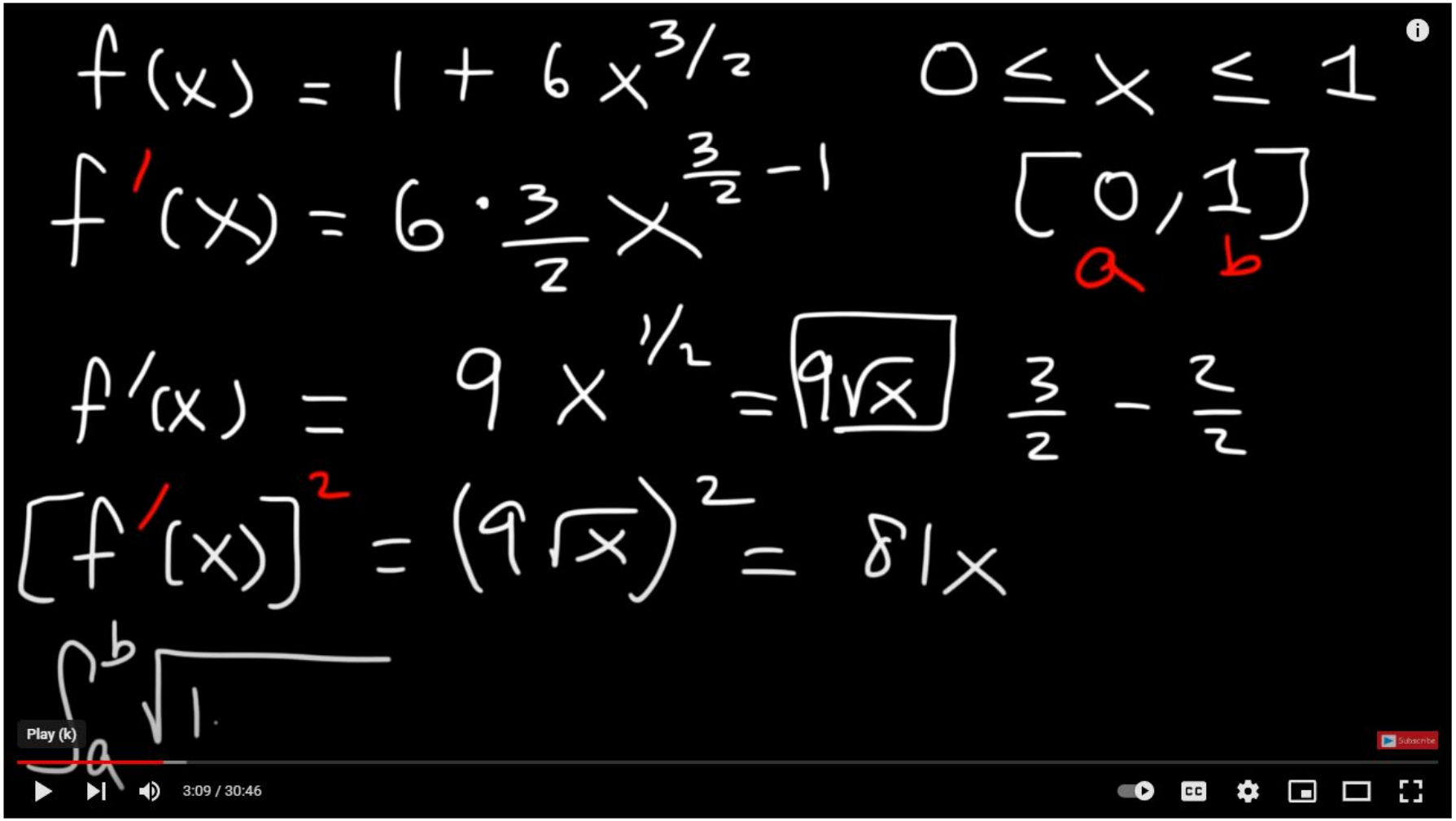
1. Find the length of an arc of a plane function, using the definite integral.
2. Use the method of partial fractions to evaluate an integral.
3. Write the Taylor series for a given function.

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
MTH 126S Objective 1 The student will 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	Jefferson Campus Level 4 7/20 35.0% Level 3 - Level 2 12/20 60.0% Level 1 - Level 0 1/20 5.0% Shelby Campus Level 4 76/90 84.4% Level 3 - Level 2 14/90 15.6% Level 1 - Level 0 0/90 0.0%	MTH 126S Instructors recommend reinforcing student learning of this objective by using an online video to organize arc length approaches with the following link. Organizing Arc Length Functions

MTH 126S Objective 2 The student will 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	Jefferson Campus Level 4 11/20 55.0% Level 3 - Level 2 8/20 40.0% Level 1 - Level 0 1/20 5.0% Shelby Campus Level 4 80/90 88.9% Level 3 - Level 2 9/90 10.0% Level 1 - Level 0 1/90 1.1%	MTH 126S instructors recommend reinforcing student learning of this objective by using the following link to access notes along with practice problems. It is good for students to view another approach. Notes on Partial Fractions

MTH 126S Objective 3 The student will demonstrate knowledge of the methods presented in this course by his/her ability to write a Taylor Series for a given function.k	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	Jefferson Campus Level 4 14/20 70.0% Level 3 - Level 2 6/20 30.0% Level 1 - Level 0 0/20 0.0% Shelby Campus Level 4 68/90 75.6% Level 3 - Level 2 22/90 24.4% Level 1 - Level 0 0/90 0.0%	MTH 126S instructors recommend reinforcing student learning of this objective by using the following link to access videos to organize and practice problems. It is good for students to view another approach. Taylor Series Video

Evidence to support SLO 1



Arc Length Calculus Problems,

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Section 7.4 : Partial Fractions

In this section we are going to take a look at integrals of rational expressions of polynomials and once again let's start this section out with an integral that we can already do so we can contrast it with the integrals that we'll be doing in this section.

$$\begin{aligned}\int \frac{2x-1}{x^2-x-6}\,dx &= \int \frac{1}{u}\,du \quad \text{using } u = x^2-x-6 \text{ and } du = (2x-1)\,dx \\ &= \ln\left|x^2-x-6\right| + c\end{aligned}$$

So, if the numerator is the derivative of the denominator (or a constant multiple of the derivative of the denominator) doing this kind of integral is fairly simple. However, often the numerator isn't the derivative of the denominator (or a constant multiple). For example, consider the following integral.

$$\int \frac{3x+11}{x^2-x-6}\,dx$$

In this case the numerator is definitely not the derivative of the denominator nor is it a constant multiple of the derivative of the denominator. Therefore, the simple substitution that we used above won't work. However, if we notice that the integrand can be broken up as follows,

$$\frac{3x+11}{x^2-x-6} = \frac{4}{x-3} - \frac{1}{x+2}$$

then the integral is actually quite simple.

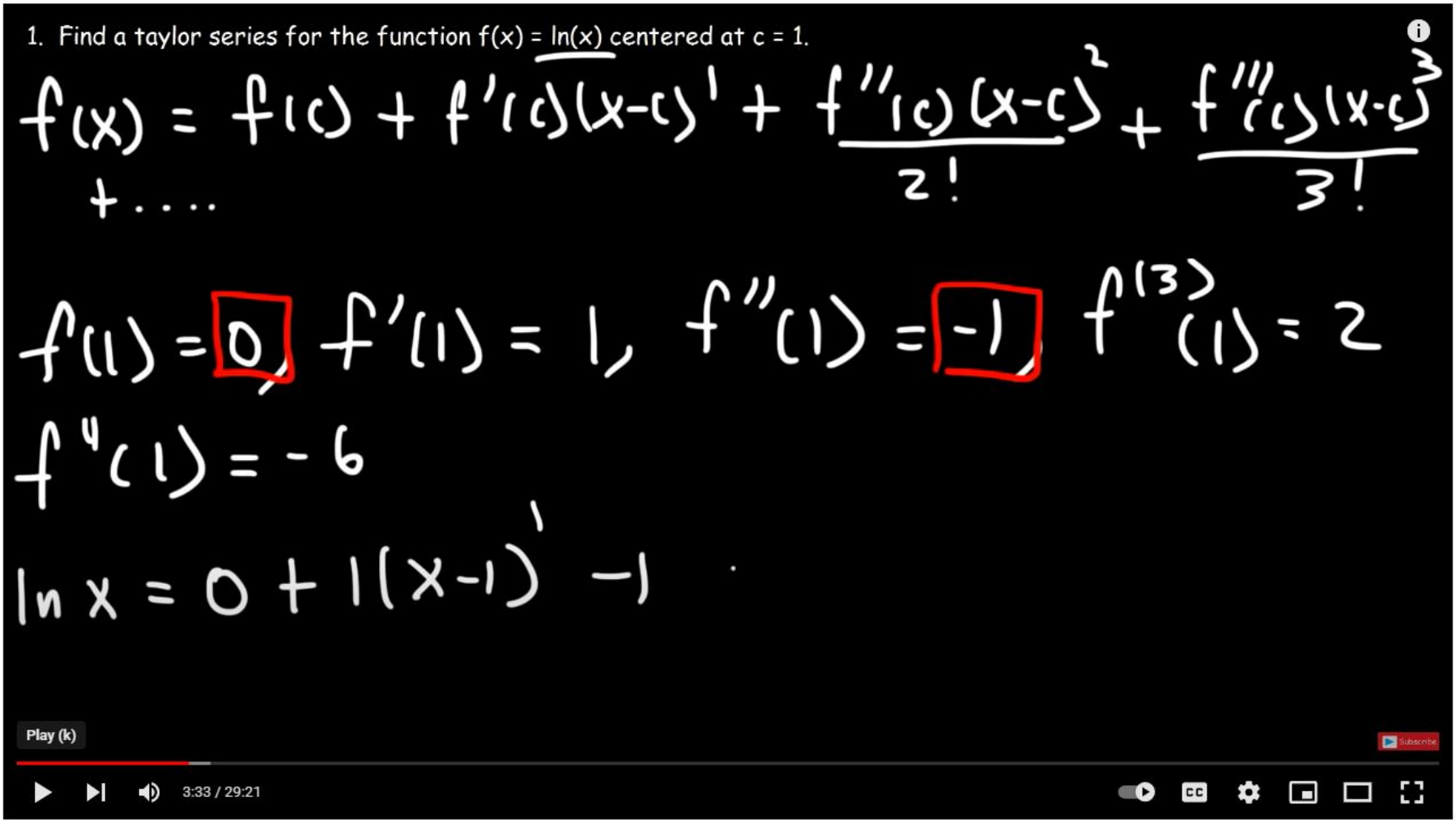
$$\begin{aligned}\int \frac{3x+11}{x^2-x-6}\,dx &= \int \frac{4}{x-3} - \frac{1}{x+2}\,dx \\ &= 4\ln|x-3| - \ln|x+2| + c\end{aligned}$$

This process of taking a rational expression and decomposing it into simpler rational expressions that we can add or subtract to get the original rational expression is called **partial fraction decomposition**. Many integrals involving rational expressions can be done if we first do partial fractions on the integrand.

So, let's do a quick review of partial fractions. We'll start with a rational expression in the form,

$$\frac{P(x)}{}$$

Evidence to support SLO 3



Taylor Series and Maclaurin Series - Calculus 2

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Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2019 – Summer 2020

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

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

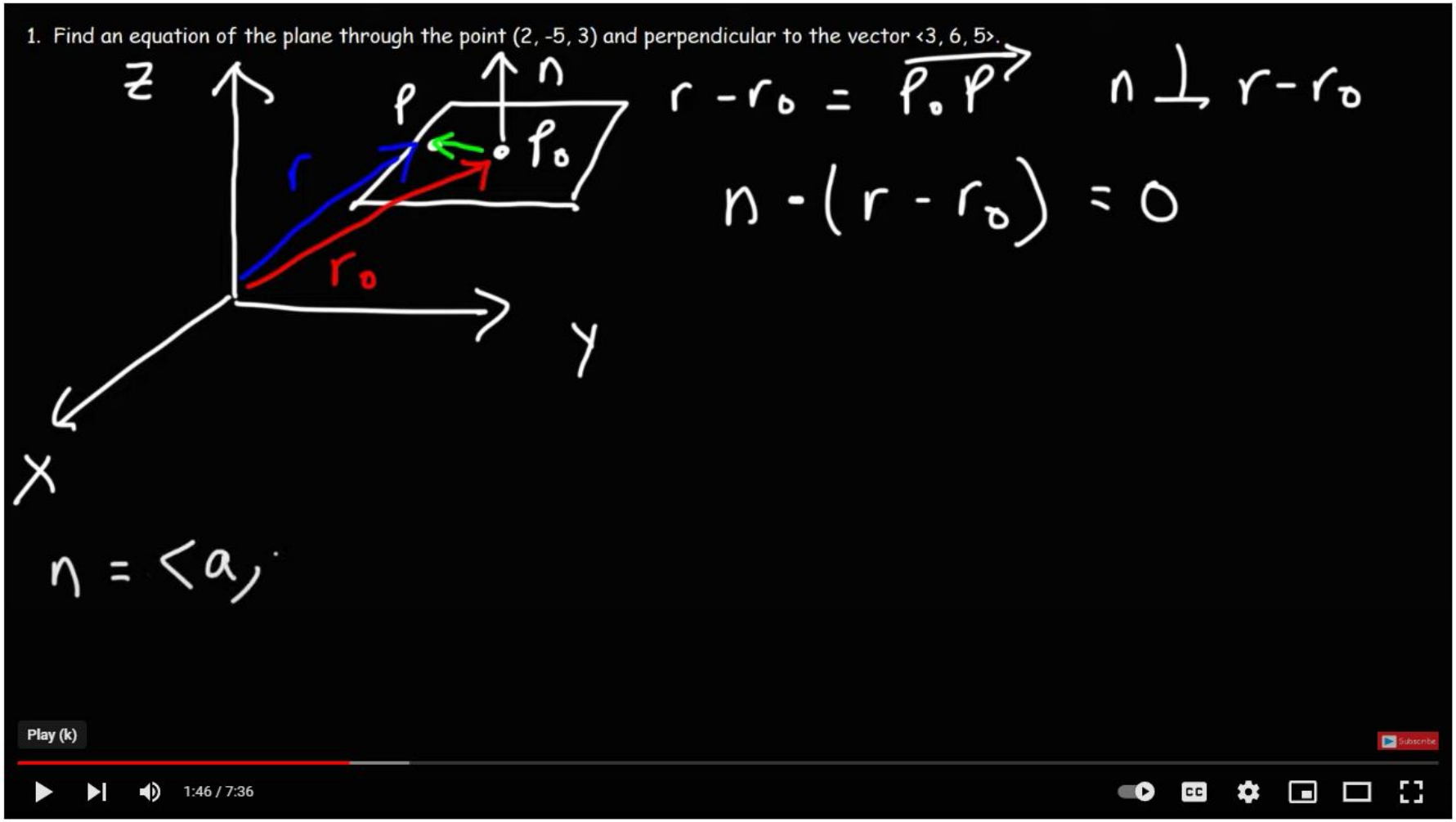
1. Find the equation of a plane.
2. Compute the directional derivative of a function.
3. Set up and evaluate a double integral.

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
MTH 227 Objective 1 The student will 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	Jefferson Campus Level 4 6/15 40% Level 3 6/15 40% Level 2 2/15 13% Level 1 1/15 7% Level 0 0/15 0% Shelby Campus Level 4 2/3 67% Level 3 0/3 0% Level 2 1/3 33% Level 1 0/3 0% Level 0 0/3 0% Internet Campus Neutral Level 4 9/16 56% Level 3 4/16 25% Level 2 3/16 19% Level 1 0/16 0% Level 0 0/16 0%	MTH 227 Instructors recommend reinforcing student learning of this objective with a video of the steps for finding the equation of a plane with the following link. Steps to Write Equation of a Plane

MTH 227 Objective 2 The student will 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	Jefferson Campus Level 4 7/15 32% Level 3 4/15 32% Level 2 3/15 27% Level 1 1/15 9% Level 0 0/15 0% Shelby Campus Level 4 2/3 40% Level 3 1/3 28% Level 2 0/3 24% Level 1 0/3 8% Level 0 0/3 0% Internet Campus Neutral Level 4 8/16 40% Level 3 3/16 28% Level 2 4/16 24% Level 1 1/16 8% Level 0 0/16 0%	MTH 227 instructors recommend reinforcing student learning of this objective by using the following link to access notes along with practice problems. It is good for students to view another approach. Notes for Directional Derivative

MTH 227 Objective 3 The student will 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	Jefferson Campus Level 4 6/15 32% Level 3 4/15 32% Level 2 4/15 27% Level 1 1/15 9% Level 0 0/15 0% Shelby Campus Level 4 1/3 40% Level 3 1/3 28% Level 2 1/3 24% Level 1 0/3 8% Level 0 0/3 0% Internet Campus Neutral Level 4 10/16 40% Level 3 4/16 28% Level 2 1/16 24% Level 1 1/16 8% Level 0 0/16 0%	MTH 227 instructors recommend reinforcing student learning of this objective by using the following link to access a video to help setup double integral problems. It is good for students to have more practice to master the objective. Setup Double Integral Video

Evidence for SLO 1



How To Find The Equation of a Plane Given a Point and Perpendicular Normal Vector

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Section 13.7 : Directional Derivatives

To this point we've only looked at the two partial derivatives $f_x(x,y)$ and $f_y(x,y)$. Recall that these derivatives represent the rate of change of f as we vary x (holding y fixed) and as we vary y (holding x fixed) respectively. We now need to discuss how to find the rate of change of f if we allow both x and y to change simultaneously. The problem here is that there are many ways to allow both x and y to change. For instance, one could be changing faster than the other and then there is also the issue of whether or not each is increasing or decreasing. So, before we get into finding the rate of change we need to get a couple of preliminary ideas taken care of first. The main idea that we need to look at is just how are we going to define the changing of x and/or y.

Let's start off by supposing that we wanted the rate of change of f at a particular point, say (x_0, y_0). Let's also suppose that both x and y are increasing and that, in this case, x is increasing twice as fast as y is increasing. So, as y increases one unit of measure x will increase two units of measure.

To help us see how we're going to define this change let's suppose that a particle is sitting at (x_0, y_0) and the particle will move in the direction given by the changing x and y. Therefore, the particle will move off in a direction of increasing x and y and the x coordinate of the point will increase twice as fast as the y coordinate. Now that we're thinking of this changing x and y as a direction of movement we can get a way of defining the change. We know from Calculus II that vectors can be used to define a direction and so the particle, at this point, can be said to be moving in the direction,

$$\vec{v} = \langle 2, 1 \rangle$$

Since this vector can be used to define how a particle at a point is changing we can also use it to describe how x and/or y is changing at a point. For our example we will say that we want the rate of change of f in the direction of $\vec{v} = \langle 2, 1 \rangle$. In this way we will know that x is increasing twice as fast as y is. There is still a small problem with this however. There are many vectors that point in the same direction. For instance, all of the following vectors point in the same direction as $\vec{v} = \langle 2, 1 \rangle$.

$$\vec{v} = \left\langle \frac{1}{5}, \frac{1}{10} \right\rangle \qquad \vec{v} = \langle 6, 3 \rangle \qquad \vec{v} = \left\langle \frac{2}{\sqrt{5}}, \frac{1}{\sqrt{5}} \right\rangle$$

We need a way to consistently find the rate of change of a function in a given direction. We will do this by insisting that the vector that defines the direction of change be a unit vector. Recall that a unit vector is a vector with length, or magnitude, of 1. This means that for the example that we started off thinking about we would want to use

Evidence for SLO 3

Setting up a Double Integral Using Both Orders of Integration

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Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2019 – Summer 2020

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 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.

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
<u>MTH 238 Objective 1</u> The student will demonstrate knowledge of the methods presented in this course by his/her ability to use an integrating factor to solve a first order linear equation.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	Internet Level 4 17/25 68% Level 3 5/25 20% Level 2 3/25 12% Level 1 0/25 0% Level 0 0/25 0%	100% (25/25) performed at Level 2 or higher. Up from 96% last year. The overall percentage of students that scored at level 2 or higher increased during this academic year. Our recommendation is to continue to concentrate more on other areas of the course. Our recommendation was to continue to add

				additional homework problems to strengthen basic math skills such as logarithms and integrals, see Addendum 1.
MTH 238 Objective 2 The student will demonstrate knowledge of the methods presented in this course by his/her ability to solve second order linear homogeneous equations with constant coefficients.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	Internet Level 4 16/25 64% Level 3 7/25 28% Level 2 2/25 8% Level 1 0/25 0% Level 0 0/25 0%	100% (25/25) performed at Level 2 or higher. Up from 85% last year. The overall percentage of students that scored at level 2 or higher increased this academic year. Our recommendation is to continue to concentrate more on other areas of the course. Our recommendation last year was to continue to supplement the homework with some practice in solving basic polynomial equations as they learned in precalculus similar to what they need for this class, see Addendum 2.

MTH 238 Objective 3 The student will demonstrate knowledge of the methods presented in this course by his/her ability to use the Laplace transform to solve a given initial valve problem.	Rubric based assessment of related common final exam problems	70% of students learning at a rubric level of 2 or higher	Internet Level 4 18/25 72% Level 3 5/25 20% Level 2 1/25 4% Level 1 1/25 4% Level 0 0/25 0%	96% (23/25) performed at Level 2 or higher. Up from 87% last year. The overall percentage of students that scored at level 2 or higher increased this academic year. Our recommendation is to continue to concentrate more on other areas of the course but continue to review partial fraction decomposition in the context of solve Laplace transform problems. Our recommendation last year was to provide review problems that address partial fraction decomposition, see Addendum 3.

Mth 238 Addendum

Addendum 1 (Example):

Solve the following problems by simplifying completely.

① $\int \frac{3t+1}{t^2+1}\,dt$ ② $e^{3\ln t}$ ③ $\ln t^2(t+1)$

Addendum 2 (Example):

Solve the basic algebraic equations.

① $\lambda^2 - 5\lambda + 6 = 0$ ② $\lambda^3 - 3\lambda^2 + 3\lambda - 1 = 0$

Addendum 3 (Example):

Perform the partial fraction decomposition.

① $\frac{t+2}{t^2-5t+6}$ ② $\frac{3t^2+2t+7}{t(t-2)^2(t^2+1)^2}$

Assessment Record

Program: **Mathematics, Engineering, Physical Sciences** **Assessment Period:** **Fall 2019 - Summer 2020**

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

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 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
Objective 1 Calculate the variance and standard deviation of a set of sample date.	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:* *x: Percentage success for mallard duck nests* *56 85 52 13 39*	70% of students learning at a rubric level of 2 or higher	Online Campus Level 4 131/153 85.6% Level 2 22/153 14.4% Level 0 0/153 0%	**Observations/Changes:** 100% (153/153) of students performed at Level 2 or higher. MTH265 instructors will reinforce student learning by continuing with the same instructional delivery of this topic. Our recommendation is to create a EdPuzzle video explaining variance and standard deviation. https://edpuzzle.com/media/6140eca35d6e1a4190720925

	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.*			
Objective 2 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. *For this problem, carry at least four digits after the decimal in your calculations. Answers 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 answers to three decimal places.)*	70% of students learning at a rubric level of 2 or higher	Online Campus Level 4 129/153 84.3% Level 2 23/153 15.0% Level 0 1/153 0.7%	99.3% (129/153) performed at Level 2 or higher. Our recommendation is to create a study guide to better prepare students for the SLOs assessment. Students can also complete the guided exercise in the textbook. The study guide will be made available at the beginning of the semester. **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 **OR** see problems below
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* *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?*	70% of students learning at a rubric level of 2 or higher	Online Campus Level 4 140/153 91.5% Level 2 10/153 6.5% Level 0 3/153 2%	**Observations/Changes:** 98.7% (151/153) performed at Level 2 or higher. The department recommends identify a testing methodology to be able to modify the rubric to include all five levels of separation in an online test to identify (if any) differentiation in the distribution of the data and to facilitate meaningful student performance and outcome comparisons. It is important to consider that during that 2019-2020 academic cycle no data was reported for the Spring semester due to 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 the textbook. The study guide will be made available at the beginning of the semester. **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.

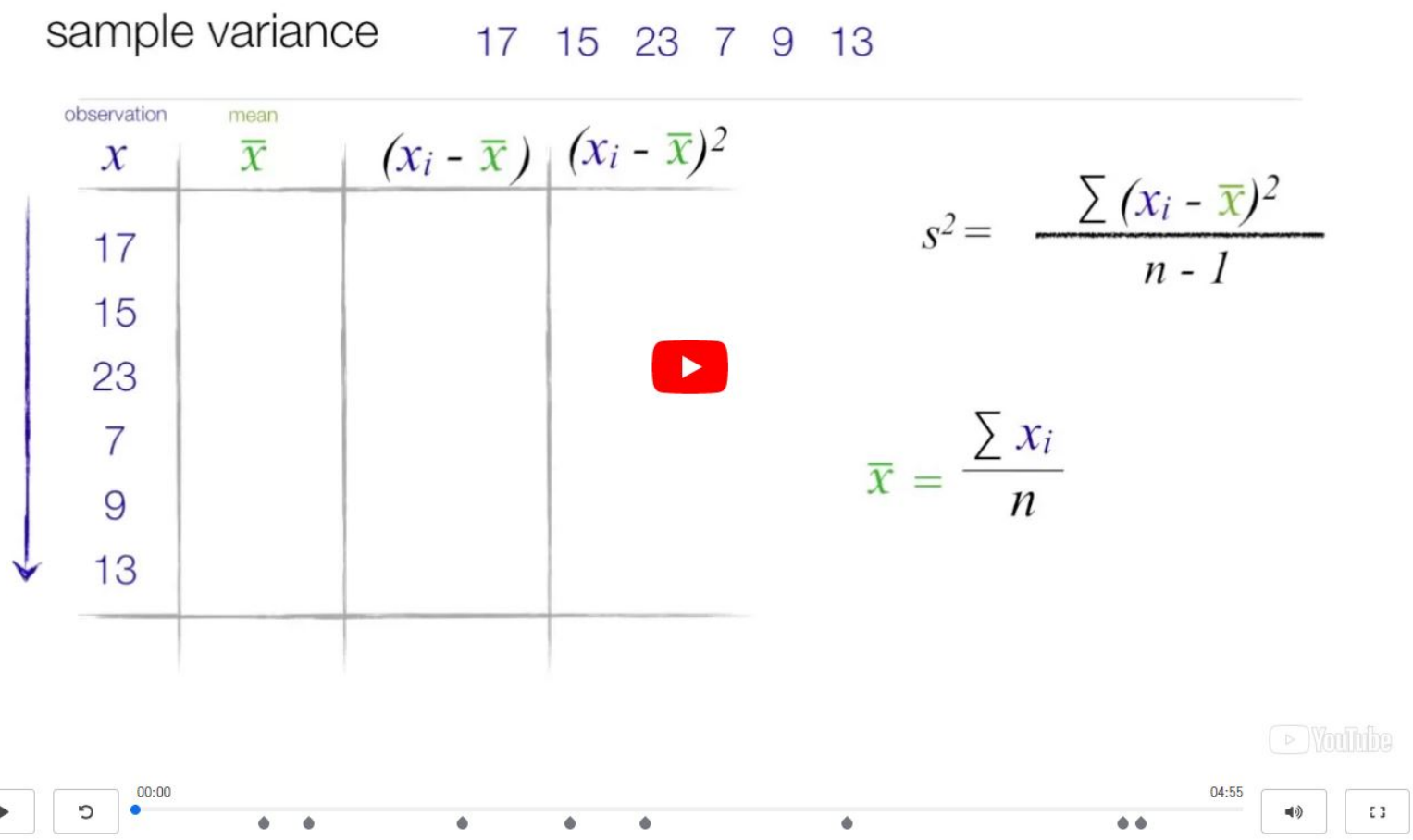
				Assessment of Objective 2: Section 8.2, textbook pages 390, Example 5. Assessment of Objective 3: Section 9.2, textbook pages 449-450, Example 5. MTH265 SLOs Study Guide Problems.pdf **OR** see problems below

Evidence for SLO 1

edpuzzle

SLOs Assessment Objective 1 Note for Variance and Standard Deviation

SU Moore



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 $\alpha = 0.05$.

Assessment Record

Program: Mathematics, Engineering, Physical Sciences **Assessment period:** Fall 2019 – Summer 2020

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 – PHS 111

Physical Science 111 Course Level Outcomes Assessment Rubric

For Exam and Quiz Questions

Level 4: Student provides a correct response that is well organized – 100% credit
Level 3: Student provides a partially correct response containing well over half of the facts expected in a Level 4 response – 75% credit.
Level 2: Student provides partially correct response containing less than one half of the facts expected in a Level 4 response – 25 - 50% credit.
Level 1: Student attempts a solution, provides an incorrect response – 0% credit.
Level 0: Student does not attempt a solution.

Evaluated Course Objectives

The student will demonstrate knowledge of physical science using writing skills with correct grammar, spelling and punctuation by his/her ability 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.

Intended Outcomes	Means of Assessment	Criteria for Success	Summary & Analysis of Assessment Evidence	Use of Results
PHS 111 Objective 1 The student will demonstrate knowledge of physical science using writing skills with correct grammar, spelling and punctuation by his/her ability to 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	Internet Level 4 – 82 Level 3 – 16 Level 2 – 19 Level 1 – 4 Level 0 – 8 N = 129 Internet – 76.0% Shelby Campus Level 4 Level 3 Level 2 Level 1 Level 0 N = Shelby Campus – %	Overall Success - 76.0% Total = 129

<table>
<tr>
<td>PHS 111 Objective 2

The student will demonstrate knowledge of physical science using writing skills with correct grammar, spelling and punctuation by his/her ability to describe different kinds of weather fronts and their associated characteristics.</td>
<td>Rubric based assessment of related common final exam problems</td>
<td>70% of students learning at a rubric level of 3 or higher</td>
<td>
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N = 135
Internet – 68.9 %

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N =
Shelby Campus – %
</td>
<td>Overall Success – 68.9%

Total = 135</td>
</tr>
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<table>
<tr>
<td><u>PHS 111 Objective 3</u>

The student will demonstrate knowledge of physical science using writing skills with correct grammar, spelling and punctuation by his/her ability to list the three types of rocks and describe their formation.</td>
<td>Rubric based on common final exam questions.</td>
<td>70% of students learning at a rubric level of 3 or higher</td>
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<tr><td>Level 3</td><td>14</td></tr>
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<tr><td>Level 1</td><td>5</td></tr>
<tr><td>Level 0</td><td>2</td></tr>
</table>
N = 39
Jefferson Campus – 48.7%

<table>
<tr><td colspan="2">Shelby Campus</td></tr>
<tr><td>Level 4</td><td></td></tr>
<tr><td>Level 3</td><td></td></tr>
<tr><td>Level 2</td><td></td></tr>
<tr><td>Level 1</td><td></td></tr>
<tr><td>Level 0</td><td></td></tr>
</table>
N =
Shelby Campus – %
</td>
<td>Overall Success – 48.7%

Total = 39</td>
</tr>
</table>

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 correct response that is well organized – 100% credit
Level 3: Student provides a partially correct response containing well over half of the facts expected in a Level 4 response – 75% credit.
Level 2: Student provides partially correct response containing less than one half of the facts expected in a Level 4 response – 25 - 50% credit.
Level 1: Student attempts a solution, provides an incorrect response – 0% credit.
Level 0: Student does not attempt a solution.

Evaluated Course Objectives

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

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

<table>
<tr><th>Intended Outcomes</th><th>Means of Assessment</th><th>Criteria for Success</th><th>Summary & Analysis of Assessment Evidence</th><th>Use of Results</th></tr>
<tr>
<td><u>PHS 112 Objective 1</u>

The student will demonstrate fundamental skills of mathematics to solve problems by his/her ability to calculate the formula weight of a compound.</td>
<td>Rubric based assessment of related common final exam problems</td>
<td>70% of students learning at a rubric level of 3 or higher</td>
<td>
<table>
<tr><td>Internet</td><td></td></tr>
<tr><td>Level 4</td><td>20</td></tr>
<tr><td>Level 3</td><td>4</td></tr>
<tr><td>Level 2</td><td>1</td></tr>
<tr><td>Level 1</td><td>3</td></tr>
<tr><td>Level 0</td><td>6</td></tr>
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N = 35

<table>
<tr><td>Shelby Campus</td><td></td></tr>
<tr><td>Level 4</td><td></td></tr>
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<tr><td>Level 1</td><td></td></tr>
<tr><td>Level 0</td><td></td></tr>
</table>
N =
Internet – 68.6%
Shelby Campus –
Overall – % Success
</td>
<td>Overall Success – 68.6%</td>
</tr>
</table>

<table>
<tr>
<td><u>PHS 112 Objective 2</u>

The student will demonstrate fundamental skills of mathematics to solve problems by his/her ability to calculate the %-age composition of a compound.</td>
<td>Rubric based assessment of related common final exam problems</td>
<td>70% of students learning at a rubric level of 3 or higher</td>
<td>
<table>
<tr><td colspan="2">Jefferson Campus</td></tr>
<tr><td>Level 4</td><td>14</td></tr>
<tr><td>Level 3</td><td>3</td></tr>
<tr><td>Level 2</td><td>4</td></tr>
<tr><td>Level 1</td><td>1</td></tr>
<tr><td>Level 0</td><td>11</td></tr>
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N = 35

<table>
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<tr><td>Level 2</td><td></td></tr>
<tr><td>Level 1</td><td></td></tr>
<tr><td>Level 0</td><td></td></tr>
</table>
N =
Internet – 48.6 %
Shelby Campus – %
Overall – % Success
</td>
<td>Overall success – 48.6%</td>
</tr>
<tr>
<td><u>PHS 112 Objective 3</u>

The student will demonstrate fundamental skills of mathematics to solve problems by his/her ability to compute the speed of a falling object given the time and initial speed.</td>
<td>Rubric based assessment of submitted lab reports for a common laboratory assignment.</td>
<td>70% of students learning at a rubric level of 3 or higher</td>
<td>
<table>
<tr><td colspan="2">Jefferson Campus</td></tr>
<tr><td>Level 4</td><td>7</td></tr>
<tr><td>Level 3</td><td>10</td></tr>
<tr><td>Level 2</td><td>8</td></tr>
<tr><td>Level 1</td><td>2</td></tr>
<tr><td>Level 0</td><td>8</td></tr>
</table>
N = 35
</td>
<td>Overall Success – 48.6 %</td>
</tr>
</table>

			<table><tr><td colspan="2">Shelby Campus</td></tr><tr><td>Level 4</td><td></td></tr><tr><td>Level 3</td><td></td></tr><tr><td>Level 2</td><td></td></tr><tr><td>Level 1</td><td></td></tr><tr><td>Level 0</td><td></td></tr></table>N = Internet – 48.6 % Shelby Campus – % Overall – % Success	
Plan submission date: September 24, 2020			Submitted by: Ann Lyons	

Assessment Record

Program: Mathematics, Engineering and Physical Science **Assessment period:** Fall 2019 - Summer 2020

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 213 S General Physics with Calculus I

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

The rubric used follows the assessment results.

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 related final exam problems	At least 70% of students will produce solutions at rubric level 2 or higher.	Jefferson Campus (Prob 1) Level 3 34/56 61% Level 2 9/56 16% Level 1 6/56 11% Level 0 7/56 12% Shelby Campus No Class Offered	Instructor Comments: For problem 1 (43/56) 77% of students performed at level 2 or higher. Most students were able to solve the problem demonstrating the physics and mathematics. This small group shows that projectile motion is well understood but still emphasis on details is essential towards the end of the term. Looks like they have a tendency to forget what they learned a few weeks earlier. Last year it was suggested that projectile motion problems may need to be review toward the end of the term, see Addendum 1.

PHY 213S Objective 2 State and Apply Newton's second law.	Rubric based assessment of related final exam problems	At least 70% of students will produce solutions at rubric level 2 or higher.	Jefferson Campus (Prob 2) Level 3 36/56 64% Level 2 10/56 18% Level 1 7/56 12% Level 0 3/56 6% Jefferson Campus (Prob 3) Level 3 23/56 41% Level 2 23/56 41% Level 1 3/56 5% Level 0 7/56 13%	Instructor Comments: For problem 2 (46/56) 82% of students and for problem 3 (46/56) 82% of students performed at level 2 or higher. Most students were able to solve the problem demonstrating understanding of the physics and the mathematics. It is hard to make a judgement when the group is so small, nonetheless, more elaborate dynamics problems needed to be worked out. Newton's 2nd Law is well understood. Slightly more challenging problems than we gave last year should be given to see what students could potentially be doing. It was suggested last year that more challenging Newton's laws problems should be given, see Addendum 2.

PHY 213S Objective 3 Calculate potential energy in the gravitational field.	Rubric based assessment of related final exam problems	At least 70% of students will produce solutions at rubric level 2 or higher.	Jefferson Campus (Prob 4) Level 3 6/20 30% Level 2 8/20 40% Level 1 5/20 25% Level 0 1/20 5% Jefferson Campus (Prob 5) Level 3 31/56 55% Level 2 7/56 13% Level 1 5/56 9% Level 0 13/56 23% Shelby Campus No Class Offered	Instructor Comments: For problem 4 (14/20) 70% of students and for problem 5 (38/56) 69% of students performed at level 2 or higher. Most students were able to solve the problems demonstrating understanding of the physics and the mathematics. Even though familiarity with integration and differentiations are evident some students seemed to be weak on basic calculus techniques. Even though most students are familiar with integration and differentiation, we may need to provide some review material on these topics. Last year it was suggested that more challenging problems should be given. Even though most students are familiar with integration and differentiation. More challenging as well as more concise problems should be given, see Addendum 3.
Plan submission date: 8/21/2020			**Submitted by: Department of Mathematics, Engineering and Physical Sciences, Robert Wallace**	

Phy 2135 Addendum

Addendum 1 (Example):

Solve the projectile motion problem:
A projectile is launched from a height of 10.0 m above the ground with an initial speed of 60.0 m/s at an angle 40.0° 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.

Addendum 2 (Example):

Solve the Newton's law problem:

A string is directed at a 25.0° angle above the horizontal is attached to a 75.0 kg box on a horizontal surface and the string is pulled with a tension of 200.0 N. The coefficient of kinetic friction between the box and the surface is 0.225. Find (a) the normal force on the box, (b) the kinetic friction, and (c) the acceleration of the box.

Addendum 3 (Example):

Solve the energy problem:

A 10.0 kg mass slides down a 30.0° incline plane before friction brings the object to rest at the bottom. ~~The potential is zero at~~ ~~ground level~~. The initial velocity of the mass is 7.50 m/s.

Compute (a) the initial gravitational energy of the mass assuming that the potential is zero at ground level and (b) compute the work done by friction.