MAC 2312: CALCULUS 2
Sections 185A, 1851, 1852
SPRING 2017

Contact Information:

Course Instructor

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1. INTRODUCTION

1a COURSE CONTENT: MAC2312 is the second in the three-semester calculus sequence MAC2311, MAC2312, MAC2313. Intended topics will include applications and techniques of integration, infinite series, and the calculus of parametrized curves.

1b PREREQUISITES: To enroll in MAC2312, you must have earned a grade of C or better in MAC2311 or have equivalent credit.

1c REQUIRED MATERIALS :

Textbook: The textbook for the course is *Calculus Early Transcendentals, by James Stewart (8th Edition)*. It is required that you get a **WebAssign code for doing online homework.** This course will be participating in the UF All Access program. The e-textbook, Calculus Early Transcendental by Stewart, is included in the required WebAssign access code. Most of you already have a multi-term access code and you

should have access to WebAssign. If you don't have a multi-term access code from FAll 2016, then:

- You have the choice to "opt-in" to WebAssign access and the e-book through CANVAS until 1/24/17 for a reduced price of $62.50 and pay for these materials through your student account. The opt-in option is the most effective one if you are planning to take only MAC 2312. The link to opt-in will be provided in the course homepage in CANVAS.

- Students who plan to take three semesters of Calculus: MAC 2311, MAC 2312, and MAC 2313 can purchase a multi-term access online via WebAssign for $125.00 and that includes the e-book. The link will be provided in the course homepage in CANVAS.

- Students who do not "opt-in" will be able to purchase a standalone WebAssign access code through the UF Bookstore (or the WebAssign website directly) for $96.00. This is not the best option as the price is significantly higher than the "opt-in" price.
  An online purchase at WebAssign should only be considered for those who need multi-term.

There is also a loose-leaf print version ($50.00) of the customized textbook available at the UF Bookstore for students who wish to have a printed resource.

Other Required Materials:

- **Access to a working computer:** All online assignments should be taken on a computer, not cell phone or tablet since there may be compatibility issues with Web-Assign. Be sure you are using a browser that works with WebAssign. Please check for WebAssign browser recommendations: http://www.webassign.net/manual/student_guide/c_a_system_requirements.htm.
  Any WebAssign questions should be directed to your TA and/or the WebAssign Student Support, https://webassign.com/support/student-support/.

- **H-ITT Clicker:** We will use the H-ITT class responder system to allow students to participate in lecture. Information will be provided in class and on the MAC 2312 homepage in CANVAS.

- **Calculators:** A graphics calculator and Wolframalpha can be useful study and learning tools when used appropriately, but are not essential. Calculus is a collection of ideas that are not mastered through calculator skills. **No calculators are allowed during in class class activities, quizzes, assessments, and the final exam.**

1d <u>**E-LEARNING CANVAS:**</u> E-learning CANVAS is located at http://elearning.ufl.edu/. Use your Gatorlink username and password to login. All course information including homework assignments, lecture outline, lecture videos, office hours are posted on this site. CANVAS provides a mail tool and discussion forum for communication.

All grades are posted in the CANVAS gradebook (except individual WebAssign and HITT points, which are accessed through those programs directly). You are responsible

for verifying that those grades are accurate. **You have one week after a score has been posted to contact your TA to resolve any grade concerns. We will not consider any grading disputes nor make any grades adjustment at the end of the semester. Be sure to save all original documents in case of grading questions.**

Please note: Important course information is clearly communicated in this course guide, the MAC 2312 homepage and links in Canvas, and announcements in lecture and discussion. Due to the volume of email received by the instructor and TA, we cannot reply to each request for this well publicized information. If you cannot find your answer in the resources above, there is also a Discussion Forum available in Canvas. Please use this to post questions and to supply answers to your fellow students. The instructor and TA will check the discussion forum regularly.

1e LECTURES: This class will take a different form than you may be used to. I will not lecture for the whole period, if at all. You will be responsible for watching pre-recorded lectures online at the course site in Canvas BEFORE coming to class. We will spend most of our class time working on problems and exploring the concepts of calculus in small groups. There is a lot of research showing that students learn and retain information better in this environment. Come to class ready to participate.

1f DISCUSSION SECTIONS, which meet once a week on Tuesday, give you a valuable opportunity for open discussion of the lecture material and assigned problems in a smaller class setting. **Attendance in discussion is required.** However, one period per week is generally not adequate to answer all questions. Be sure to take advantage of the opportunities outside of class for additional help.

Your main resource person is your discussion leader, Shane Welker. He is a graduate student in mathematics and has experience in teaching calculus. He is available during office hours (or by appointment) to answer your questions about the course material. Shane is responsible for recording all scores. You must retain <u>all</u> returned papers in case of any discrepancy with your course grade. As mentioned above, **you should check CANVAS regularly and consult with Shane if you have any questions about recorded grades. All grade concerns must be taken care of <u>within one week</u> of receiving the score.** Your grade is subject to being raised or lowered if there is a recording error, computational error, bubbling error, "padding" error, etc.

If you have concerns about your discussion class which cannot be handled by your TA please contact Dr. Christodoulopoulou in Little 370.

1g FREE HELP: In addition to attending your discussion section regularly and visiting your discussion leader, lecturer or the course coordinators, during their office hours, the following aids are available.

- The Teaching Center Math Lab, located at SE Broward Hall, is a tutorial service staffed by trained math and science students to provide help with your calculus questions and homework. Tutors will be glad to provide guidance on specific problems after you have attempted them on your own. You may want to attend different hours to find the tutors with whom you feel most comfortable. You can also request free one-on-one tutoring.

The Broward Teaching Center also offers a more structured tutoring program for MAC 2312, called **supplemental instruction**. A tutor, assigned specifically to MAC 2312, provides weekly help sessions. More details will be provided in lecture.

In addition, the Broward teaching center tutors hold reviews on the evenings before each exam. They also provide videos of review and sample test problems. Check the webpage, https://teachingcenter.ufl.edu/, for a map of the location, tutoring hours and test review dates and locations.

- The Little Hall Math Lab, located in LIT 215, provides free drop-in tutoring in math courses. More details will be posted on the course page in CANVAS.

  All students are encouraged to use the Teaching Center and the Little Hall Math Lab.

- Office of Academic Support offers free one-on-one and small group tutoring sessions to any UF students. See http://oas.aa.ufl.edu/programs/tutoring/ for details.

- UF Counseling Center provides information and workshops on developing Math Confidence. The center also offers counseling support in case of issues with academics, adjusting to the stress of college life, or personal challenges. Please use this resource before you get overwhelmed! You may also speak to Dr. Christodoulopoulou or an advisor in your college if you are having difficulties. You may contact the center at http://www.counseling.ufl.edu/cwc/.

- Textbooks and solutions manuals are located at the reserve desks at Marston Science Library.

- Private Tutors: If after availing yourself of these aids, you feel you need more help, you may obtain a list of qualified tutors for hire at https://math.ufl.edu/. Search for "tutors".

1h SUCCESS: Other than having a strong precalculus background, success in MAC 2312 depends largely on your attitude and effort. Attendance and participation in class is critical. It is not effective to sit passively in class and let the other members of your group do the work. Students who do not actively participate have much more difficulty.

However, be aware that much of the learning of mathematics at the university takes place outside of the classroom. You need to spend time reviewing the concepts of each lecture **before** you attempt homework problems. It is also important to look over the textbook sections to be covered in the next lecture to become familiar with the vocabulary and main ideas before class. That way you will better be able to grasp the material presented by your lecturer. As with most college courses, you should expect to spend a **minimum** of 2 hours working on your own for every hour of classroom instruction (at least 8 hours per week).

It can also be very helpful to study with a group. This type of cooperative learning is encouraged, but be sure it leads to a better conceptual understanding. **You must be able to work through the problems on your own.** Even if you work together, each student **must turn in his or her own work, not a copied solution, on any collected individual assignments**.

In studying calculus, you must be careful not to let a tutor, friend, or calculator "think" for you. Be sure that you can work problems completely on your own, without help, by the time of a quiz or exam.

Use the resources available as you study! We encourage you to seek help from your lecturer and TA during office hours. Please contact us for an appointment if your classes conflict with our office hours, or in the case of an emergency. We also encourage you to use the Little Hall Math Lab, the Broward Teaching Center and OAS for group and private tutoring.

If you are having difficulty with calculus, do not get discouraged! See your lecturer or course TA right away when you have questions.

Our hope is that through focused study and practice you will gain a real appreciation for the important concepts of calculus and their application. We want you to succeed in this class! But you must keep up with the course material and take the initiative to see us and 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.

1i <u>**STUDENTS WITH LEARNING DISABILITIES:**</u> Students requesting class and exam accommodations must first register with the Dean of Students Office Disability Resource Center(DRC), https://www.dso.ufl.edu/drc/. That office will provide a documentation letter to the student to present to Dr. Christodoulopoulou in Little 370. This must be done as early as possible in the semester, **at least one week before the first evening assessment**, so there is adequate time to make proper accommodations.

1j <u>**ACADEMIC HONESTY:**</u> Remember that you committed yourself to academic honesty when you registered at the University of Florida. All students are bound to

The Honor Pledge
We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied:
"On my honor, I have neither given nor received unauthorized aid in doing this assignment."

Academic Honesty Guidelines: "All students are required to abide by the Academic Honesty Guidelines which have been accepted by the University. The academic community of students and faculty at the University of Florida strives to develop, sustain and protect an environment of honesty, trust, and respect. Students are expected to pursue knowledge with integrity. Exhibiting honesty in academic pursuits and reporting violations of the Academic Honesty Guidelines will encourage others to act with integrity. 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. We are bound by university policy to report any instance of suspected cheating to the

proper authorities. **This includes clicker points submitted in lecture. Each student must enter his or her own response; clicking for another student is a violation of the Academic Honesty Guidelines and will be reported.**

You may find the Student Honor Code and read more about student rights and responsibilities concerning academic honesty at the link https://www.dso.ufl.edu/sccr/. In addition, we remind you that lectures given in this class are the property of the University/faculty member and may not be taped without prior permission from the lecturer 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.

2. TESTING

2a <u>**EVENING ASSESSMENTS:**</u> The "traditional" sections of this course will have three evening exam periods. We will use these for (re)assessment of various standards. See the grading policy below for further explanation. **The evening assessments for our class are 8:30PM-10PM on the following dates: Tuesday, February 7, Thursday, March 2, and Thursday April 6. The policies below will apply to the evening assessments as well as the final exam.**

2b <u>**FINAL EXAM:**</u> A mandatory, comprehensive final examination will be given on Saturday, April 22, 10AM-12PM. Location is to be determined and will be announced in class. The registrar's office determines which exam has priority in the case of a conflict. **Missing the final exam due to negligence will result in a minimum 10-point penalty.**

2c <u>IMPORTANT EVENING ASSESSMENT AND FINAL EXAM POLICIES:</u> MAC 2312 requires that students take evening exams/assessments on the listed dates. There are no exceptions to this. Students with conflicts, including regularly scheduled classes, must make advance arrangements to be present at the test.

(1) Students are responsible for material covered in lecture videos, in class activities, reading assignments, and text problems. Questions will test mastery of concepts and include challenging calculation problems. **A command of related algebraic and trigonometric concepts is assumed** (see the Prerequisites, page 16, in this guide).

(2) Bring only the following to the final exam:
- Soft lead graphite pencils (number 2 lead or softer) for bubbling your scantron
- Ink Pen (To sign your test)
- Knowledge of your SECTION NUMBER and UF ID number
- Picture ID (UF Gator One card or your state driver's license) with a **legible signature**

DO NOT BRING ANYTHING OF VALUE TO THE EXAM/EVENING ASSESSMENT, since all backpacks must remain at the front of the exam room

during testing. Do not bring books or other aids; scratch paper is provided. **No calculators are permitted.**

Cell phones and other electronic devices must be turned off and out of sight. If any such device rings, buzzes, or otherwise causes a distraction during the exam, your test will be considered to be compromised.

(3) Students should be at the exam/evening assessment location at least 10 minutes early. No student will be admitted to the test later than 20 minutes after its starting time, and no one will be permitted to leave the room in those first 20 minutes.

(4) The **Test Form Code**, as well as **your UFID**, name, and section number must be encoded correctly or you will lose 3 points. You must also take the test in your assigned test location or you will be penalized.

See Section 3 for the Conflict and Makeup Policies.

3. GRADING We will use the Standards Based Grading system. The standards appear below, but your grade will be determined using a combination of many things.

3a ONLINE HOMEWORK: Online homework assignments will be posted regularly during the semester and must be completed by the specified due date. There will be extra points available to offset credit lost due to technical difficulties or an occasional missed assignment. **There are no makeups for online homework since you have several days to complete each assignment. Do not try to complete an assignment in one sitting; start early instead of waiting until the due date to avoid missing the deadline.**

3b ASSESSMENTS: Standards will be assessed via quizzes in discussion, in class, and during the three evening assessment periods. I reserve the right to put some of these assessments into WebAssign as well. You will have a maximum of FOUR attempts to master any particular concept.

3c CLASS PARTICIPATION POINTS: Class participation points will be collected through the use of the H-ITT course responder system (clicker) as announced in lecture. We may also collect your in class activities work at the end of class. More details will be available in class and on the course home page in CANVAS. **YOU MAY NOT TURN IN WORK FOR A STUDENT WHO IS NOT IN CLASS (see section 2j)**. There will be extra points available to account for an occasional absence or technical difficulties with your clicker.

Following university policy, you may expect a penalty (additional lost points) for attending fewer than 75% of your classes. In addition, you will lose the opportunity to earn additional points if available at the end of the semester.

3d LECTURE QUIZZES: After watching each lecture, you will take a short quiz in CANVAS to test your understanding of the concepts. These will factor into your grade as outlined below.

3e <u>**MAKE-UP POLICY:**</u> All make-up work must be approved by Dr. Christodoulopoulou in LIT 370 during office hours. You must provide documentation of your absence.

- **Exam/Evening Assessment Conflicts – The UF during Term Assembly Exam Policy** (https://catalog.ufl.edu/ugrad/current/regulations/info/exams.aspx): "Exams may be held Monday – Friday from 8:20 – 10:10PM (periods E2–E3) for the fall and spring terms. If other classes are scheduled during an exam time, instructors must provide make-up class work for students who miss class because of an assembly exam. If two exams are scheduled at the same time, assembly exams take priority over time-of-class exams. When two assembly exams conflict, the higher course number takes priority. Instructors giving make-up exams will make the necessary adjustments."

  If MAC 2312 is the lower course number, students must inform Dr. Christodoulopoulou in person at least ONE WEEK in advance of the exam date so that appropriate accommodations can be made. Otherwise it may not be possible to reschedule.

- If you are participating in a UF sponsored event or religious observance, you may make up an exam/assessment only if you make arrangements with Dr. Christodoulopoulou in her office at least ONE WEEK PRIOR to the event. You must present documentation of a UF sponsored event.

  If illness or other extenuating circumstances cause you to miss an exam, contact Dr. Christodoulopoulou immediately (no later than 24 hours after the exam) by email. Then, as soon as possible after you return to campus, bring the appropriate documentation to her in LIT 370 during office hours.

  To be eligible for any make-up you must have received at least half of the lecture participation points that have been given so far.

- **Make-up WebAssign HW:** There are no make-ups. You can request an extension on WebAssign homework within 2 days after the deadline and you will have 48 hours to complete it after extension request. The extension must be submitted in WebAssign directly. However, there will be a 20% grade penalty for those problems completed after the original due date for the assignment.

- **Make-up Clicker points:** There are no make-ups.

- **Make-up Lecture Quizzes:** There are no make-ups since you have several days to complete each lecture quiz.

3f <u>**10-MINUTE POLICY:**</u> Only the students who are present within the first 10 minutes of the class and stay for the entire period will be allowed to participate in the class activities (including submitting clicker questions, taking quizzes, and turning in class work).

3g <u>**INCOMPLETE:**</u> A student who has completed a major portion of the course with a passing grade but is unable to complete the final exam or other course requirements due to illness or emergency may be granted an incomplete, indicated by a grade of "I". This allows the student to complete the course within the first six

weeks of the following semester. The student must contact the course coordinator before finals week to sign an incomplete grade contract (http://clas.ufl.edu/forms/incomplete-grade-contract.pdf), and must provide documentation of the extenuating circumstances preventing him or her from taking the final exam. The grade of "I" is never used to avoid an undesirable grade, and does not allow a student to redo work already graded or to retake the course. See the official policy at http://www.math.ufl.edu/department/incomplete-grades/.

3h STANDARDS-BASED GRADING METHOD: Here's a question to consider: what does it mean to say a student scored an 87 on a test? You may never have thought about this carefully because you are so used to earning points on exams and in your courses. What it means is that the student managed to aggregate 87 points out of 100. What it does not mean is that the student understands things very well (necessarily). In fact, it might be that the student did not get any question on the test completely right, but merely managed to get most of the problems mostly right. Standards-based grading aims to remedy this situation by testing students on specific concepts that they should master and grading the papers as pass or fail. There is no partial credit and there are no points. It's either correct or not. Students then receive grades based on how many concepts they have mastered. Wait, you say. That's not fair. What if I had a bad day and just miss or blew a quiz? The remedy for that is that you get to retake the assessments up to four times until you prove mastery. Also, once you've proved that you know a concept, no one can take that away from you; it's in the bank. So, if you master the number of concepts required to earn a B in the course, no future assessment can damage that. This is in stark contrast to the traditional points system in which each test is high pressure-any one of them can really hurt your grade. Another advantage is that there is no quibbling about points. Your assessments are either correct or not and we can therefore talk about the mathematics instead of arguing about a point or two. Here are the standards grouped by **"big questions".**

<div align="center">

Standards.

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What kinds of applied problems can we solve using integration?

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1. *Areas between curves.* Finding the area between curves. Use definite integrals to calculate the area of a region bounded by one or more functions, including integrating with respect to either axis.

2. *Volumes of solids of revolution.* Compute the volume of various solids.

3. *Volumes by slicing.* Compute the volume of a solid by integrating cross-sectional area

4. *Areas of polar regions.* Compute the area of a region bounded by a curve in polar coordinates.

5. *Arc length of polar curves.* Compute the length of a curve in polar coordinates.

<div align="center">

What techniques can we use to evaluate integrals?

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6. *Integration by Parts.* Apply the method of integration by parts in simple cases or in extended cases, applying the correct formula or using a tabular method.

7. *Trigonometric Integrals.* Evaluate integrals of various trig functions.

8. *Trigonometric Substitution.* An important technique for finding antiderivatives.

9. *Partial Fractions.* Use a partial fraction decomposition to evaluate the integral of a rational function.

What can we say about the motion of objects moving in more than one dimension?

10. *Calculus of parametric curves.* Find the tangent vector, length, etc. of parametrized curves.

How can we add infinitely many items together?

11. *Geometric Series.* Find the sum of a geometric series, if it converges.

12. *Comparison Tests.* Use the comparison tests to determine convergence of a series

13. *Ratio Test.* Use the ratio test to determine convergence of a series

14. *Alternating Series.* Determine convergence of alternating series

15. *Taylor Series.* Compute Taylor series of various functions

16. *Alternating Series Error Estimation.* Evaluate the error in using partial sums to estimate infinite sums

17. *Taylor Series Error Estimation.* Evaluate the error in using Taylor polynomials to estimate function values

18. *Improper Integrals.* Evaluate and determine convergence of improper integrals

19. *Integral Test.* Determine convergence of series using the integral test

20. *Root Test.* Use the root test to determine convergence of series

21. *Convergence of Sequences.* Find limits of sequences of real numbers

22. *Summing Infinite Series.* Find the sum of series using sequences of partial sums

23. *Absolute and Conditional Convergence.* Determine type of convergence of series.

To calculate your grade using the standards-based method, consult the following chart. In addition to those criteria to receive the mastery grade **YOU MUST PASS THE FINAL EXAM WITH A SCORE OF AT LEAST 60%.** If your score in the final exam is below 60%, then your mastery grade will be lowered in increments of 1/3 of a letter grade (i.e. an A to an A-, a B+ to a B, etc.) as follows: if your final exam score is in the range 50%-59.5%, your mastery grade will be lowered by 1/3 of letter grade; in the range 40%-49.5%, by 2/3 of a letter grade; in the range 30%-39.5%, by a full letter grade; in the range 20%-29.5%, by 4/3 of a letter grade, etc.

A	master 21 (or 91%) of course standards
	have a class participation score of at least 85%;
	have a homework grade of at least 95%;
	earn at least 32 points on lecture quizzes
B	master 18 (or 78%) of course standards;
	have a class participation score of at least 75%
	have a homework grade of at least 85%
	earn at least 28 points on lecture quizzes
C	master 15 (or 65%) of course standards;
	have a class participation score of at least 70%
	have a homework grade of at least 75%
	earn at least 24 points on lecture quizzes
D	master 8 of course standards;
	have a class participation score of at least 60%;
	have a homework score of at least 65%;
	earn at least 20 points on lecture quizzes
E	does not fit in the categories above

Plusses/minuses will be given for slightly exceeding/falling just short of each grade threshold. The percentages on class participation, homework, and lecture quizzes are non-negotiable for these purposes (that is, you must achieve the required percentages to get a grade in that range). For example, mastery of 20 standards will earn an A- and of 19 standards a B+. The point, though, is that there is no quibbling about the letter grade; these standards are absolute. If you do not achieve mastery on a particular concept, then you may reassess later. The (re)assessments schedule will be announced in class and on CANVAS. You have four attempts to master each concept.

4. ONLINE COURSE EVALUATION

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu. Evaluations are available in GatorRater near the end of the semester.

PREREQUISITES FOR MAC 2312

This course assumes that you have a sound precalculus background and have done well enough in MAC2311. The following is a summary of some important concepts used in solving calculus problems. The appendices in the text provide a more complete review of these essential topics. **ALGEBRA**

1. Basic Geometric Formulas: (b = base, l = length, h = height, w = width)

    Triangle: area $= \dfrac{1}{2} bh$

    Circle: area $= \pi r^2$; circumference $= 2\pi r$

    Parallelogram: area $= bh$
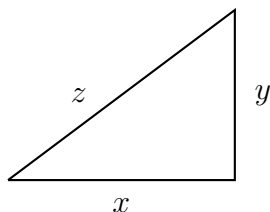
    Rectangular box: volume $= lwh$

    Sphere: volume $= \dfrac{4}{3}\pi r^3$; surface area $= 4\pi r^2$

    Right circular cylinder: volume $= \pi r^2 h$;   surface area $= 2\pi rh + 2\pi r^2$

    Right circular cone: volume $= \dfrac{1}{3}\pi r^2 h$;   surface area $= \pi r \sqrt{r^2 + h^2}$

    Facts about similar triangles

    Pythagorean theorem: $x^2 + y^2 = z^2$

2. Basic Functions and their graphs:

$f(x) = x$; $f(x) = x^2$; $f(x) = x^3$; $f(x) = |x|$; $f(x) = \sqrt{x}$; $f(x) = 1/x$;

$f(x) = b^x$, $b > 0$ and $b \neq 1$, such as $f(x) = 2^x$

3. Factoring:

$$x^3 + y^3 = (x + y)(x^2 - xy + y^2); \quad x^3 - y^3 = (x - y)(x^2 + xy + y^2); \text{ etc.}$$

4. Fractions: $\dfrac{a}{b} + \dfrac{c}{d} = \dfrac{ad + bc}{bd}$, etc.

5. Exponents: $x^n y^n = (xy)^n$; $x^n x^m = x^{n+m}$;

$$\dfrac{x^n}{x^m} = x^{n-m}; \quad (x^n)^m = x^{nm}$$

6. Roots, including rationalizing the denominator or numerator.

$$\sqrt[n]{x} = x^{\frac{1}{n}}; \quad x^{-n} = \dfrac{1}{x^n}, \text{ etc.}$$

7. Inequalities and absolute values:

$|x| \leq a \qquad -a \leq x \leq a; \qquad\qquad |x| > a \qquad x > a \text{ or } x < -a$

8. Equation solving: Finding solutions for x if

$$ax + b = 0; \quad ax^2 + bx + c = 0; \text{ etc.}$$

9. Logarithms: If $x > 0$, $\log_a x = y$ if and only if $x = a^y$

If $m > 0$ and $n > 0$, then

$\log(nm) = \log(n) + \log(m) \qquad \log\left(\dfrac{n}{m}\right) = \log(n) - \log(m)$

$\log(n^c) = c\log(n)$

TRIGONOMETRY

1. Identities:

$$\sin(-\theta) = -\sin\theta \qquad\qquad \cos(-\theta) = \cos\theta \qquad\qquad \tan(-\theta) = -\tan\theta$$

$$\sin\left(\frac{\pi}{2} - \theta\right) = \cos\theta \qquad \cos\left(\frac{\pi}{2} - \theta\right) = \sin\theta \qquad \tan\left(\frac{\pi}{2} - \theta\right) = \cot\theta$$

$$\sin^2\theta + \cos^2\theta = 1 \qquad\qquad \sec^2\theta = 1 + \tan^2\theta \qquad\qquad \csc^2\theta = 1 + \cot^2\theta$$

2. Sum and Difference Formulas:

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

3. Double Angle Formulas:

$$\sin 2\theta = 2 \sin\theta \cos\theta$$

$$\cos 2\theta = \cos^2\theta - \sin^2\theta = 2\cos^2\theta - 1 = 1 - 2\sin^2\theta$$

4. Half-Angle Formulas:

$$\sin^2\theta = \frac{1 - \cos 2\theta}{2} \qquad\qquad \cos^2\theta = \frac{1 + \cos 2\theta}{2}$$

4. Trigonometric Values:

θ	0	$\pi/6$	$\pi/4$	$\pi/3$	$\pi/2$
$\sin\theta$	0	$1/2$	$\sqrt{2}/2$	$\sqrt{3}/2$	1
$\cos\theta$	1	$\sqrt{3}/2$	$\sqrt{2}/2$	$1/2$	0
$\tan\theta$	0	$\sqrt{3}/3$	1	$\sqrt{3}$	undef