FLORIDA ATLANTIC UNIVERSITY

Your **future** awaits.

LAs in Calculus

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Outline

- What is the Learning Assistant (LA) Program
- Brief history of LAs in Calculus at FAU
- Logistics – Structure for all modalities at FAU
- Partnerships that make our LA Program work
- Outcomes at FAU
- Challenges

What is the Learning Assistant Program?

Goals:

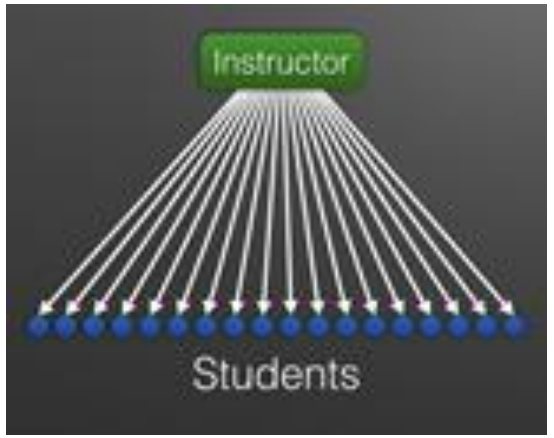
- Course redesign to include active learning through small group collaboration facilitated by undergraduate Learning Assistants (LAs)
- Teach students how to be successful college students through intentional course structuring
- Provide more equitable and inclusive learning environments

Who are LAs?

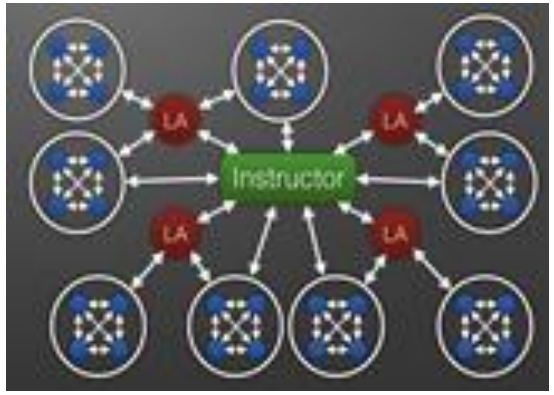
- Undergraduate students who, with the guidance of the instructor and a pedagogy course, facilitate among groups of students in a variety of classroom settings that encourage student engagement and interaction.

LA supported courses provide opportunities for students to work together toward a learning goal and to articulate and defend their ideas.

*LAs are NOT content experts… they are experts at **learning** in the course.*



Traditional classroom setting (instructor-centered)



LA classroom setting (student-centered)

History of LAs in Calculus at FAU

Started in Calculus in 2014

Several different approaches before arriving at our current structure

Effective change takes time

- Expanded to all sections in 2018 (Calc 1) and 2019 (Calc 2)

Continual assessment and improvement

Logistics – Structure (in-person classes)

Classes meet twice per week for 1 hour and 50 minutes

- Half lecture, half group work with LAs
- 1:20 LA to student ratio
  - In person enrollment 40 (2 LAs)
- Learning team: faculty, LAs, GTA grader

Faculty are provided with an organized Canvas shell and google drive containing all documents

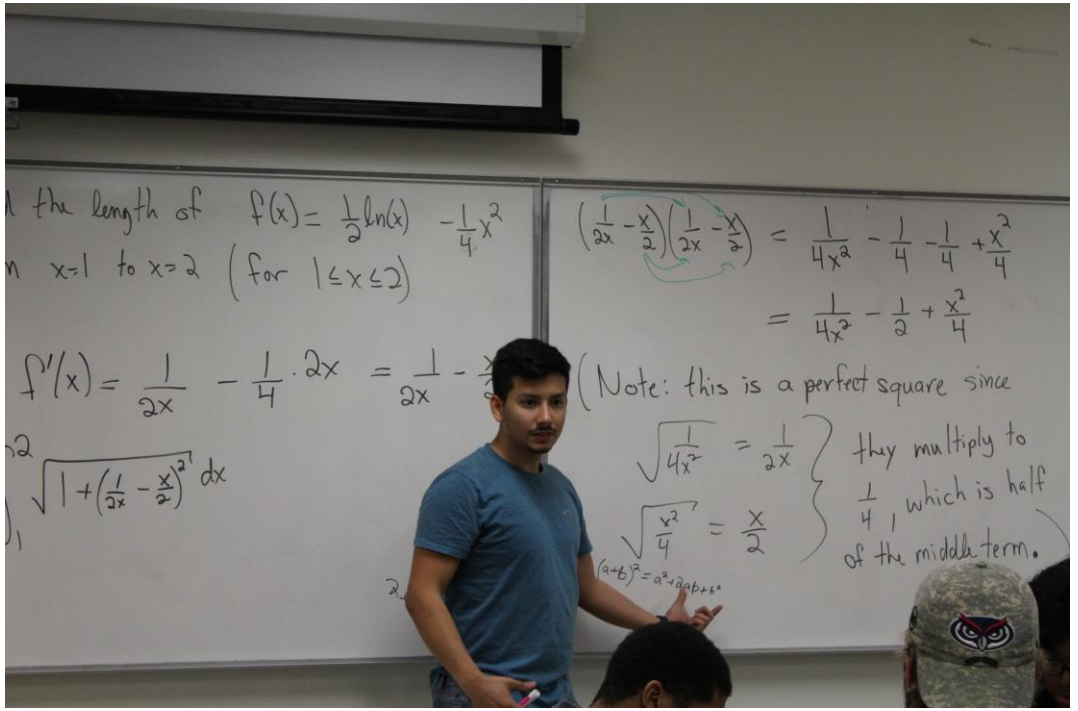
Each class, except around exam days, has a pre-worksheet and worksheet/HW associated with it

Students get feedback on assignments in timely fashion

Opportunity to earn points back (called corrections)

In Person Classes

- Active learning classroom



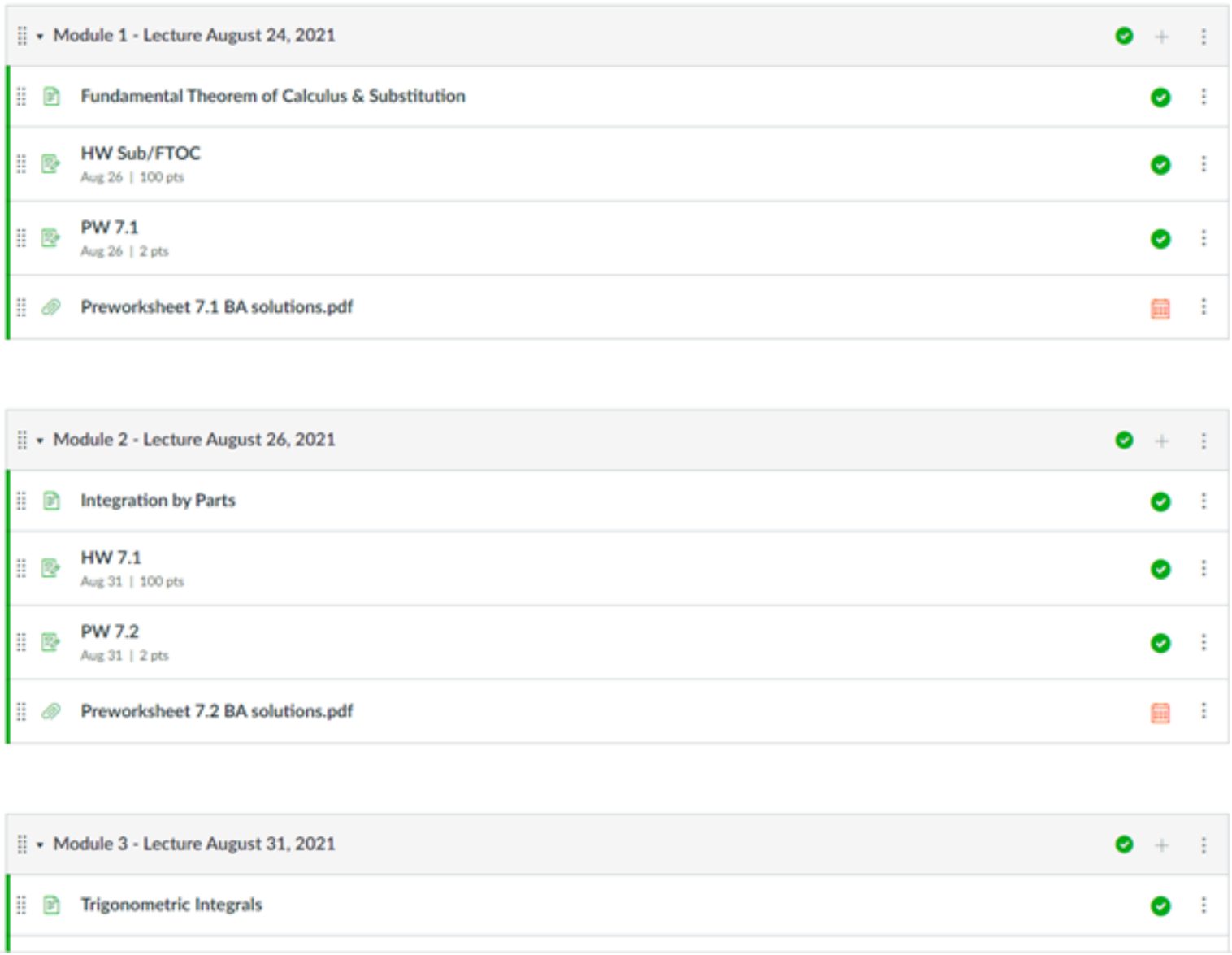
Canvas Example – In Person Classes

Integration by Parts

To Do

All activities in this module are required unless otherwise noted. Complete the following:

1. Read section 7.1
2. Attend class
3. Complete the homework: worksheet and textbook problems
4. Complete the pre-worksheet for the next class
5. Upload homework and pre-worksheet in Canvas before the next lecture

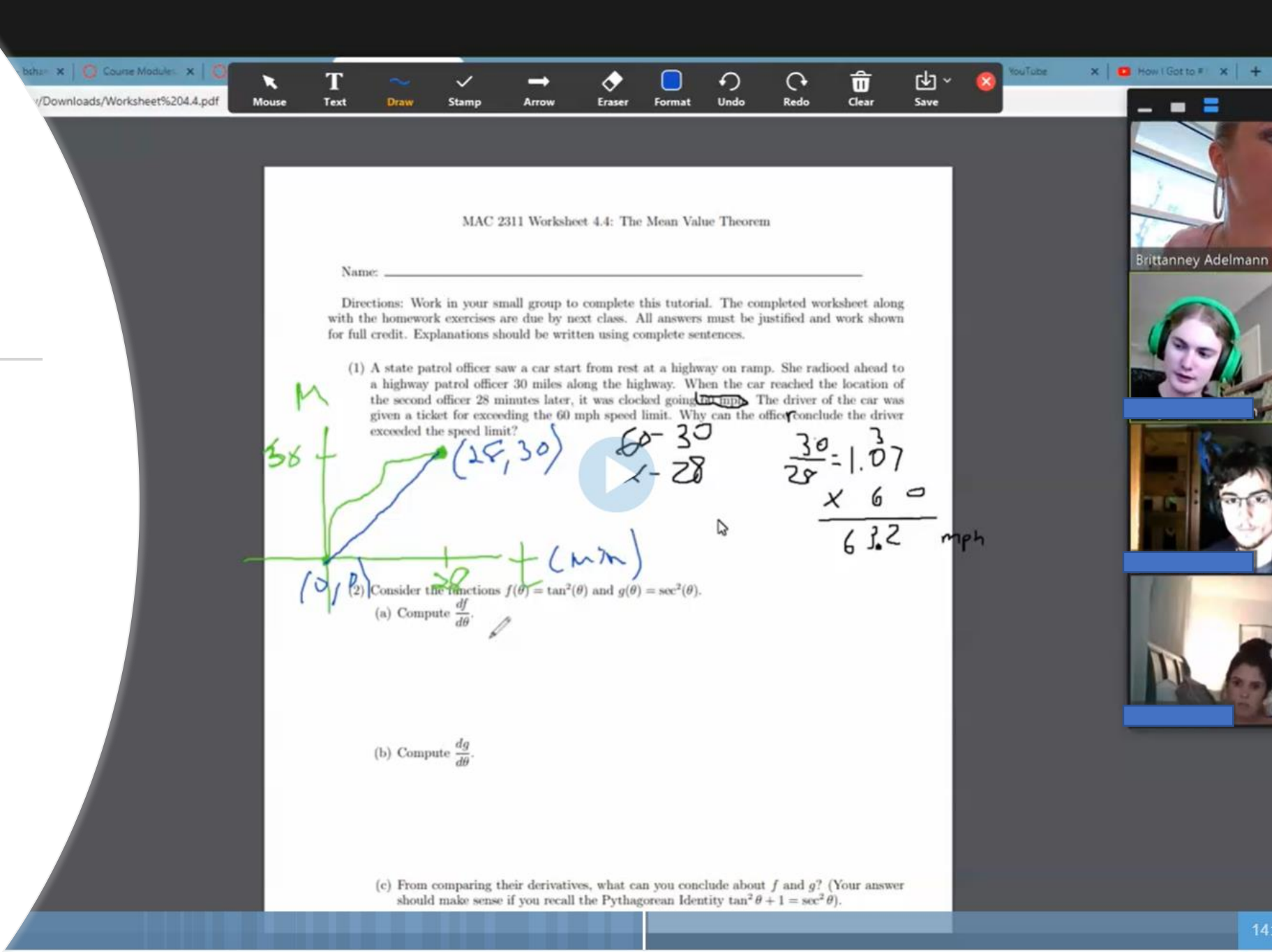


Logistics – Structure (online live lecture)

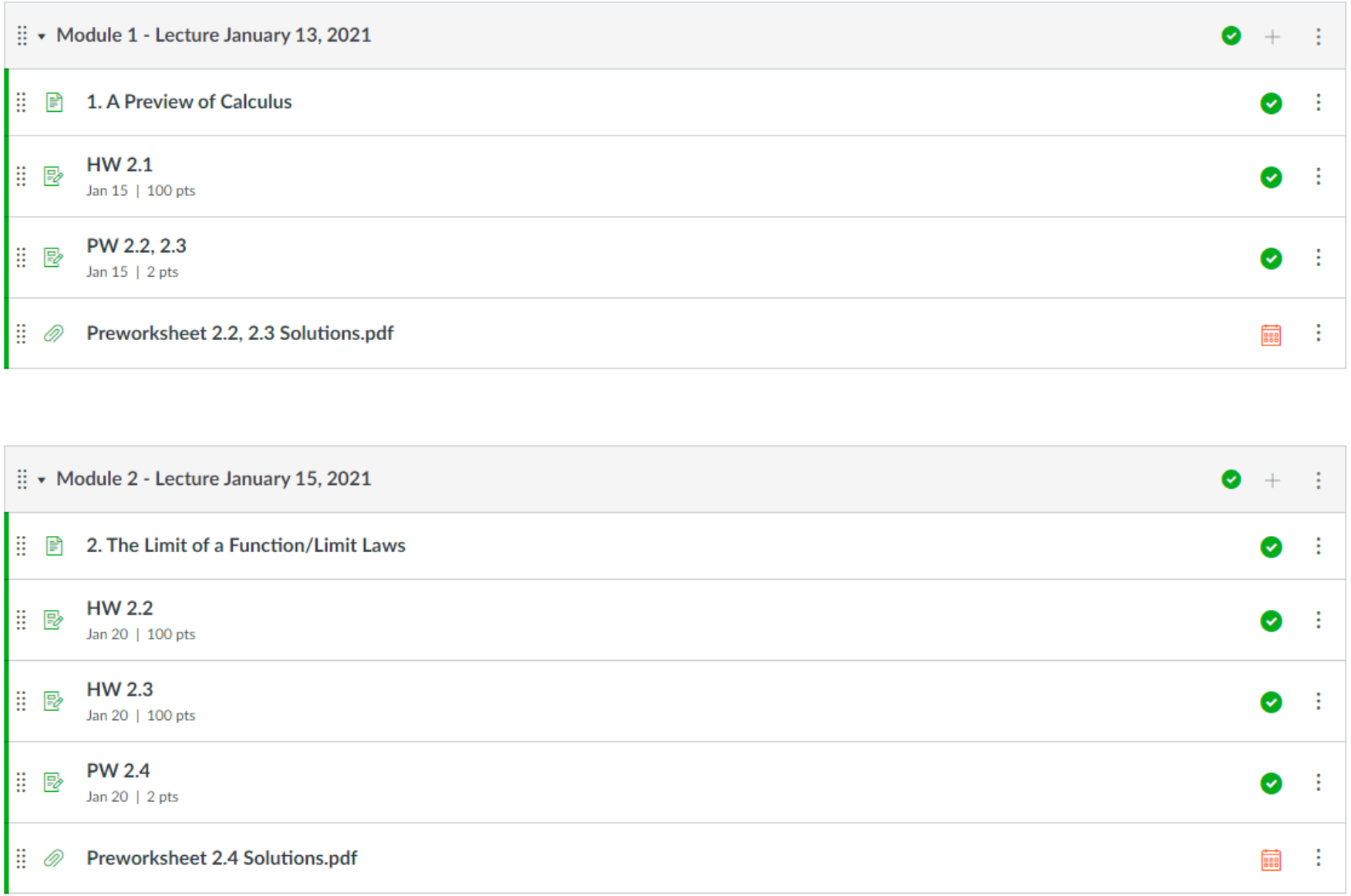
- Same general structure
- Faculty are provided with an organized Canvas shell that DOES contain the electronic documents
- Lecture attendance is part of the grade (includes using webcam during group work)

Online Live Lecture Class

- Zoom breakout rooms



Canvas Example – Online Live Lecture Classes



1. A Preview of Calculus

Example of Module Page

Introduction to Module 1

In this section we discuss the "idea" of limits -- since limits underlie the the two fundamental operations of Calculus: differentiation and integration.

To Do

All activities in this module are required unless otherwise noted. Complete the following:

1. Read sections 2.1, 2.2, and 2.3
2. Print the powerpoint
3. Attend live lecture
4. Complete the homework: worksheet and textbook problems
5. Complete the pre-worksheet for the next class
6. Upload homework and pre-worksheet in Canvas before the next lecture

Readings

The following text-based resources have been selected to support your success on course assignments and to meet the objectives for this module.

- Read section 2.1
- Read section 2.2
- Read section 2.3

Instructional Materials

These instructional materials are designed to support your success on course assignments and in meeting the objectives for this module.

Lecture PowerPoint:

Lecture: insert here

Assignments

Complete the following assignments by the date and time indicated on each assignment page.

- Attend live lecture
- Complete the homework: worksheet and textbook problems
- Complete the pre-worksheet for the next class (answers available Friday mornings)
- Upload homework and pre-worksheet in Canvas before the next lecture

Select the Next ▶ button to proceed.

Preparation / Pre-worksheets

- Prerequisites
- Definitions/Theorems

MAC2311 Name: _____ Preworksheet 3.5

irections: *Complete this preworksheet before class. You will need your book for some information and you also use other textbooks or the internet for other prerequisite information you may not recall.*

Calculus typically requires angles be measured in **radians** versus degrees (radians are "nicer" to ork with). The radian measure of an angle θ is the length of the arc subtended by angle θ, ided by the radius r of the circle (see page A24). Radians and degrees are just two different s of measure for angles (like meters and feet are for length).

arc subtended is the entire circle, and knowing the circumference of a circle is given by $2\pi r$ r is the radius, then we get

$$2\pi \text{ radians} = 360 \text{ degrees}$$

is fact, fill in the blanks below (divide both sides of the above equation by the quantity es the desired result):

ns = _____ degrees

_____ radians = 90 degrees

= _____ degrees

_____ radians = 1 degree

(d) are most commonly used to convert degrees to radians and vice versa.

nt are the following angles in?

uadrant _____

quadrant _____

c) 850° is in quadrant _____

d) −75° is in quadrant _____

ce angle is the angle that the given angle makes with the x-axis. Regardless of the he terminal side of the angle, the reference angle measures the *closest distance of that le to the x-axis.*

ference angles for the following angles:

_____

_____

_____

e) $\frac{9\pi}{7}$ _____

f) 954° _____

g) $\frac{16\pi}{9}$ _____

the Pythagorean identity $\sin^2(x) + \cos^2(x) = 1$, find the other two Pythagorean identities:

ivide the equation above by $\cos^2(x)$ and put a box around the result

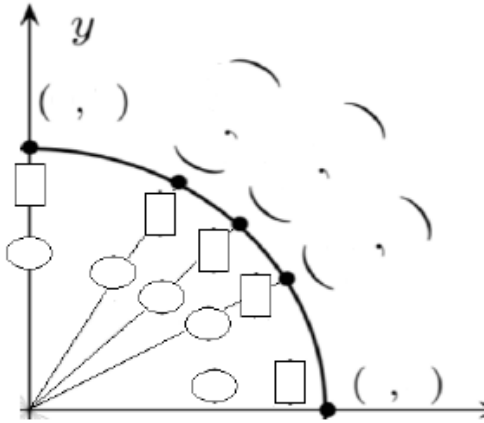
b) Divide the equation above by $\sin^2(x)$ and put a box around the result

5. Recall (write) the following from page 68:
   - The reciprocal identities
   - The Double-Angle formulas

Notice, you can also find the trigonometric addition/subtraction form

6. List the Derivatives of Trigonometric Functions on pages 278 and 28

7. Recall that points on the unit circle look like $(\cos(x), \sin(x))$.
   a) Fill in the first quadrant of the unit circle below (put degree mea measures in the boxes):



*We only need to know the points (x, y) in quadrant 1 as we will use ref other quadrants and **refer** back to quadrant 1 (keeping in mind the si the angle is originally in).*

b) Using the reference angle and *referring* to quadrant 1, find the ex

$\cos\left(\frac{19\pi}{6}\right)$ = _____ $\sin\left(\frac{19\pi}{6}\right)$ = _____

$\cos\left(\frac{5\pi}{3}\right)$ = _____ $\sin\left(\frac{5\pi}{3}\right)$ = _____

File Tools View Worksheet 11.9 BA - Last Modified: 4/10/2020

MAC2312 Name: _____ Worksheet

Section 11.9

Representations of Functions as Power Series

Directions: *Work in your small group to complete this tutorial. Return the completed worksheet along with the homework exercises at the beginning of next class. All answers must be justified and work shown for full credit. Explanations should be written using complete sentences on the lines provided.*

1. Follow the steps to find a power series representation for the function

$$f(x) = \frac{1}{1-2x}$$

a) Use the fact that $\frac{1}{1-x}$ has power series representation $\sum_{n=0}^{\infty} x^n$ and substitute $2x$ for x in the series.

b) Determine the radius and interval of convergence for the power series representation you found in (a).

2. Follow the steps to find a power series representation for the function

$$f(x) = \frac{2}{(1-2x)^2}$$

a) Calculate $\int \frac{2}{(1-2x)^2}$

b) Notice, what we found in (a) looks like the sum of a geometric series, the same series we found in question 1. Hence, we get the equation

$$\frac{1}{1-2x} = \sum_{n=0}^{\infty} (2x)^n$$

Now, differentiate each side of the equation to get a power series representation for our original function.

3. Follow the steps to find a power series representation and determine the radius of convergence for

$$f(x) = \tan^{-1}(x^3)$$

a) First, think about $\tan^{-1}(x)$. This function has a derivative that "looks like" a sum of a geometric series. Find $\frac{d}{dx}(\tan^{-1}(x))$.

Screens 1-2 of 7 Display Settings Focus 140%

Group Work Worksheets

- Breathing documents
- Contributions from faculty

Logistics – Structure (fully online)

Same general structure

Students MUST attend at least ONE group work session per week as part of their grade

- LAs keep track on a google sheet

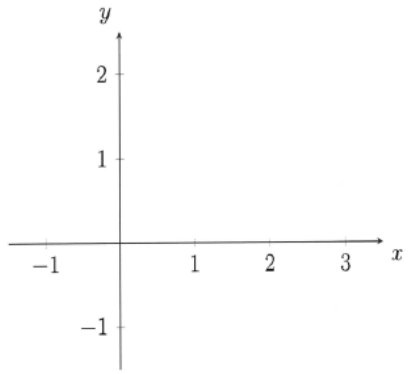
Pre-worksheet change

- Quizzes coming directly from the pre-worksheet
- Two chances, 15 mins
- Relief of faculty grading and students not taking them seriously
- Pre-class module

Preparation / Pre-worksheets

as we let the width of each rectangle $\Delta x \to 0$ (take the limit as $n \to \infty$).

1. Keeping this idea in mind, use the graph below and follow the instructions:



For help drawing this, see part (b) on page 441.

a) Draw the region bounded by $y = \sqrt{x}, y = 0$ and $x = 1$
b) Revolve this region about the x-axis
c) Cut into the region, perpendicular to the x-axis, to make a cross-sectional DISK

To find the volume of the region, we look at the volume of each cross-sectional and sum them all up!

The volume of an object is generally the area of the "base" times the height. For DISKS, the base is a circle, making the area:

$$A(x) = \_\_\_\_\_$$

What is the radius represented by in our drawing above? _____

So, the volume of a general region by DISKS would be given by

$$\lim_{n\to\infty} \sum_{i=1}^{n} A(x_i)\Delta x = \_\_\_\_\_$$

where $A(x_i)$ is the area of the base of each cross-sectional disk and Δx is the height.

d) Now, what formula could we use to calculate the volume of the solid you drew above?

Questions on this quiz come **directly** from the pre-worksheet for this section.

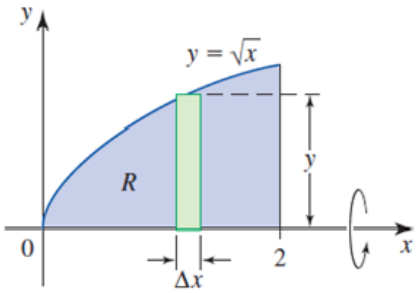
You should complete the pre-worksheet BEFORE attempting the quiz. You have TWO attempts and the best score will be kept.

You must submit this quiz in order to open the items in the next module.

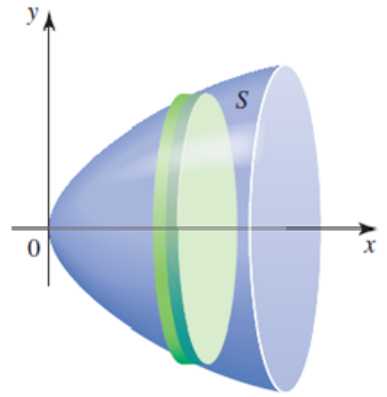
Question 1 — 2 pts

Consider the region bounded by $y = \sqrt{x}, y = 0, x = 1$. (Note: in the picture the region is bounded by x=2, not x=1.)

Revolve the region about the x-axis and answer the following questions about the cross-sectionals and the resulting solid.



(a) The region R

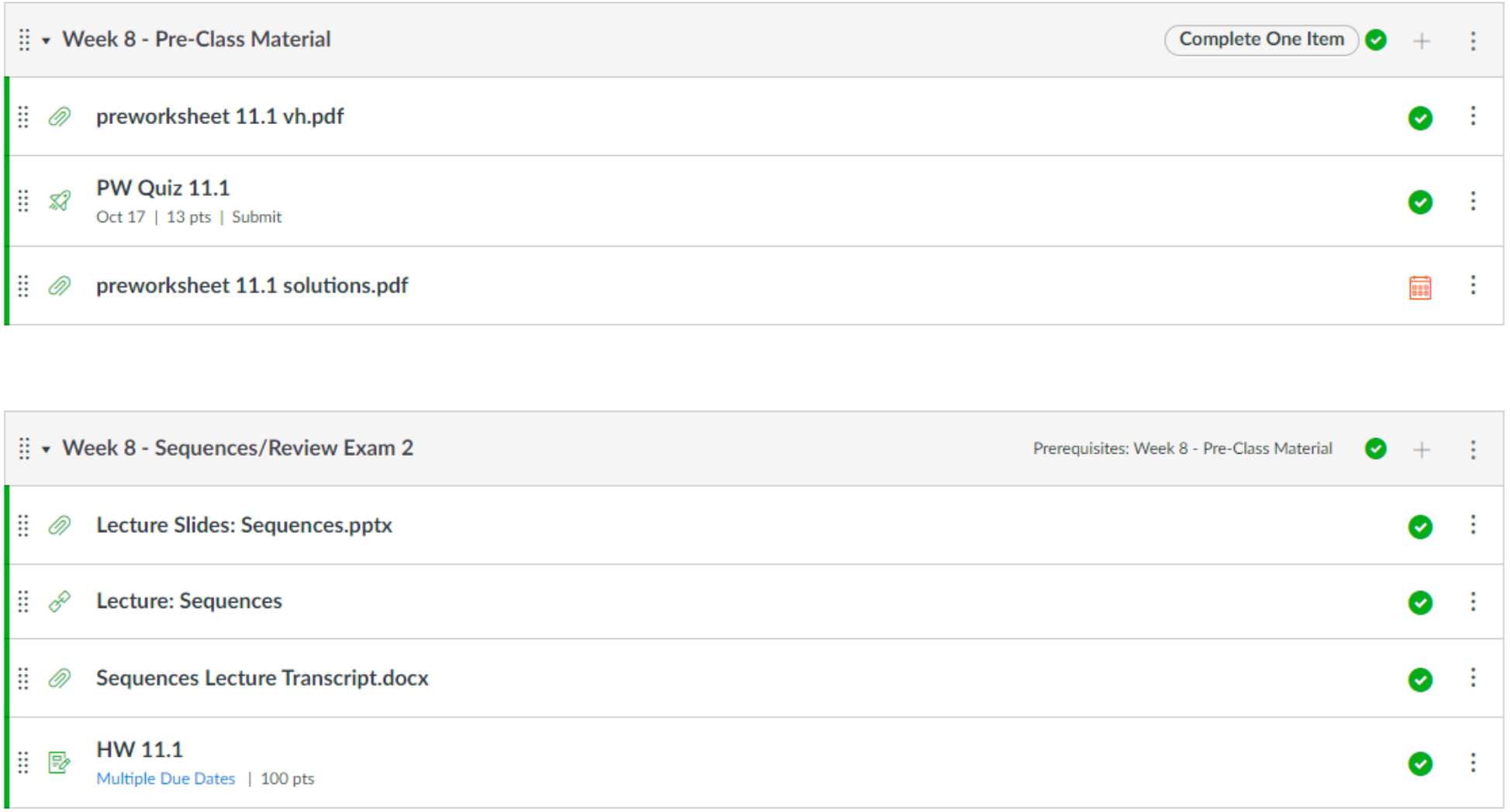


(b) The solid S

The cross-sectional is a [Select]

The volume of an object is generally the area of the "base" times the height. For a disk, the base is a circle with area πr^2. To calculate the volume of the solid, we use $\int_0^1 \pi(\sqrt{x})^2 dx$ where $\sqrt{x}$ represents the [Select] .

Canvas Example – Fully Online Classes



The LA Position

10 hours per week

$13.50 – $15.00 per hour (current)
$12.00 per hour (QEP)

LAs attend class (4 hours)
Office hours (5 hours)
    New LAs: pedagogy (2 hours)
    Office hours (3 hours)
- Weekly Prep meeting (1 hour)

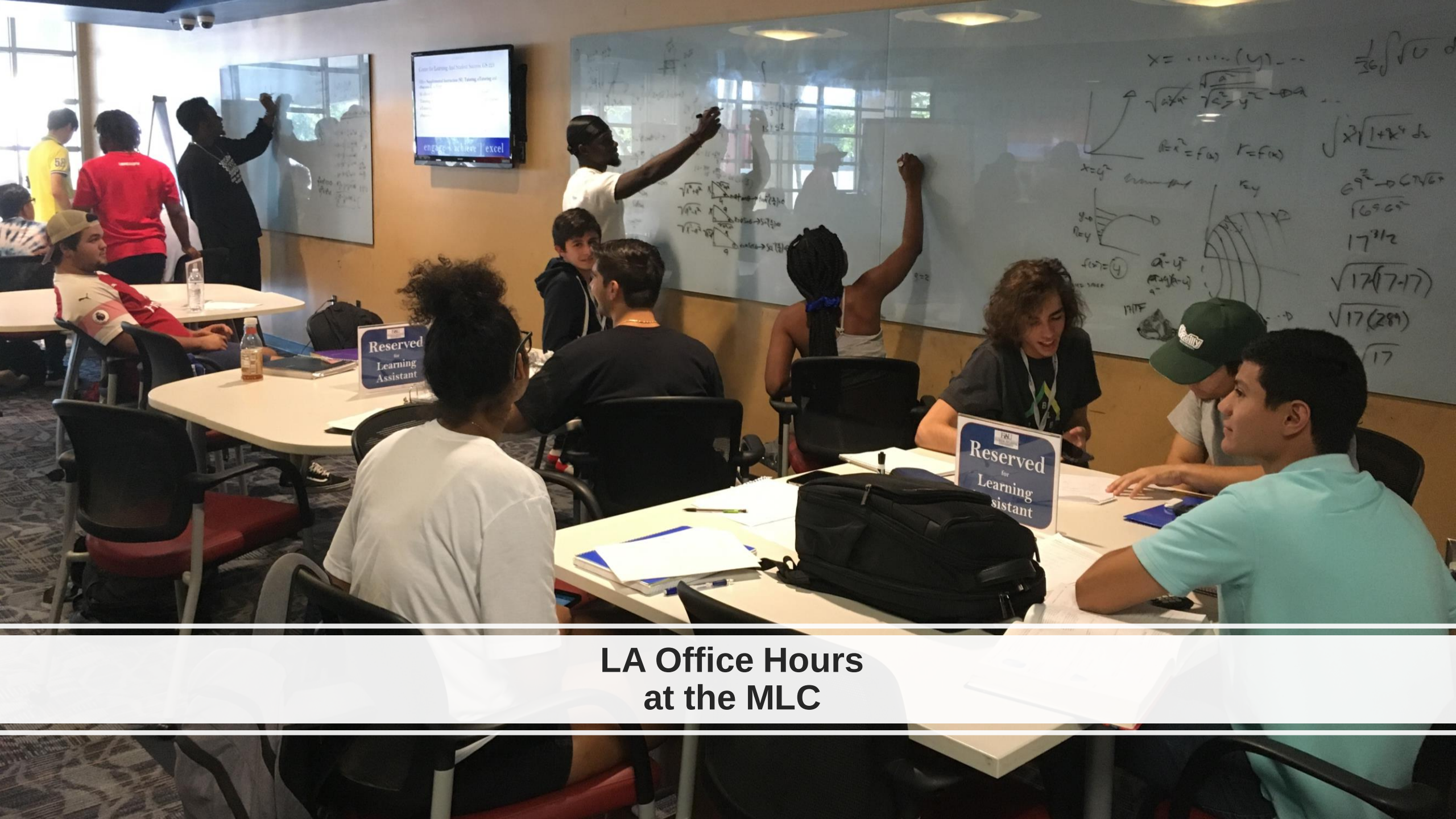
For fully online sections, we provide more group work hours since it is mandatory to attend once

New LAs are assigned an LA Mentor for the first 4 weeks

Partnerships

Many LA Programs are faculty driven and not through the learning center. FAU runs the LA program in math through the Math Learning Center but with the support of the Department of Mathematical Sciences.

- **Funding:** started through MLC dollars; shared with Math dollars as the program grew; currently funded by QEP dollars through the new LA office
- **Administration:** Hiring, Scheduling, Training (pedagogy course), Canvas Shells, Housing and Maintaining of LA documents, and evaluation is handled through the MLC
- **GTA graders:** on stipend from Math, assigned to MLC duties (including LA grading)
- **Faculty Teaching in the model:** the MLC and Math work together to schedule faculty or GTAs who are interested in teaching in the model as instructors and the MLC Director works with the Math Coordinator to ensure fidelity of program



LA Office Hours at the MLC

Results—DFW

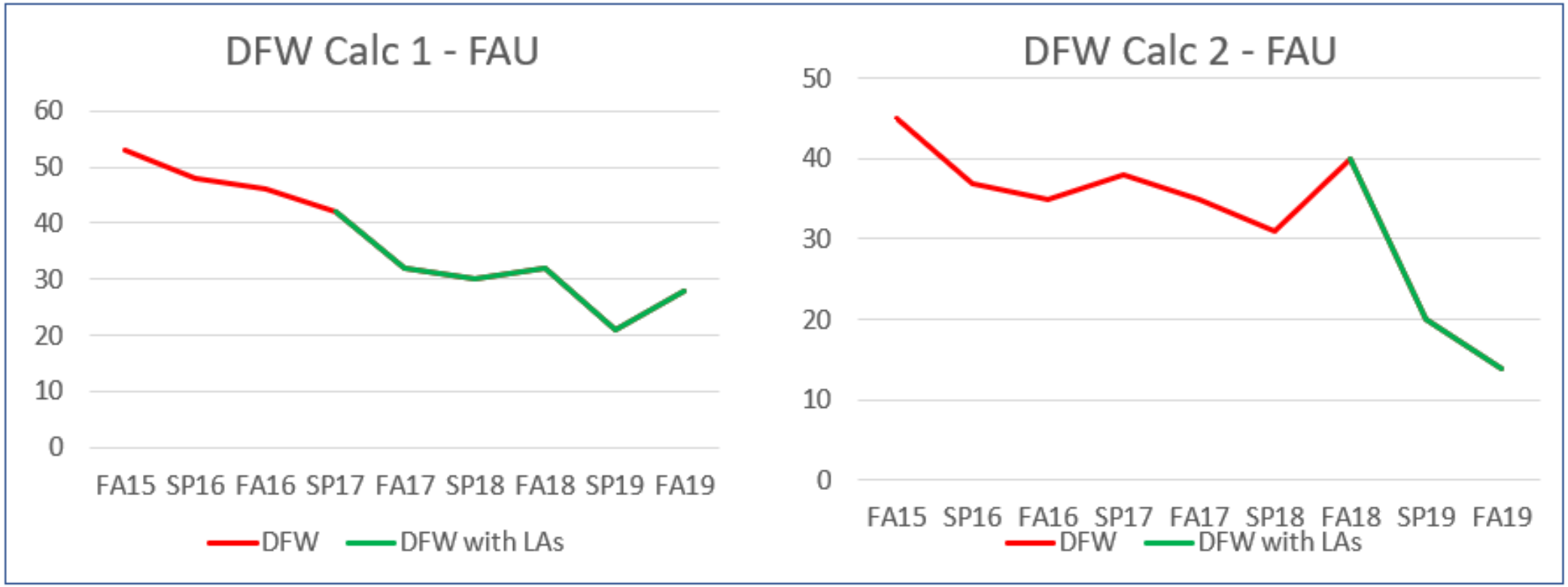
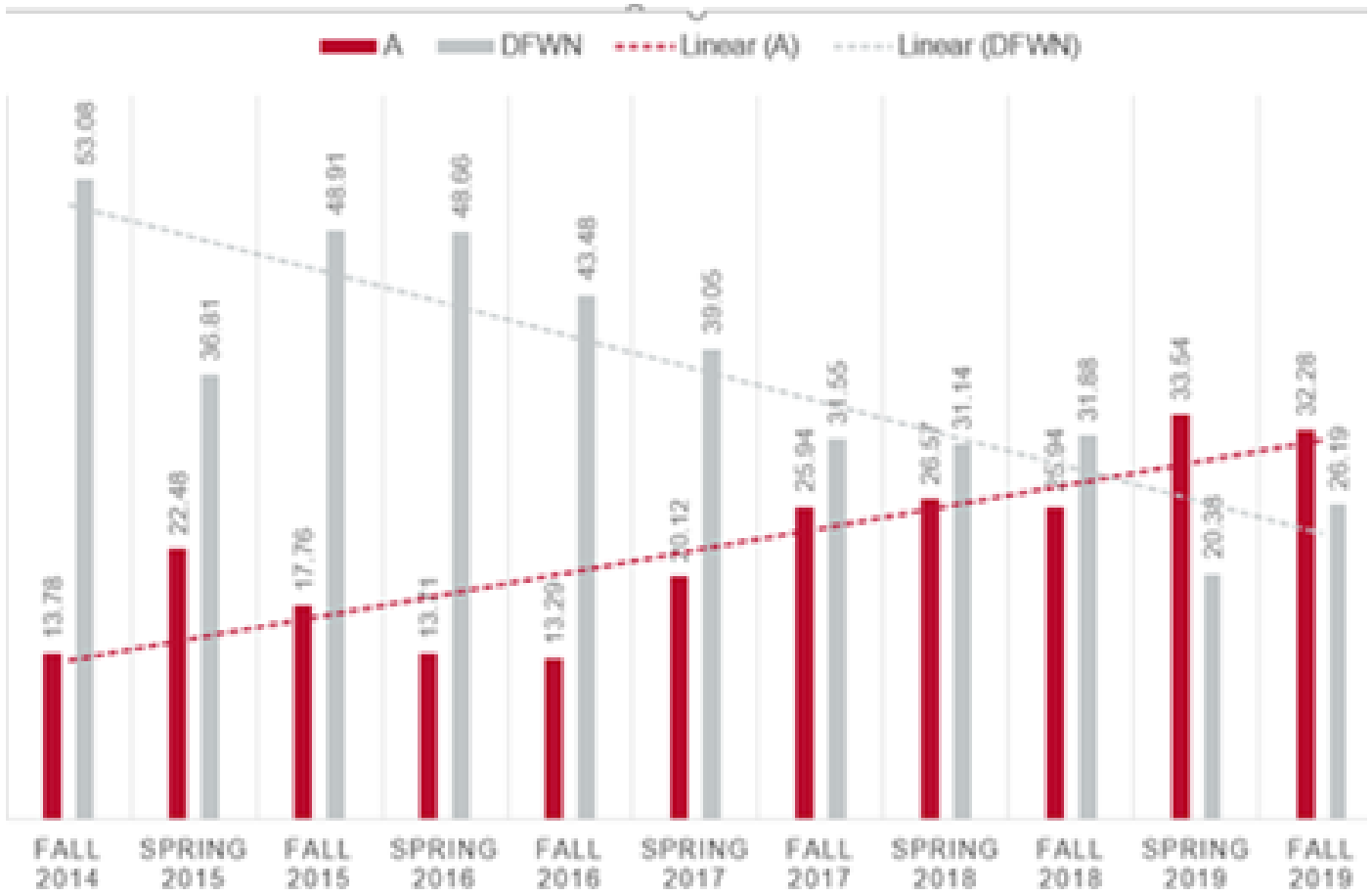


Figure 1

Calculus I (Fall 2016 to Fall 2019):

- Women passed 5.3% higher rate with LAs
- Black students passed 4.7% higher rate with LAs

Results—Increased A's



LA model increases the number of As earned in Calculus while decreasing the number of Ds, Fs and Ws

What if the intervention does not work?

Continually assessing any intervention we make is vital for success

MAC1147 – Precalculus & trigonometry

MAC2210 – Intro to Calculus with Applications

Designed similar to Calculus 1 and 2

Funding pulled – MAC1147 under redesign

Other Challenges

Faculty

- Structured format can be overwhelming
- Less lecture time
- Weekly prep meetings

LAs

- Scheduling is always fun!
- Don’t be an answer fairy – facilitate learning

Students

- Working in groups is new
- Engagement in online and online live lecture modalities

Questions