

MAC 2312: Calculus II

Online Sections 1693, 1872, 24D3

Spring 2020

COURSE COORDINATOR

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Text: There is no required texts for this course. For anyone who wish to study from a text book, we suggest this online open source [textbook](#) (ch.3, 5-7 & 2). Calculus Early Transcendental by Stewart or Rogawski are also great reference books, any edition is good.

Lecture Outline: You may purchase a printed packet from [Target Copy](#) at 1412 W. University Ave. (Not the Target Store), cover of the packet is a red rose. Or, print it off from Canvas. Go to [Course Resources](#) in [Syllabus](#) tab in Canvas to locate the lecture shell and free printing information.

Prerequisites: MAC 2311. Strong Algebra, Trigonometry and Calculus 1 skills.

Grade issues and the One Week Policy: Once a grade is posted in Canvas, you have one week to contest the grade and resolve any grade disputes with your TA. Once the one week passes, there are no further disputes. In particular, there is absolutely no grade disputes at the end of the semester.

Grades: Syllabus & Lecture Quizzes	10%
Online Homework (by topics)	5%
Online Homework (by units)	5%
Written homework (upload)	10%
Written Exam Review (upload)	10%
Unit exams and final exam	60%

Total: 100%

A	90% - 100%	C	70% - 74%
A –	87% - 90%	C – *	67% - 70%
B +	84% - 87%	D +	64% - 67%
B	80% - 84%	D	60% - 64%
B –	77% - 80%	D –	50% - 60%
C +	74% - 77%	E	< 50%

Extra Credits: Discussions 3% (see Discussions in Canvas)

Course Management System: [CANVAS](#)

Homework: You will access it in Canvas.

UF Free Tutoring Service: [Broward Teaching Center](#)

MAC 2312 -- ANALYTIC GEOMETRY & CALCULUS II

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MAC 2312 Online Course Calendar, Spring 2020

	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1(L1-3) 1/6	Class Begins		Syllabus Quiz Due Basic Integration	LQ1-2	LQ3
Wk 2(L4-6) 1/13	LQ4	IBP	LQ5 Trig Int		LQ6
Wk3(L7-9) 1/20	LQ7	TrigSub	LQ8 UHW1	makeup signup deadline	LQ9
Wk4(L10-13) 1/27	LQ10	PFD	LQ11		LQ12-13
Wk 5(L14) 2/3	Study for Exam 1	Improper Int. PEInt(L1-10)	DB1 UHW2 UE1R	2/6 Exam 1 (L1-13)	LQ14
Wk 6(L15-17) 2/10	LQ15		LQ16, Seq		LQ17
Wk 7(L18-20) 2/17	LQ18	GeoTelTFD	LQ19, Int Test		LQ20
Wk 8(L21-23) 2/24	LQ21	LCT/DCT, AST	LQ22		LQ23
Wk 9 3/2	Spring	Break			
Wk10 (L24) 3/9	Study for Exam 2	RatioRoot, PEConTests(14-23)	DB2 UHW3, UE2R	3/12 Exam2 (14-23)	LQ24
Wk11(L25-27) 3/16	LQ25		LQ26		LQ27
Wk12(L28-30) 3/23	LQ28	RIR	LQ29, Taylor		LQ30
Wk13(L31-33) 3/30	LQ31	TPA PEPow(24-29)	LQ32 UHW4		LQ33
Wk14(L34-36) 4/6	L34	PE	LQ35		LQ36
Wk15(L37) 4/13	Study for Exam 3	Polar Areas PEPol(30-35)	DB3 UHW5, UE3R	4/16 Exam3 (24-35)	LQ37
Wk16 4/20	Volume PEVol(36-37)	DB4 UHW6, UE4R	Class ends Verify grades	Study for Finals	
	4/27 Final (L1-37)				

All exams: open from 6AM – 11PM. Schedule a test time to begin no later than 7pm with ProctorU at least a week ahead to avoid fees.

Exam 1: 2/6; Exam 2: 3/12; Exam 3: 4/16; Final Exam (Monday): 4/27

- Verify and resolve all Canvas grade issues within 1 week after the grade is posted or by Wednesday 4/22/20, whichever comes first (except for the final exam). Absolutely No grade disputes after 4/29/20.**
- All course material and assignments are open at the beginning of the term and due at 11:59 pm on due dates. You may always complete them early if you have other plans, but not late! Exams must be taken on specified exam date.**
- UHWx– Upload Written Homework Due. UExR- Upload Exam Review Due.**
- Discussions Boards(Extra Credits): (DBn), see Discussions for more details.
- Due date is NOT Do date. If you wait till last minute to submit and you run into any submission issues, you will be out of luck. There is a 20% late penalty for each day late.**

2. COURSE DESCRIPTION

2a. CONTENT. MAC2312, Calculus II, is the 2nd semester in a three semester calculus sequence. The course begins where MAC2311 left off at the integration techniques. This is followed by a study of infinite sequences and series, calculus of parametrized curves, polar coordinates and closed with applications of definite integrals.

This is an ONLINE VERSION of MAC2312 – all content is delivered online. Students view 37 online **lecture videos** and complete **lecture quizzes** in the course management system Canvas. Students also complete **online homework and upload the completed written work** in Canvas. Students are encouraged to **post** questions and answers on the **Discussions Board** in Canvas. **Three unit exams** and a cumulative **final exam** are posted in Canvas and administered through ProctorU. **There is no drop of any exams. You must take the exams on the assigned dates.**

2b. PREREQUISITES. MAC 2311! MAC2312 assumes that you have essential PreCalculus skills (both Algebra and Trigonometry) and calculus 1 skills necessary to succeed in this course. Students should be able to do arithmetic without a calculator. In the last section of this syllabus, students may find a short list of review materials to practice.

A grade of C in UF MAC2311 meets the minimum requirement for the course. We encourage students to review the prerequisite material to refresh your knowledge on these topics in order to succeed in calculus II. MAC2312 begins with integration chapter, you should already be competent in integrating simple functions and the use of u-substitution. We strongly recommend students who are having difficulty with these core skills and students who have gap years since the last math class to consider reviewing MAC2311 right away before we get deeper into the course (or take MAC 2311 if you have not done so at UF). An AP CalcBC score may not have prepared you adequately for this class. You may switch courses on [ONE UF](#) during the drop-add period.

2c. COURSE MATERIALS.

Lecture Notes Outlines: See 2f.

Computer access and requirements: All assignments should be taken on a computer, not cell phone or tablet, since there may be compatibility issues with CANVAS. Be sure you are using a browser (Chrome, Firefox) that works with Canvas (Do Not use Safari, Internet Explorer); **DueDate is NOT DoDate**. Internet sometimes is not reliable, a reason you should not wait till last minute to complete your online assignment. **If your computer or internet goes down while you try to submit an assignment, you will need additional time...etc. If you try to submit in last minutes and miss a due date, no credit will be given for the work not submitted.** It's student's responsibility to have a reliable internet and computer and **to verify your work is submitted successfully.** **You are responsible for having access to a hardwired Ethernet connected working computer** and complete and submit your work early.

Calculators: A graphing calculator or computer program can be useful as a learning tool when used appropriately, but they are not essential. I recommend the online graphing tool [Desmos](#). Calculus is a collection of concepts, ideas and process that are not mastered through calculator skills. No calculators or smart phones, smart watches are allowed during exams.

2d. ASSIGNMENT CALENDAR. Check the course calendar for due dates and plan your schedule accordingly. **You may complete your homework early, but you must take exams on the assigned dates. A 20% penalty per day is incurred for late *homework* submissions.** See description in each assignment for more details. When a conflict occurs between due dates in the course calendar and Canvas calendar, go with the Canvas one.

2e. CANVAS. [Canvas](#) is an UF courses management system. Use your Gatorlink username and password to login. All Students are expected to check Canvas on a regular basis. Please ensure that you have access to this service and have the alerts turned on from Canvas so that you get timely course updates. Important course information including your grade, lecture videos, syllabus, calendar, office hours, Announcements, exam dates, ProctorU, mail tool, free help information, Zoom Conference (digital office hours)...etc. will be housed in Canvas.

ONE WEEK POLICY –

You are responsible for verifying that all grades are accurate. You have one week after a score has been posted in Canvas to resolve any grade concerns with your TA. There is absolutely no grade dispute at the end of the term.

MAIL –

Your instructor is coordinating multiple classes, when you email your instructor for private matters, please write ‘**Online Calc2**’ in the subject line so it can be put in context.

2f. LECTURE VIDEOS. The lecture videos provide the main presentation of course material. You may access each video directly through each Lecture on Canvas Home Page. Re-watch it if necessary. Attend digital office hours (Zoom Conference in Canvas). You may also post Q & A in Discussions Board (via the Discussions tab on the left side of Canvas).

To stay current with the course, you must watch the lecture video weekly following the schedule posted in the course calendar. Start early so you don’t miss the due dates.

As stated in 2d, it’s possible to get ahead in this class if you complete each assignment early, **but you must take exams on the specified dates. If you have other commitment, adjust your**

schedule to complete the assignments earlier rather than later. You should watch the lectures and answer the corresponding Lecture Quiz in Canvas before attempting homework.

Lecture Notes outlines: It is important that you should have a paper copy of the lecture outlines. This will make it easier to take notes and to follow the lecture when watching the videos. Students can purchase the printed outlines from the [Target Copy Center](#) (not the Target store) at 1412 West University Avenue (the cover is a red rose for the online sections), or print them out from each lecture in Canvas. Each enrolled student gets 250 pages of [free printing](#) per semester.

2g. SUCCESS: Other than having a strong precalculus and calculus I background, success in MAC 2312 depends largely on your attitude and effort. **Keeping up with the videos** is critical. You may find it beneficial to **work daily** on the course material as opposed to saving it all for one day. It is not effective to watch video and copy notes without following the thought processes involved in the lecture. For that reason, there are **Lecture Quizzes** for each lecture which you will need to complete and submit in Canvas as part of your course grade. (see 3d)

EXPECTATION: This is a very challenging course. Treating it as anything less than that is inherently unwise, both for your learning and for your grade. Be aware that much of the learning of mathematics at the university takes place outside of the classroom (in the case of an online class, spend additional time working on the material after watching the lecture videos). “At a minimum” we expect students to spend 3 hours effectively studying on your own (in addition to watch the lecture video) for every credit hour of the course. MAC 2312 is a 4 credit course, which means at least 12 hours per week preparing and practicing problems for this course *in addition to* watch lecture videos. If you are not doing as well as you would like in MAC 2312, you may need to put forth more effort. Keep in mind that the goal is to be able to apply the techniques of calculus to problems, not just reproduce the problems you see in the class.

Do you know that it takes roughly 45 lecture hours in colleges vs. roughly 150 lecture hours in high school to complete a calculus course? We do not talk 3⁺ times faster at university level, we expect students do work outside the classroom to keep up the learning. You probably won’t do well if you don’t watch lecture regularly or wait till the week of the exam to start preparing for the exam. Much of the learning is on you. Therefore, it is critical that you keep pace with the course material and assignments each week. Do not fall behind.

Use the resources available as you study! We encourage you to ask questions, participate in Discussions, seek help from online office hours, live office hours if you are on campus and the [Broward Teaching Center](#), for free tutoring services. Do not let misunderstandings go unanswered.

DISCUSSIONS BOARD –

We encourage students to work together, and an important resource to facilitate communication in an online course is the **Discussions Board** in CANVAS. You should check the Discussions Board

regularly, posting questions and answers. The effort of asking questions, communicating ideas with fellow students, as well as writing solutions for these posts, are effective tools in helping you better understand calculus concepts. This is YOUR forum, take advantage of it by participating in it. **Two extra credits** can be earned when you post at least 2 distinct math question **and** answer at least 2 *distinct* math questions during each exam period. See description in [Discussions](#).

Important course information is clearly communicated in this syllabus. Assignments and course materials are easily accessible from day 1 through CANVAS. If you can not find your answer in the resources above, please use the Discussions Board in CANVAS to post questions and to supply answers to your fellow classmates.

In studying calculus, you must be careful not to let a tutor, a friend or calculator ‘think’ for you. Be sure to compare the help you get with the class material and ask questions to make sure that you can work out problems completely on your own before an exam. Be a responsible learner!

It’s our hope that through focused study and practice you will gain a true appreciation for the important concepts of calculus and their application. We want you to succeed in this class! Keep up with the course material and take the initiative to **get help in time**, before you get too far behind. Students with a positive attitude who are intellectually engaged in learning the material will get the most from the course.

2h. STUDENTS WITH DISABILITIES. UF welcome students with disabilities into the UF programs. Students requesting classroom accommodations must first register with the Dean of Students Office [Disability Resource Center](#) (DRC). The DRC will provide documentation to the student who must then provide this to the instructor as soon as possible when request accommodation.

2i. ACADEMIC HONESTY.

Academic Integrity: We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.

Students are required to be honest in all of their university class work. Faculty members have a duty to promote ethical behavior and avoid practices and environments that foster cheating. Faculty encourage students to bring incidents of dishonesty to their attention.

Student Honor Pledge:

“On my honor, I have neither given nor received unauthorized aid in doing this assignment.”

Violations of the Academic Honesty Guidelines shall result in judicial action and a student being subject to the sanctions in paragraph XIV of the Student Code of Conduct”.

The mathematics department expects you to follow the Student Honor Code. This policy will be rigorously upheld at all times in this course.

In addition, we remind you that lecture videos and the course content, learning material are the property of the University/faculty member and may not be used for any commercial purpose. Students found to be in violation may be subject to discipline under the Student Conduct Code.

3. GRADING & ASSIGNMENTS

3a. GRADE SCHEME. Your course grade is determined as follows:

Grades: Syllabus & Lecture Quizzes	10%
Online Homework (by topics)	5%
Online Homework (by units)	5%
Written homework (upload)	10%
Written Exam Review (upload)	10%
<u>Unit exams and final exam</u>	<u>60%</u>
Total:	100%

A	90% - 100%	C	70% - 74%
A –	87% - 90%	C – *	67% - 70%
B +	84% - 87%	D +	64% - 67%
B	80% - 84%	D	60% - 64%
B –	77% - 80%	D –	50% - 60%
C +	74% - 77%	E	< 50%

There will be no additional curve in this course, extra assignments for individual students to improve a grade are NOT possible.

*Note: A grade of ‘C –’ or lower DOES NOT give University General Education credit!

For those taking the ‘S – U’ option: S[> 70%] , U[< 70%] , Approval of the ‘S – U’ option must be approved by the registrar’s office. The deadline for filing an ‘S – U’ option can be found in the undergraduate UF Catalog.

Extra Credits: Answer 2 distinct questions posted by your classmates in Discussions during each exam period. See Discussions in Canvas for details.

3b. INCOMPLETE GRADES POLICY. A grade of I (incomplete) will be considered only if you meet the [math department criteria](#). If you meet the criteria you must see the instructor before the beginning of the finals week to sign a contract. **A grade of “I” only allows you to make up your incomplete work. You can not redo any previously completed work, nor closed work.**

Missing an exam due to negligence, however, will result in a minimum 10–point penalty.

3c. GETTING STARTED - START HERE: INTRODUCTORY VIDEO, SYLLABUS QUIZ.

Log in to Canvas and go to the [Start Here page](#). Watch the Introductory video and then read the important information. After you feel comfortable with the course policies in the syllabus, take the [syllabus quiz](#) in Canvas. The syllabus quiz is to make sure you understand what is expected of you in this course. After completing the introductory part and achieve at least 80% in the syllabus quiz, you are ready to move to the main content: Lecture 1 – Lecture 37.

3d. VIDEOS AND LECTURE QUIZZES. MAC2312 is organized into 37 lectures, each lecture has an introductory page including the concepts to be covered, things you need to do for this lecture. From there, you may access a copy of the note outlines, links to the **lecture videos** and links to additional examples and Lecture Quizzes. **Viewing the lecture video** is an important aspect of the learning process. There are several simple **Lecture Quiz** to be completed in each lecture. You need to work out these problems as you watch the video. We encourage you to use the notes as well as the videos or the Discussions Board to help answer these questions which are not timed, you have 2 submissions to complete each quiz. The two lowest Lecture Quiz scores will be dropped to offset possible credit lost due to technical issues or a missed assignment.

NOTE: At the time of the taping, we used a specific text book. Now we do not require a text book. Please go by the ‘topic name’ and ignore any chapter numbers mentioned in the videos.

NOTE: There might be minor typos in some of the lecture videos. Post them in Discussion Board if clarification is needed.

3e. HOMEWORK. There are online homework as well as written homework. The written homework are the solution you have already worked out for the online homework. Here, you get the opportunity to practice writing out complete math solution:

1. **Online Homework** – You may access all online assignments in Canvas. Access the *Lecture Quizzes* (LQ) within each lecture, and access practice problems in [GLC2](#) (Google Learning Calculus 2) or, by clicking the **Assignment tab** on the left side of Canvas.
2. **Written Homework** – to be uploaded in Canvas:
There are two types of written homework assignments. The first one is the written work you did while working on the Google problems in *GLC2*. Go to the Assignments tab in Canvas, click on ‘Upload Homework (UHWn)’. The second one is for *exam reviews*. Go to the Assignment tab, click on ‘Upload Exam Review (UEnR)’.

Scan your completely worked out solution and upload them before due date. You will see detailed instructions in each assignment set in UHWn and UEnR.

Why GLC2 and What is GLC2? Quite often, students in the online class can suffer from the lack of opportunity and ability to write mathematics and that they do not have enough resources when it comes to worked-out examples. As a result, I have created an interactive ‘Guided-Learning Calculus 2’ ([GLC2](#)) in Google in hope to give students a valuable resources to guide you through the course successfully. The flow of the structure is as follows: Students will

- **LEARN** from watching the lecture videos,
- **REVIEW** the [Notes and annotated Examples](#) in GLC2,
- **PRACTICE** by working out more examples in GLC2 and writing out complete solutions,
- **TEST** your understanding by taking the [quizzes](#) and [practice exams](#) in GLC2, writing out the complete solution and upload them in Canvas for the written homework grades.

In the GLC2 notes section: You will find a brief summary of each topic covered in the course follow by examples with annotated solutions and, more examples for you to practice. These examples also have worked out solutions that is just a click away. After you have worked out all the examples, you should be ready to test your understanding by taking the quiz and practice exam questions. You can start as early as you have watched the first video in that unit.

The quizzes and practice exams are your homework assignments, they provide you the opportunity to review the concepts and test your understanding before exams. You are allowed to get help on these homework problems. Remember that the important thing is to learn the material well before exams.

Go to each lecture in Canvas Homepage to access the problems in GLC2. You will have unlimited time before due date with 2 submissions. There is 1 drop in the *homework by topics*, but not in *homework by units*.

Do not try to complete all assignments in one sitting; Remember: Due Date is NOT Do Date! Start and submit early so you have time to digest and absorb the material and not miss the deadline.

NOTE: The purpose of homework is to practice problems in order to understand and master the material learned. Complete them before each exam. **Complete them after exams is not helpful to your learning nor your grades.**

If you are experiencing problems with logging in GLC2 in general, please contact your TA immediately, your TA is your first contact in the course. You may also use the Discussions Board.

NOTE: Post your **math questions** to the discussions board. Do **not use email** for math problems or non-private issues.

Please take time to engage in regular study. You will form a solid knowledge foundation as you begin to synthesize your understanding before you start to tackle challenging homework problems and prepare for exams.

3f. EXAMS See 4. Testing

3 g. ADDITIONAL PRACTICE PROBLEMS. There are also problems listed at the end of each lecture called ‘Now You Try It’ (NYTI). These were written by the course coordinator and are designed to emphasize important concepts and provide extra practice of the lecture material. Some of them are included in the Lecture Quiz. NYTI problems are not graded, but it is strongly encouraged that you work them out. Solutions to NYTI are posted in the ‘Lecture Notes’ table in the Syllabus Tab in Canvas.

4. TESTING.

There will be three 90-minute unit exams and one two-hour **cumulative** final exam, all mandatory, no drops. The exams will be given in Canvas and administered through ProctorU. You must register with [ProctorU](#) for each exam at least 1 week prior to the exam date to avoid a fee. Schedule a 120 (90+extra 30)* minutes time block for each unit exam and a 150 (120+extra 30)* minutes block for the final. All exams are open from 6AM – 11PM EST only, schedule your exam to start no later than 7PM EST.

Make sure you are available to take the exam at the designated date and time. Also, you will not see your exam if you are late, and it may take you a lot of time to contact ProctorU and re-sign in...etc. So be sure to show up on time.

***Possible ProctorU issues, temporary internet issues, etc., all these take time to resolve:**

We offer a generous 30 extra minutes on all exams to compensate for possible internet problems, times when the keyboard is disabled by ProctorU, or any other technical issues that may arise.

*Please **do not request a retake** unless you have documented evidence that your disconnect or technical issues **exceeded 30 minutes and it is not due to your negligence**. It's your responsibility to have a reliable internet connection and fast enough computer/internet speed, make an ‘equipment check’ appointment with ProctorU before your first exam. You will not be able to request a makeup exam if problems arise due to your own negligence.*

*Please **do not use Safari nor Internet Explorer (IE)** while working on math equations, it's known that math images may not be displayed properly in Safari nor IE. We will not accommodate you if you can't view math properly when you use Safari or IE.*

If you are uncertain as to the reliability of your internet service provider or internet connection, find a place to take your exam where the connection is reliable or, switch to conventional course during drop/add period.

We urge you to **connect to [Proctor U Help Desk representatives](#), at least a few days prior to your exam**, and do a live chat to confirm your connection and equipment are all good. It is your responsibility to be sure that you have a reliable Ethernet internet connection and verify with the proctor for an acceptable internet speed, location & environment (ex. webcam) to ensure that it meets proctoring requirements. Go [here](#) for more details. If your answers are not received by Canvas due to your faulty connection/equipment, they are lost for good, we are not able to take anything else to replace your lost answers.

Follow the proper procedure to log off the exam **before disconnect from proctor. Failure to do so may result in a 0 on the exam.**

Note: You may NOT use a calculator or any other aid for exams. Be sure to read the ProctorU handout thoroughly to understand the exam procedures before you go to a test.

4a. SEMESTER UNIT EXAMS. Each Unit Exam will be given in Canvas and scored on a scale of 0 to 70 points, consisting only multiple choice questions and possibly a few fill-in-the-blank questions. **The exam is locked after the test. You may request a 15 minutes private conference within one week after each exam to review your exam with your TA**, or if you are on campus, please come to my live office hours, I will be glad to go over your exam with you in details.

4b. FINAL EXAM. A mandatory, cumulative final exam in Canvas will be given on the date shown in the course calendar. The exam consists of multiple choice questions and possibly a few fill-in-the-blank questions and graded on a scale of 0 to 100 points. **You may request 15 minutes private conference to go over your final exam within 24 hours after the exam, or visit with me to go over it with you in person.**

4c. MAKEUP POLICIES. Exams must be taken on the exam date.

1. **Makeup – Exams:** If you have a court order, or if serious illness or other last minute extenuating emergency circumstances cause you to miss an exam, you must contact your TA within 24 hours of the exam with a valid documentation for approval and you will need to reschedule the exam with ProctorU. To be considered for a makeup exam, you must have completed at least 75% of all the course work thus far and have completed all prior exams. (we do not accept teledoc's notes)
2. **If you have a schedule conflict with an exam**, such as religious observance or participate in an UF approved event, you must sign up for makeup with your TA by the deadline specified in the course calendar.

3. **Other make ups:** There are **no makeup** on any course work nor other extra credit opportunities. There is a 20% penalty each day the work is received late. See the description in each assignment for more details.

You are responsible to schedule make up exam with ProctorU if you are approved for a makeup. All makeups must be completed by the **last Monday** of the semester **before the final exam**.

5. FORMULAS YOU ARE EXPECTED TO KNOW.

This course assumes that you have a sound precalculus and calculus 1 background. The following is a summary of some important concepts used in solving calculus problems. The textbook provides a more complete review of these essential topics.

COMPLETING THE SQUARE $x^2 + ax + b = (x + \frac{a}{2})^2 + (b - (\frac{a}{2})^2)$

LAW OF EXPONENTS $a^{n+m} = a^n a^m$ $a^{n-m} = \frac{a^n}{a^m}$ $(a^m)^n = a^{mn}$

PROPERTIES OF logarithms $\log_b |xy| = \log_b |x| + \log_b |y|$

$$\log_b \left| \frac{x}{y} \right| = \log_b |x| - \log_b |y|$$

$$\log_b |a^m| = m \log_b |a|, \quad \log_b |x| = \frac{\ln |x|}{\ln b}$$

PARABOLA $y = f(x) = ax^2 + bx + c$ CIRCLES $(x - a)^2 + (y - b)^2 = r^2$

Vertex $x = -\frac{b}{2a}, y = f(-\frac{b}{2a})$ Center $(a, b), \text{ radius} = r$

Derivatives

$$\frac{d}{dx}(\sin x) =$$

$$\frac{d}{dx}(\csc x) =$$

$$\frac{d}{dx}(\cos x) =$$

$$\frac{d}{dx}(\sec x) =$$

$$\frac{d}{dx}(\tan x) =$$

$$\frac{d}{dx}(\cot x) =$$

$$\frac{d}{dx}(\arctan x) =$$

$$\frac{d}{dx}(a^x) =$$

$$\frac{d}{dx}(e^x) =$$

$$\frac{d}{dx}(\log_a x) =$$

$$\frac{d}{dx}(\ln x) =$$

Integrals

$$\int \frac{1}{x} dx =$$

$$\int e^x dx =$$

$$\int a^x dx =$$

$$\int \sin x dx =$$

$$\int \cos x dx =$$

$$\int \tan x dx =$$

$$\int \cot x dx =$$

$$\int \sec^2 x dx =$$

$$\int \csc^2 x dx =$$

$$\int \sec x \tan x dx =$$

$$\int \cot x \csc x dx =$$

$$\int \tan^2 x dx =$$

$$\int \cot^2 x dx =$$

$$\int \frac{1}{a^2 + x^2} dx =$$

Trig Identities

$$\sin^2 x + \cos^2 x = 1$$

$$\tan^2 x + 1 = \sec^2 x$$

$$1 + \cot^2 x = \csc^2 x$$

$$\sin^2 x =$$

$$\sin 2x =$$

$$\cos^2 x =$$

$$\cos 2x =$$

Know values of $\sin x$, $\cos x$, $\tan x$ at $x = 0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}$; $\arctan(a)$ at $a=0, 1, \sqrt{3}, 1/\sqrt{3}$.

(know the values of the other trig. functions at these angles and know the values of all trig functions at complementary and supplementary angles of the angles above)

Chain Rules

$$(f(g(x)))' = f'(g(x))g'(x)$$

Derivative of an Inverse

$$\text{If } g = f^{-1}, \text{ then } g'(x) =$$