

# MAC 2311: CALCULUS 1

## SPRING 2014

### Contact Information:

#### Course Coordinator

Name: Dr. Shu-Jen Huang

Office: Little 372

Office Hours: M3, W4, F6

Phone: 352-294-2309

Email: [huang@ufl.edu](mailto:huang@ufl.edu)

Course homepage is on e-Learning, <https://lss.at.ufl.edu>.

#### Course Lecturer

Name: \_\_\_\_\_

Office: \_\_\_\_\_

Office Hours: \_\_\_\_\_

Phone: \_\_\_\_\_

Email: \_\_\_\_\_

#### Discussion Leader (TA)

Name: \_\_\_\_\_

Office: \_\_\_\_\_

Office Hours: \_\_\_\_\_

Phone: \_\_\_\_\_

Email: \_\_\_\_\_

# MAC2311 – Calculus 1

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### MAC 2311 Calendar, Spring 2014

Monday	Tuesday	Wednesday	Thursday	Friday
Jan 6 L1	7 First Discussion Class	8 L2	9 First Discussion Class	10 L3
13 L4	14 Quiz 1 (L1-L3)	15 L5	16 Quiz 1 (L1-L3)	17 L6
20 <b>MLK Day No Class</b>	21 Quiz 2 (L4-L5)	22 L7	23 Quiz 2 (L4-L6)	24 L8
27 L9	28 Quiz 3 (L6-L8)	29 Review	30 Discussion Class (L7-L9) <b>Exam 1*</b>	31 L10
Feb 3 L11	4 Discussion Class (L9-L10)	5 L12	6 Quiz 3 (L9-L11)	7 L13
10 L14	11 Quiz 4 (L11-L13)	12 L15	13 Quiz 4 (L12-L14)	14 L16
17 L17	18 Quiz 5 (L14-L16)	19 L18	20 Quiz 5 (L15-L17)	21 L19
24 Review	25 Discussion Class (L17-L18) <b>Exam 2*</b>	26 L20	27 Discussion Class (L18-L19)	28 L20
Mar 3 <b>No Class</b>	4 <b>SPRING No Class</b>	5 <b>No Class</b>	6 <b>BREAK No Class</b>	7 <b>No Class</b>
10 L21	11 Quiz 6 (L19-L20)	12 L22	13 Quiz 6 (L20-L21)	14 L23
17 L24	18 Quiz 7 (L20-L22)	19 L25	20 Quiz 7 (L22-L23)	21 L26
24 L27	25 Discussion Class (L23-L25) <b>Exam 3*</b>	26 Review	27 Discussion Class (L25-L26)	28 L28
31 L28/L29	Apr 1 Quiz 8 (L26-L27)	2 L29	3 Quiz 8 (L27-L28)	4 L30
7 L31	8 Quiz 9 (L28-L30)	9 L32	10 Quiz 9 (L29-L31)	11 L33
14 L34	15 Quiz 10 (L31-L33)	16 Review	17 Quiz 10 (L32-L33) <b>Exam 4*</b>	18 L35
21 L35	22 Discussion Class (L33-L34)	23 Review	24 <b>Reading Day No Class</b>	25 <b>Reading Day No Class</b>

**\*Testing Times: 8:30-10:00 PM. Locations will be announced in class.**

**FINAL EXAM: Saturday, April 26, 10:00 am – 12:00 noon**

## 2. INTRODUCTION

**2.a COURSE CONTENT:** MAC2311 is the first in the three-semester sequence MAC2311, MAC2312, MAC2313 covering the basic calculus. Intended topics will include limits, differentiation, applications of the derivative and introduction of integration.

A minimum grade of C (not C–) in MAC2311 satisfies four credits of general education requirement and also satisfies the pure math portion of the state Writing/Math requirement.

**2.b PREREQUISITES:** MAC2311 assumes that you have essential precalculus skills (both algebra and trigonometry) necessary to succeed in calculus. Students should be able to do arithmetic without a calculator.

To enroll in MAC2311, you must have earned a grade of C or better in MAC1147 (or its equivalent, both MAC1140 and MAC1114), earned calculus credit through an exam or earlier coursework, or have taken the ALEKS placement assessment and attained the required minimum score. You may take the ALEKS assessment through the ISIS homepage [isis.ufl.edu](http://isis.ufl.edu); click on Placement under My Online Services. For more complete information, check the page [isis.ufl.edu/aleksinfo.html](http://isis.ufl.edu/aleksinfo.html). Note the following paragraph: “The Department of Mathematics encourages you to take the assessment even if you have met one of the prerequisites for MAC2311. Quite often, your algebra and trigonometry skills may need review and your placement assessment can provide information and specific areas for additional study.” You can check with an advisor in your college, the MAC2311 course coordinator, or in the main math office (Little 358) to be sure that you are eligible for MAC2311.

MAC2311 begins with a short review of precalculus topics. **You should already be competent in working this material.** We **strongly recommend** that students who are having difficulty with the precalculus review material consider first taking MAC1147, a four credit precalculus course reviewing essential calculus skills. You may switch courses on ISIS during the drop-add period. In an agreement with the registrar’s office, you have one additional week to drop back to MAC1147. **After the drop-add period, the paperwork to move back to precalculus MAC1147 must be completed through the math department. The deadline is Tuesday, September 3 at 4PM.** See the course coordinator, Dr. Huang, in Little 372 for details.

**2.c REQUIRED MATERIALS:** Access to the textbook and to the online program WebAssign are required. The solutions manual is NOT required.

Textbook – Calculus: Early Transcendentals, 2nd edition, by Rogawski will be used for this course. Copies of the book and solutions manual are also available for in-library use at the reserve desk of UF Marston Science Library.

Online homework and quizzes from WebAssign will count toward your grade. Students will need to purchase the access code for the WebAssign online homework system at [www.webassign.net](http://www.webassign.net); it will be ready in the beginning of the second week of the semester. WebAssign provides a two-week grace period to use the online homework

system before you must pay for access. Details will be provided in lecture and on the MAC2311 E-Learning homepage. **DO NOT TRY TO REGISTER until it is announced that the course is ready for use. You are responsible for having access to a working computer and have your work completed on time.**

In addition, we will use the **H-ITT** class responder system (“clicker”) to allow students to participate in lecture. Information will be provided in class and on the MAC2311 homepage.

**CALCULATORS:** A graphics calculator and Wolframalpha are useful as a study and learning tool when used appropriately, but they are not essential. Calculus is a collection of ideas that are not mastered through calculator skills. No calculators are allowed on quizzes or on the exams

**2.d E-LEARNING SAKAI:** E-learning Sakai, a UF course management system, is located at [lss.at.ufl.edu](http://lss.at.ufl.edu). Use your Gatorlink username and password to login. All course information including your grade, course homepage, syllabus, lecture outlines, office hours, test locations, mail tool, discussion forum, free help information, etc. can be accessed from this site.

You are responsible for verifying that your grades are accurate. **You have one week after a score has been posted to contact your discussion leader if you believe there has been a recording error. There is no grade dispute at the end of the semester.**

**Please note:** Important course information is clearly communicated in this course guide, the MAC 2311 homepage and links in Sakai, and announcements in lecture and discussion. Due to the volume of email received by the course coordinator, your lecturer 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 Sakai. Please use this to post questions and to supply answers to your fellow students. The lecturers and discussion leaders will check the discussion forum regularly.

**2.e LECTURES:** The lecture provides the main presentation of course material. You may print out the outlines for the lecture notes which can be found on Sakai under **Course Materials**, or purchase a copy of the notes at Target Copy Center. **Attendance in lecture is required.** You are responsible for learning lecture material missed due to an excused absence. Within a day after class, the completed lecture notes will be available to copy on the door of Little 372, M-F, 8-4:30.

**2.f DISCUSSION SECTIONS,** which meets once a week (either Tuesday or Thursday, depending on the section in which you are registered) gives you a valuable opportunity for open discussion of the lecture material and assigned problems in a smaller class setting. **Attendance in discussion is required; a significant portion of the points that determine your grade in the course are earned in your discussion class.** 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, a teaching assistant (TA) in the mathematics department. He or she is available during office hours (or by appointment) to answer your questions about the course material. Your TA is responsible for recording all quiz, homework, and test scores. You must retain all returned papers in case of any discrepancy with your course grade. As mentioned above, **you should check Sakai regularly and consult with your discussion leader if you have any questions about recorded grades. All grade concerns must be taken care of within one week 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 the course coordinator, Dr. Huang, in Little 372.

**2.g FREE HELP:** In addition to attending your discussion section regularly and visiting your discussion leader, lecturer or the course coordinator, 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 math lab also offers a more structured tutoring program for MAC2311, called **supplemental instruction**. A tutor, assigned specifically to MAC 2311, 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, [teachingcenter.ufl.edu](http://teachingcenter.ufl.edu), for a map of the location, tutoring hours and test review dates and locations. **All students are encouraged to use the teaching center.**

- Office of Academic Support offers free one-on-one and small group tutoring sessions to any UF students. See <http://oas.aa.ufl.edu/tutoring.aspx> for details.
- 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 [www.math.ufl.edu](http://www.math.ufl.edu). Search “tutors”.
- The Counseling Center has some informative information on developing math confidence. Go to <http://www.counseling.ufl.edu/cwc/DevelopingMath-Confidence.aspx> for information on math confidence and information on joining the Academic Confidence Group.

**2.h SUCCESS:** Other than having a strong precalculus background, success in MAC 2311 depends largely on your attitude and effort. Attendance and participation in class is critical. It is not effective to sit and copy notes without following the thought processes involved in the lecture. For example, you should try to answer the questions posed by your lecturer. 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 6 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.**

**REMEMBER** that there are 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. As mentioned before, we also encourage you to use the Broward Teaching Center.

**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.**

**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.**

**2.i STUDENTS WITH LEARNING DISABILITIES:** Students requesting class and exam accommodations must first register with the Dean of Students Office Disability Resource Center(DRC), [www.dso.ufl.edu/drc/](http://www.dso.ufl.edu/drc/). That office will provide a documentation letter to the student to present to the course coordinator, Dr. Huang in Little 372. This must be done as early as possible in the semester, **at least one week before the first exam**, so there is adequate time to make proper accommodations.

**2.j 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 conduct set forth hereinafter constitutes a violation of the Academic Honesty Guidelines (University of Florida Rule 6C1-4.017).

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. You may find the Student Honor Code and read more about student rights and responsibilities concerning academic honesty at the link [www.dso.ufl.edu/sccr/](http://www.dso.ufl.edu/sccr/).

When submitting your lecture clicker points, each student sends in his or her own response. Clicking in for another student is in violation of the Academic Honesty Guidelines. In such case, the student will receive a zero for the Class Participation Points for the course.

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.

### 3. TESTING

During the semester, four tests will be given from 8:30 – 10PM on the dates shown on the calendar in this guide. These will be scored on a scale of 0 to 80 points and will consist of both a multiple-choice section and a free response, partial credit section (tearoff sheet). **The best three of your four test scores will be used in the computation of your course grade. That is, the lowest of your four exam scores will be dropped.**

A mandatory, comprehensive final examination will be given on Saturday, December 7, at 3PM. This two hour exam is scored on a scale of 0 to 110 and consists of multiple choice questions only (no tearoff sheet). **Missing a final exam due to negligence**, however, will result in a **minimum** 10-point penalty.

The location of each exam will be announced in lecture and posted on Sakai one week prior to the exams.

**IMPORTANT EXAM POLICIES:** MAC 2311 requires that students take evening exams 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.



The following applies to all exams:

**3.a** Students are responsible for material covered in lectures, 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 13, in this guide). Sample tests are available from the Teaching Center one week before each exam.

**3.b** Bring only the following to the 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 books or other aids; scratch paper is provided. **Calculators are not permitted.**

**DO NOT BRING ANYTHING OF VALUE TO THE EXAM**, 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. Calculators are not 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.c** 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 lose 3 points on your exam.

**3.d** 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 exam room in those first 20 minutes.

**3.e** An answer key will be posted on Sakai within one day after each exam. To check your answers, record them on the test or scratch paper that you keep after turning in your scantron and tearoff sheets.

**3.f** Graded tearoff sheets will be returned in discussion. You then have **one week** to see your discussion leader if you have questions about your exam grade.

## 4. GRADING

**4.a COURSE GRADE:** Your course grade is based on 500 points accumulated as follows:

8 highest quiz scores (up to 8 points each)	64
Online homework assignments	40
4 highest written homework scores (up to 4 points each)	16
Class participation points	30
3 best exam scores (of the four semester exams)	240
Final exam	<u>110</u>
	<b>500</b>

The total sum of points is your numerical score, which will be converted to a letter grade according to the following scale. **The course grade is determined by the number of points you earn, not by the percentage**, and will be strictly enforced. Scores within 0.5 of the next cutoff will round up.

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

A	450 - 500 pts (90%)	C	335 - 369 pts (67%)
A-	435 - 449 pts (87%)	C-*	320 - 334 pts (64%)
B+	420 - 434 pts (84%)	D+	300 - 319 pts (60%)
B	400 - 419 pts (80%)	D	285 - 299 pts (57%)
B-	385 - 399 pts (77%)	D-	270 - 284 pts (54%)
C+	370 - 384 pts (74%)	E	0 - 269 pts

**\*NOTE** A grade of C- DOES NOT give Gordon Rule or General Education credit!

For those taking the S-U option: S [335 - 500 points] U [0 - 334 points]

Approval of the S-U option must be obtained from your instructor. The deadline for filing an application with the Registrar and further restrictions on the S-U option are given in the Undergraduate Catalog.

For a complete explanation of current policies for assigning grade points, refer to the UF undergraduate catalog:

[catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx](http://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx)

**NOTE: We will not review disputed points at the end of the semester. All grade concerns must be settled within one week of the return of the paper.**

**4.b WRITTEN HOMEWORK:** The written assignments posted on Sakai presents the minimum number of problems you should do in each section and will be collected by your discussion leader five times during the semester. The assignments will be graded on a scale of 0 – 4 points; each is checked for completeness and some problems will be graded for accuracy. The work must be your own and not taken from other sources. The top four scores will count, up to a total of 16 points.

An important part of each assignment is reading and understanding the concepts of the lecture and text material, and to preview the next lecture before class. Of course

working problems is essential. Calculus material is cumulative, so you should complete each assignment as thoroughly as possible before your next class. While some problems may look similar, they demonstrate a unique detail of a calculus skill.

If you are having difficulty with any assignment, you may seek help from your lecturer or TA during scheduled office hours as well as the tutors at the Broward Teaching Center. Be sure to start problems early so you have time to get your questions answered!

Some homework problems may suggest the use of a graphing calculator. They are designed to help you visualize important concepts and to reinforce the mathematical processes involved. The use of a calculator is recommended but not required.

**4.c ONLINE HOMEWORK:** The online homework administered on WebAssign is planned to complement the written exercises to maintain your knowledge of recent material. Online homework assignments will be posted 12 times during the semester and must be completed by the specified due date. Your score on each assignment will count up to a maximum 40 points, but the total number of points available is higher to offset credit lost due to technical difficulties or a missed assignment. **There are no make-ups or drops 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.**

**4.d QUIZZES:** Your discussion leader will administer ten quizzes, either in class or online, on the dates listed in the course calendar. Each will be graded on a scale of 0 to 8 points, and the top eight scores will count, to total up to 64 points. The quiz will be based on previous lectures and homework assignments.

**4.e CLASS PARTICIPATION POINTS:** Up to 30 points may be earned by attendance in lecture and completing problems in class. Points will be collected through the use of the H-itt course responder system (clicker) as announced in lecture. More details will be available in class and on the course home page. **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.

**NOTE: Homework, quizzes and class participation points account for 150 points of the total to be earned in the course. They are a significant part of your grade, to reflect their importance in understanding course concepts.**

**4.f MAKE-UP POLICY:** All make-up work must be signed up with the coordinator, Dr. Huang, in LIT 372, during office hours.

- **Exam Conflicts - UF during Term Assembly Exam Policy**

( [catalog.ufl.edu/ugrad/current/regulations/info/exams.aspx](http://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 2311 is the lower course number, students must inform Dr. Huang 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.

The conflict exam will be offered from 6:40 – 8:20 on the same night as the regular exam. You must sign up with Dr. Huang as indicated above. You will not be permitted to leave the exam room before 8:20PM.

- **Make-up Exams:** If you are participating in a UF sponsored event or religious observance, you may make up an exam only if you make arrangements with Dr. Huang 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 the course coordinator 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 Dr. Huang in Little 372. You will be allowed to sign up to take a makeup exam as scheduled during the semester.**

There will be two versions of the makeup exam: makeup A to cover tests 1 and 2, and makeup B to cover tests 3 and 4.

- **Make-up Quizzes:** Since there are two drops, **the first missed quiz for any reason cannot be made up. You should keep all the documentations for all your excused missed quizzes.** If you must miss more than one quiz for documentable reasons, bring the documentations and see Dr. Huang to discuss makeup work. **Your discussion leader cannot give makeups without the authorization of the course coordinator.**
- **Make-up Homework collection:** If you have an excused absence, are observing a religious holiday or are participating in a University of Florida sponsored event, you may turn in a written assignment within 48 hours of its due date if you bring your documentation to your discussion leader.
- **Make-up WebAssign HW:** There are no make-ups.
- **Make-up Clicker points:** There are no make-ups.

4.g **INCOMPLETE:** Students who are currently passing a course but are unable to complete the course because of illness or emergency may be granted an incomplete grade of I which will allow the student to complete the course within the first two weeks of the following semester. See the policy on <http://www.math.ufl.edu/fac/incompletes.html>. If you meet the criteria, you must see Dr. Huang before finals week to be considered for an I. An I only allows you to make up your incomplete work, not redo your work.

## PREREQUISITES FOR MAC2311

This course assumes that you have a sound precalculus background. 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 =  $\frac{1}{2}bh$

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

Parallelogram: area =  $bh$

Rectangular box: volume =  $lwh$

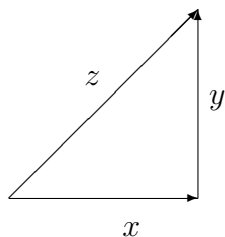
Sphere: volume =  $\frac{4}{3}\pi r^3$ ; surface area =  $4\pi r^2$

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

Right circular cone: volume =  $\frac{1}{3}\pi r^2 h$ ; 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:

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

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

3. Factoring:

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

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

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

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

6. Roots, including rationalizing the denominator or numerator.

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

7. Inequalities and absolute values:

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

8. Equation solving: Finding solutions for  $x$  if

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

9. Logarithms:  $\log_a x = y$  if and only if  $x = a^y$

$$\log(nm) = \log(n) + \log(m) \quad \log\left(\frac{n}{m}\right) = \log(n) - \log(m)$$

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

## TRIGONOMETRY

### 1. Identities:

$$\begin{array}{lll} \sin(-\theta) = -\sin \theta & \cos(-\theta) = \cos \theta & \tan(-\theta) = -\tan \theta \\ \sin\left(\frac{\pi}{2} - \theta\right) = \cos \theta & \cos\left(\frac{\pi}{2} - \theta\right) = \sin \theta & \tan\left(\frac{\pi}{2} - \theta\right) = \cot \theta \\ \sin^2 \theta + \cos^2 \theta = 1 & \sec^2 \theta = 1 + \tan^2 \theta & \csc^2 \theta = 1 + \cot^2 \theta \end{array}$$

### 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:

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

### 4. Trigonometric Values:

$\theta$	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