MTH 201: Calculus I, Fall 2016

Instructor: David Clark – call me **David!**

Why should I take this class?

This class is your first look at the big ideas of Calculus. However, it's also much more than that. In this class, **I want you to…**

… succeed! Specifically, I want you to develop a deep, conceptual, and personal understanding of the major ideas in Calculus 1. You will have to work hard to achieve this. I will support you and organize class to make it possible.

… understand how Calculus naturally arises from real problems, using tools we already understand. Derivatives and integrals exist because people asked interesting questions, and figured out how to solve them using algebraic ideas such as lines, slopes, and areas.

… proficiently use Calculus to model, predict, and make sense of the real world. Calculus is an amazingly powerful tool that can help mathematicians, scientists, and engineers work with physical phenomena.

… practice working with others to improve your learning. The ability to work successfully with others to achieve a common goal is a top skill desired by employers. We will practice it every day.

… practice professional communication. Another top skill desired by employers is the ability to read, write, and communicate technical ideas in a professional manner. We will learn tools of the trade (during labs), learn to communicate technical ideas clearly (in advanced homework), and learn about the process of logical, structured thinking (*all of the time!*).

Prerequisites: MTH 124, or both MTH 122 and MTH 123, or placement via the Calculus Readiness Test.

General Education: See the last page of this syllabus for information about the General Education requirements that this course fulfills.

Key information

How to contact me

Email:	clarkdav@gvsu.edu (Use this!)
Phone:	616-331-3698
Office:	Mackinac A-2-104

Office Hours: Noon – 1 pm daily

Monday, Wednesday, Friday: *In my office*
Tuesday, Thursday: *In the Math Center*
You can stop by any time my door is open.

Textbook: *Active Calculus* (Matt Boelkins)

This book is a *free* PDF (2016 edition): http://scholarworks.gvsu.edu/books/10/.

You *do not* need a printed copy of the textbook. If you want one, you can order a printed copy at http://amzn.to/2aoOGtv

Class materials and announcements are on Blackboard: **http://mybb.gvsu.edu**

Check Blackboard and your GVSU email at least once before and after each class.

Class meetings

Section 08: 11 am – Noon:

Mon, Wed, Fri in MAK B-LL-116.
Tue (Lab) in MAK A-2-151

Section 09: 10 – 11 am:

Mon, Wed, Thu in MAK B-LL-116.
Tue (Lab) in MAK A-2-151

Check Blackboard daily for the latest news, including changes to this Syllabus.

What will each class be like?

Everything about this class is based on one idea:
You will learn better by *actively doing* math.

In class, we will *do* Calculus, together and individually. We will focus on understanding the Big Ideas that represent the main ideas of Calculus.

You will **prepare for class** by reading the textbook for comprehension**,** watching videos covering the material, and answering questions about fundamental ideas before class.

Find the videos at:
http://www.youtube.com/gvsumath/

These videos cover the same material as regular class lectures, but you can watch them (and re-watch them…) any time you want. *Past students say: These videos are enormously helpful. Use them!*

The textbook and videos will give you lots of support as you understand the basic ideas of each topic. This will let us tackle the hardest, most confusing, and most fascinating ideas together in class.

After class, you will practice these new ideas with several different types of homework.

How to succeed in class

1. **Take responsibility for your own learning.** This is not a lecture-oriented class. You won't pass by mimicking examples. You *will* be expected to actively work to construct your own understanding, with readily available help from the book, videos, your classmates, and David.
2. **Be ready to work hard.** Many concepts and problems will be new to you. They will stretch your thinking. You will experience frustration and failure before you experience understanding. This is part of the normal learning process. Your viability in the modern workforce depends on embracing this learning process and making it work for you. You will have support on all sides from your classmates and David. But: Nobody is exempt from this process and the hard work it entails.
3. **Demonstrate mastery.** Hard work is important, but it's not enough. You must eventually *master* the important ideas of calculus and *demonstrate* this to me. Use everything available to you – your group, the Math Center, the textbook and videos, and of course me! – to reach this point.

I have high expectations, but I've set up class so that **you can succeed.**

What assignments will there be?

Guided Practice (due 2 hours before every class, individual): Daily reading and videos, with questions to be submitted online before class. These will help guide you through the basic ideas that you will need in class. They will be *marked for **effort** and **completeness** only*.

Webwork (due every 1-2 weeks, individual): Online homework assignments to help build computational skills. *You may re-submit most Webwork problems until they are fully correct.*

Advanced Homework (due every 2-3 weeks, individual or in pairs): Your chance to show your best work. These are more conceptual problems for which you will produce a professionally written solution.

Labs (due weekly, groups of 2-4): One hour per week, we will meet in a computer lab and learn how to tackle a variety of problems with the help of technology.

Checkpoints (every 2-3 weeks, individual): There will be six 50-minute checkpoints, one after each major section of the course. These are an opportunity to demonstrate mastery of that section's ideas.

Final exam (cumulative): Section 08: Wednesday December 14, 10 – 11:50 am in MAK B-LL-116.
Section 09: Tuesday December 13, 12 – 1:50 pm in MAK B-LL-116.

All assignments will be posted or linked on Blackboard. See "Grades" for details.
More information about the expectations for each assignment will be given when it is first assigned.

How do I earn a final grade?

Learning happens over time, as we revisit ideas and reflect on them. In this class, your final grade will reflect how well you *eventually understand* each topic. You can make mistakes without penalty, as long as you *eventually* demonstrate mastery of the topic.

In this class, there are **no points or percentages**. Instead, all grades are based on learning targets that describe the most important ideas in Calculus 1. See "Learning Targets and Big Ideas" below for a list. **Your grades are determined by showing me that you have mastered these targets.** You will have many opportunities to demonstrate that you have mastered these targets.

How assessments work: Every assessment lists several targets. You will earn a mark for each target. These indicate how well you demonstrated understanding of that target on that assessment. Marks are:

E	**Exceeds Expectations!**	Correct, complete, convincing, and clear.
M	**Mastered**	Demonstrates understanding of the relevant target. May include some errors, but no additional study or review is needed.
P	**Progressing**	Demonstrates partial understanding, but with a fundamental error, misunderstanding, or is incomplete. Needs review and revision.
X	**Not assessable**	Not enough work to determine mastery: An insubstantial attempt, too many errors to correct each individually, or uses an inappropriate method or tool.

Mastering Targets and Big Ideas: For each learning target, you must earn a certain number of E's or M's in order to master it, much like filling up a progress bar. The number required is listed next to each target. Only E's and M's count towards mastering a target. **There is *no penalty* for earning a P or X.** By *eventually* earning enough E's and M's, you demonstrate that you have mastered the target. By mastering a group of related learning targets, you will master the **Big Idea** that they represent.

Final grades: Your final grade is determined by the **highest** row that you **fully** complete:

Grade	**Big Ideas mastered**	**Guided Practices completed with an E or M**	**WebWorks completed with 95% or higher**
A	10 (of 10)	≥ 27 (of about 30)	≥ 10 (of about 11)
B	9	24-26	9
C	7 - 8	21-23	7 - 8
D	5 - 6	18-20	5 - 6
F	Have not **fully** completed **any** row.		

I will set **+/- grades** based on how close you are to the next higher (or lower) letter grade.

Revisions: You may revise and resubmit each assignment *one time* in order to improve your marks.

Complete instructions on how to revise are available in the Revision Instructions on Blackboard. Be sure to read these – if you don't follow them, I'll return your revision unmarked! Here are some highlights:

- You may revise one assignment each week.
- To revise, you must both correct your work and thoughtfully reflect on your work and mistakes. See the Revision Instructions for details.
- You may revise Advanced Homework, Labs, and Checkpoints (*not* Guided Practices or WebWork).

Revision advice from past students

Revisions are the *best* way to demonstrate mastery and earn marks. Don't ignore them – they're a key part of earning a good grade.

An example of how grades work

	D.1 [2 required]	C.1 [6 required]
S. Kovalevskaya	E E	M E E
I. Newton	X M P E	P P X M X E

Sonya Kovalevskaya (the first female professor of math), has done excellent work on D.1 and has enough E's to master it (she can stop bothering with D.1!). Her extensive speaking tour has kept her busy, and so she has not yet earned enough marks to master C.1 (she needs 3 more M's or E's).

Isaac Newton (the founder of Calculus) had some trouble making sense of D.1. However, he eventually earned a total of two M's and E's and so he has mastered D.1. The X and P don't stop this – he just had to try a few extra times. However, Sir Isaac often forgets about communicating his work clearly to others, and so he has *not* mastered C.1. He still needs 4 more M's and/or E's.

FAQs About Grades

Q: Why aren't you using points or percentages? Isn't that simpler?

A: It's simpler, but it's also less clear. To see what I mean, suppose I gave 5 homeworks on calculating derivatives, each worth 10 points (see the grade book on the right).

	Hw1	*Hw2*	*Hw3*	*Hw4*	*Hw5*	*Total*
Alice	0	0	10	10	10	30
Bob	6	6	6	6	6	30

Both students earned 30 out of 50 points (60%). Alice struggled initially and then figured things out. On the other hand, Bob started out doing so-so, and never improved. Which student do you think should earn a higher grade? Points don't show this difference.

In our class, the marks might look like the table on the right. You can see that Alice mastered this learning target, while Bob never mastered it. This makes the difference between their work much clearer! This is why I use this system: It shows both of us exactly what you've learned and where you're struggling.

	Hw1	*Hw2*	*Hw3*	*Hw4*	*Hw5*	*M's*
Alice	X	X	M	M	M	3
Bob	P	P	P	P	P	0

In addition, this system avoids unnecessary busywork and is more forgiving. In a traditional points system, you may have mastered an idea, but still have to complete more assignments -- or suffer the consequences of losing points. Plus, you can always revise assignments, which is one of the *best* ways to demonstrate that you've really got the idea!

Q: If I miss an assessment (lab, advanced homework, checkpoint, etc.), what happens?

A1: *Fire and brimstone coming down from the skies! Rivers and seas boiling! Forty years of darkness! Earthquakes, volcanoes… Dogs and cats living together... mass hysteria!*[1]

A2: Actually, nothing. *There is no penalty for missing an assignment*, other than missing a chance to demonstrate mastery. You do not lose points, because there are no points. Just make sure that you earn enough marks eventually.

Q: I don't like this grading system. It's overly complex / unnecessary / hurting my grade.

A: I strongly believe that this system is much more fair than the usual system. That's *not* to say that it is easy to earn a good grade! If you have a specific example that demonstrates a flaw, please let me know (during office hours, or by email) -- I'll consider it carefully and respond appropriately.

Important note: You may find that it seems harder than usual to earn a "good grade" in this class. Most students discover that this grading system really pushes them to learn deeply, and that can take time. This is OK! But if at first you don't succeed, keep trying – and master the idea!

[1] *1000 bonus points to anyone who recognizes this. Note: We don't use points in this class. That's the… point!*

Learning Targets and Big Ideas

The number in brackets after each target indicates how many E's and/or M's are needed to master it.

Mathematical Practice Learning Targets

I am an *independent and engaged* student who takes responsibility for my own learning. *(Master 3/3)*

IE.1: I take responsibility for my learning by taking full advantage of opportunities to master the week's topics. This includes (but is not limited to) attending class, working with my group, coming to office hours, and emailing with the instructor. [13]

IE.2: I take responsibility for assignments by being the lead author. [6]

IE.3: I attend to details (including all instructions) in my work. [12]

I can use different *representations and tools* to solve problems. *(Master 3/4)*

R.1: I can represent information using tables, graphs, diagrams, and equations and can translate among those representations to help me solve problems. [4]

R.2: I can use technology to help me solve a difficult Calculus problem. [4]

R.3: I can create a precise mathematical description of a problem that is given in real world terms. This includes identifying relevant variables and formulas, identifying assumptions, and creating helpful diagrams. [4]

R.4: I draw upon problem solving strategies and make connections to previous work to solve genuine problems. [2]

I can *communicate* my ideas and solutions clearly and professionally. *(Master 3/4)*

C.1: I communicate my solutions in clear and well-organized writing that correctly incorporates mathematics. [6]

C.2: I format mathematical formulas professionally in my writing. [6]

C.3: I consistently label my answers with appropriate units. [6]

C.4: I can create graphics that illustrate mathematical concepts and incorporate them in my writing. [2]

I *reason* clearly and can *critique* others' reasoning. *(Master 2/2)*

RC.1: I can write a convincing explanation of my work that clearly explains why it is correct and would convince a skeptic. [6]

RC.2: I can accurately critique the reasoning of others, identify common misconceptions, and modify their work to produce a correct response. [2]

Mathematical Content Learning Targets

I can use *functions* and other pre-Calculus mathematics proficiently. *(Master 3/3)*

F.1: I can read and use graphs and tables to gain relevant information within a problem. [6]

F.2: I can use appropriate algebraic techniques and terminology to help me solve problems. [4]

F.3: I can identify the fundamental algebraic structure of a function (product, composite, etc.). [2]

I can calculate, use, and explain the idea of *Limits. (Master 3/4)*

L.1: I can explain the meaning of a limit. [2]

L.2: I can evaluate a limit graphically, numerically, and analytically (using algebra), including one-sided and infinite limits. [2]

L.3: I can recognize points at which a function is (and is not) continuous, and can use continuity to evaluate limits. [2]

L.4: I can identify limits in indeterminate form and can apply L'Hopital's rule correctly. [2]

I understand the *meaning of the derivative. (Master 6/7)*

DM.1: I know the limit definition of the derivative and can explain the purpose of each symbol in the definition. [2]

DM.2: I can calculate derivatives and estimates of derivatives using difference quotients (including average and instantaneous velocity) [4]

DM.3: I can explain the connection between average and instantaneous rates of change, and can interpret them using secant and tangent lines and limits. [2]

DM.4: I can find the tangent line to a function at a given point. [4]

DM.5: I can recognize points at which a function is (and is not) differentiable, and can use the definition or interpretation of the derivative to support my thinking. [2]

DM.6: I can use tangent lines to approximate function values and roots. [2]

DM.7: I use derivative notation correctly (such as $f'(x)$ and $\frac{dy}{dx}$) [4]

I can use *shortcuts* to calculate derivatives efficiently. *(Master 4/4)*

DS.1: I can compute derivatives correctly for sums, constant multiples, and power, polynomial, trig, exponential, logarithmic, and inverse trigonometric functions. [6]

DS.2: I can compute derivatives correctly using the product, quotient, and chain rules. [4]

DS.3: I can compute derivatives correctly using multiple rules in combination. [2]

DS.4: I can compute derivatives correctly using implicit differentiation. [2]

I can use derivatives to understand and solve genuine *applications. (Master 5/6)*

DA.1: I can correctly interpret the meaning of a derivative in context. [8]

DA.2: I can use calculus to find relative and absolute extrema and points of inflection of functions. [4]

DA.3: I can recognize and explain the relationships among the behaviors of f, f', and f'', including slopes, rates of change, and concavity. [6]

DA.4: I can use the information provided by f, f', and/or f'' to identify and draw accurate graphs of the other functions. [4]

DA.5: I can solve related rates problems completely and correctly. [2]

DA.6: I can solve optimization problems completely and correctly. [2]

I can calculate totals and sums using the *Fundamental Theorem of Calculus. (Master 3/4)*

FTC.1: I can calculate the area between curves, net change, and displacement using Riemann sums and the Fundamental Theorem of Calculus. [2]

FTC.2: I can explain the meaning of the Fundamental Theorem of Calculus, definite integrals, and Riemann sums in terms of a graph, and interpret them using the idea of rates of change, net change, and displacement. [2]

FTC.3: I can write and recognize a definite integral as the limit of a Riemann sum. [2]

FTC.4: I can correctly anti-differentiate basic functions and identify antiderivatives. [2]

If you are confused or worried about your grade or our grading system, see me immediately. I'll be glad to discuss it with you. *Talk to me as soon as you feel that you are falling behind.* While it is important to *eventually* demonstrate mastery, keep in mind that the class must eventually end, and so you will eventually run out of opportunities.

What else should I know? (Late work, etc.)

You are expected to know and follow the Student Code. Here are some special instructions:

Early and late work and attendance

Grace Days

I recognize that things can get hectic and unexpected problems can arise. To help you deal with these situations, you have 4 *grace days* for this semester. A grace day allows you to **hand in a Lab, WebWork, or Advanced Homework assignment one class day after it is due**. For WebWork, email me so that I can change the due date. Otherwise, simply turn in the assignment one class day later with "GRACE DAY" clearly written on it. Grace days may not be used on Guided Practices and Checkpoints.

Early work: You may always arrange an early drop-off time, send homework with a friend, or leave it with a secretary in the math office. If this happens before the deadline, it will *not* cost a grace day.

Extreme situations: If you miss many assessments due to *significant* extenuating circumstances (even with grace days), see me as soon as possible to discuss arrangements. Please be prepared to provide documentation of the reason for your absence (such as a doctor's note or a mug shot).

Miss class? Check Blackboard first!

In case of an absence, *you* are responsible for catching up with class. Luckily, **everything is posted on Blackboard:** Check Blackboard *first* to find everything we've done.

There is no specific penalty for missing class, but read learning target IE.1 carefully: Even when absent, you are responsible for your own learning.

Collaboration and academic honesty

I strongly encourage you to collaborate with others while learning new ideas. In addition, many assignments may be completed in pairs or groups, although others are individual. In all cases:

The Golden Rules of Academic Honesty

For individual assignments: Your submitted work must represent *your own* understanding in your *own* words, regardless of collaboration. You may not use solutions, directly or indirectly, from any sources (including other students, online sources, or other textbooks).
For group assignments: You must make a significant contribution to any assignment that is submitted with your name on it. As a lead author, you may not include a student's name on an assignment if that student did not make such a contribution to all parts of the assignment.

Violations will result, at a minimum, in earning X's on all learning targets for that assignment. This may include all students involved, such as other group members. Extreme cases may result in: Failing the "Independence and Engagement" Big Idea, failing individual learning targets, or failing the class. I reserve the right to discuss the nature and origins of any work with any student prior to recording marks.

Special accommodations

If you have special needs because of learning, physical or other disabilities, it is your responsibility to contact Disability Support Resources (DSR) at 616-331-2490 or http://www.gvsu.edu/dsr/. DSR will help you arrange accommodations. Then, speak with me in person about making those accommodations and ensure that they are consistent with your arrangements with DSR.

Other bits of information you should know

Technology

We will use technology frequently in class. Here is a very brief rundown of what is required. Don't worry -- you will be trained on how to use all of this during class and lab sessions!

- You do *not* need a graphing calculator (but it's OK if you have one).
- You *do* need something that can act like a graphing calculator, such as a laptop, smart phone or tablet with an appropriate app. Bring this to class every day. It will be used on many assignments, including Checkpoints.
- In lab and at home, you will use some *free* software: Geogebra, Wolfram Alpha, and a spreadsheet. Excel works but is not required. Google Sheets or Libre Office work equally well.

Appropriate use of technology

Use technology appropriately and only in the manner required for class activities. In particular, avoid texting, checking email, playing games, etc. Activities that distract yourself or others from the task at hand will result in some or all of these:

- A request to put away your technology for the remainder of class.
- Earning an "X" on IE.1 for the week.
- A request to leave class entirely for the day.
- Failure of the IE.1 learning target, and thus failure of the "Independence and Engagement" Big Idea as well (when then leads to a lower final grade).

GRAND VALLEY STATE UNIVERSITY
GENERAL EDUCATION PROGRAM

MTH 201 Calculus I

Foundations – Mathematical Sciences

This course is part of GVSU's General Education Program. MTH 201 is designed to help you learn:

1. Computer science, logic, mathematics, or statistics as a "way of knowing," including an examination of principles and questions that define the field.
2. Techniques for problem solving, including recognition of key problem elements, the choice of suitable methods for solving a problem, and the appropriate application of these methods.
3. PROBLEM SOLVING is the process of designing and evaluating strategies to answer open-ended questions. Students will:
    - Construct clear and insightful problem statements that prioritize relevant contextual factors. [R.3]
    - Identify multiple approaches for solving the problem within the given context. [R.4]
    - Design and fully explain solutions that demonstrate comprehension of the problem. [e.g. DA.5, DA.6]
    - Evaluate the feasibility of solutions considering the context and impact of potential solutions (e.g., historical, ethical, legal, practical). [RC.1, RC.2]
4. QUANTITATIVE LITERACY is a competency and confidence in working with numbers. Students will:
    - Interpret information appearing in different forms (e.g., graphs, tables, equations, and text). [R.3]
    - Evaluate assumptions or biases associated with the chosen method. [RC.2]
    - Solve quantitative problems using appropriate techniques. [e.g. DA.5, DA.6]
    - Draw valid conclusions based on data analysis and critically evaluate conclusions made by others. [e.g. DA.1, RC.1]

Teaching in the liberal tradition is at the heart of Grand Valley's identity, and this focus is critical in our General Education Program. Liberal education transcends the acquisition of information; it goes beyond the factual to ask important evaluative and philosophical questions. Liberal learning holds the fundamental principles and suppositions of a body of knowledge up to inquiry, question, and discussion. It helps a person recognize the assumptions under which he or she operates and encourages the examination and questioning of those assumptions. Liberal learning begins in the General Education Program and continues through the more specialized studies comprising each student's major and minor areas of study.

Grand Valley State University educates students to shape their lives, their professions, and their societies.

MTH 201 Schedule-ish*

Highly subject to change: Come to class to find out for sure!

Week	Monday	Wednesday	Thursday / Friday
1 8/29	**Intro & organization**	**Functions (F)**	
2 9/5	**Labor Day (no class, no labs)**	**Average Velocity and Limits (L & DM)**	
3 9/12	**Derivative Meaning (DM)**		*Checkpoint 1 (L & DM)*
4 9/19			
5 9/26			
6 10/3	**Derivative Shortcuts (DS)**		*Checkpoint 2 (DM)*
7 10/10			
8 10/17			*Checkpoint 3 (DS)*
9 10/24	**Using derivatives to understand how related things change (DA)**		
10 10/31			
11 11/7	**Using derivatives to find the best ways to do things (DA)**		*Checkpoint 4 (DA)*
12 11/14			
13 11/21	*Checkpoint 5 (DA)*	**Thanksgiving Break (no class)**	
14 11/28	**Definite Integrals (FTC)**		
15 12/5			*Checkpoint 6 (FTC)*

Final Checkpoint: Section 08: Wednesday December 14, 10 - 11:50 am in MAK B-LL-116
Section 09: Tusday December 13, 12 - 1:50 pm in MAK B-LL-116