

# MAC 2311: CALCULUS 1 COURSE GUIDE SUMMER 2016

## Contact Information:

INSTRUCTOR: \_\_\_\_\_

OFFICE: \_\_\_\_\_

PHONE: \_\_\_\_\_

OFFICE HOURS: \_\_\_\_\_

EMAIL: \_\_\_\_\_

Course homepage is on e-Learning Canvas, [elearning.ufl.edu/](http://elearning.ufl.edu/).

# MAC2311 – Calculus 1

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## MAC 2311 Calendar, Summer 2016

Monday	Tuesday	Wednesday	Thursday	Friday
May 9 L1	10 L2	11	12 L3	13 L4
16 L5	17 L6	18 WA HW 1 due	19 L7 Quiz 1 (L1-L4)	20 L8
23 L9	24 L10	25 WA HW 2 due	26 L11 Quiz 2 (L5-L8)	27 L11
30 <b>HOLIDAY NO CLASS</b>	31 Review	Jun 1 WA HW 3 due <b>EXAM 1</b>	2 L12	3 L13
6 L14	7 L15	8 WA HW 4 due	9 L16 Quiz 3 (L12-L14)	10 L17
13 L18	14 L19	15 WA HW 5 due	16 L20 Quiz 4 (L15-L18)	17 L21
20 <b>NO CLASS</b>	21 <b>SUMMER NO CLASS</b>	22 <b>NO CLASS</b>	23 <b>BREAK NO CLASS</b>	24 <b>NO CLASS</b>
27 L21	28 L22	29 WA HW 6 due	30 Further Lecture Quiz 5 (L19-L21)	Jul 1 L23
4 <b>HOLIDAY NO CLASS</b>	5 Review	6 WA HW 7 due <b>EXAM 2</b>	7 L24	8 L25
11 L26	12 L27 Quiz 6 (L23-L25)	13 WA HW 8 due	14 L28	15 L29
18 L30	19 L31 Quiz 7 (L26-L29)	20 WA HW 9 due	21 L32	22 L33
25 Further Lecture	26 Review	27 WA HW 10 due <b>EXAM 3</b>	28 L34	29 L35
Aug 1 L35	2 Review Quiz 8 (L33-L35)	3 WA HW 11 due	4 Review <b>FINAL EXAM</b>	5

**EXAM 1 (L1-L11) June 1, Wednesday, 7:00-8:30 PM**

**EXAM 2 (L12-L22) July 6, Wednesday, 7:00-8:30 PM**

**EXAM 3 (L23-L33) July 27, Wednesday, 7:00-8:30 PM**

**FINAL EXAM (L1-L35) August 4, Thursday, 7-9 PM**

**TEST LOCATIONS WILL BE ANNOUNCED IN CLASS AND POSTED IN CANVAS!**

## 2. INTRODUCTION

**2a 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.

**2b 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 Student Self Services homepage [student.ufl.edu/](http://student.ufl.edu/); click on Placement under My Online Services. For more complete information, check the page [student.ufl.edu/aleksinfo.html](http://student.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, 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 the Student Self Services during the drop-add period.

**2c 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. The text as an ebook is included with the Webassign online access code (see below), so you do not need to purchase a hard copy. If you prefer, packages including a hard copy of the text and a Webassign access code are available at local bookstores. Hard copies of the book and solutions manual are also available for in-library use at the reserve desk of UF Marston Science Library.

WebAssign online homework will count toward your grade. Students will need to purchase an access code at <https://www.webassign.net/ufl/login.html>; it will start enrollment on Wednesday, May 11. 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 Canvas 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 to have your work completed on time.

**CALCULATORS:** A graphics calculator and Wolfram Alpha can be beneficial 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

**2d E-LEARNING CANVAS:** E-learning Canvas, a UF course management system, is located at [elearning.ufl.edu/](http://elearning.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 instructor if you believe there has been a recording error. There is no grade dispute at the end of the semester.**

**2e LECTURES:** Course lectures are given each Monday, Tuesday, Thursday, and Friday (exceptions are indicated on the course calendar). **Attendance in lecture is required.** You are responsible for learning lecture material missed due to an excused absence.

Students may print out the outline for the lecture notes which can be found on Canvas under **Course Resources**, or purchase a copy of the notes at Target Copy Center on West University Avenue or Archer Road.

**2f FREE HELP:** In addition to attending class regularly and visiting your instructor during scheduled 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.

In addition, the Broward teaching center provides videos of review and sample test problems. Check the webpage, [teachingcenter.ufl.edu](http://teachingcenter.ufl.edu), for a map of the location and tutoring hours. **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/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 your instructor

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 [www.math.ufl.edu](http://www.math.ufl.edu). Search “tutors”.

**2g 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 instructor. 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.

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 instructor 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.**

**2h 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 his or her instructor. 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.

**2i ACADEMIC HONESTY:** 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.

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/). 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**

**3a SEMESTER EXAMS:** Three semester exams will be administered from 7:00 – 8:30 PM 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).

**3b FINAL EXAM:** A mandatory, comprehensive final examination will be given at the time shown on the calendar. This two hour exam is scored on a scale of 0 to 80 and consists of multiple choice questions only (no tearoff sheet).

We allow the final exam score to improve your grade on one of the semester exams. That is, if your final exam grade is higher than the lowest of your three semester exam scores, its score will replace that lowest test.

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

**3c 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:**

- (1) 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 14, in this guide).
- (2) 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 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. **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 location at least 10 minutes early. No student will be admitted to the test later than 10 minutes after its starting time, and no one will be permitted to leave the exam room in those first 10 minutes.
- (4) The **Test Form Code**, as well as **your UFID**, name, and section number must be encoded correctly or you will lose 2 points. You must also take the test in your assigned test location or you will lose 2 points on your test.
- (5) An answer key will be posted on Canvas 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.
- (6) Graded tearoff sheets will be returned in class. You then have **one week** to see your instructor if you have questions about your exam grade.

See Section 4f for the Exam Conflict and Makeup Policies.



## 4. GRADING

4a **COURSE GRADE:** Your course grade is based on 450 points accumulated as follows:

6 highest quiz scores (up to 8 points each)	48
4 highest written homework scores (up to 3 points each)	12
Online homework assignments	46
Class participation points	24
3 semester exams	240
Final exam	<u>80</u>
	<b>450</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 POINT 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	405 - 450 points	C	300 - 329 points
A-	390 - 404 points	C-*	285 - 299 points
B+	375 - 389 points	D+	270 - 284 points
B	360 - 374 points	D	255 - 269 points
B-	345 - 359 points	D-	240 - 254 points
C+	330 - 344 points	E	0 - 239 points

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

For those taking the S-U option: S [300 - 500 points] U [0 - 299 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.**

4b **WRITTEN HOMEWORK:** The written assignments posted on Canvas present the minimum number of problems you should do in each section and will be collected by your instructor five times during the semester. The assignments will be graded on a scale of 0 – 3 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 12 points.

An important part of each assignment is reading and understanding the concepts of the lecture and text material, and previewing 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 instructor 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.

**4c 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 11 times during the semester and must be completed by the specified due date. Your score on each assignment will count up to a maximum 46 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.**

**4d QUIZZES:** Your instructor will administer eight quizzes on the dates listed in the course calendar. Each will be graded on a scale of 0 to 8 points, and the top six scores will count, to total up to 48 points. The quiz will be based on recent lectures and homework assignments.

**4e CLASS PARTICIPATION POINTS:** Up to 24 points may be earned by attendance in lecture and completing problems in class. Your instructor will provide more information on the first day of class. **YOU MAY NOT TURN IN WORK FOR A STUDENT WHO IS NOT IN CLASS (see section 2i).** There will be extra points available to account for an occasional absence and total points will be capped at 24.

Following university policy, you may expect a penalty (additional lost points) for attending fewer than 75% of your classes.

**NOTE: Homework, quizzes and class participation points account for 130 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.**

**4f MAKE-UP POLICY:** You must sign up for all makeup work with your instructor.

- **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 7:00 – 9:45PM (periods E1–E2) for the summer 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 their instructor 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.

- **Make-up Exams:** If you are participating in a UF sponsored event, you may make up an exam only if you bring documentation to your instructor at least ONE WEEK PRIOR to the event.

If you have to miss an exam due to religious observance, you must notify your instructor **within the first week of class** and sign up for a make-up exam.

If illness or other extenuating circumstances cause you to miss an exam, contact your instructor 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 your instructor. **To be eligible for this make-up you must have received at least half of the class participation points that have been given so far. You will be allowed to take a make-up exam on Friday, August, 5.**

- **Make-up Quizzes:** There are no make-ups, unless,
  - 1) you are participating in a UF sponsored event, for which you must bring your documentation at least **one week prior** to your instructor.
  - 2) you miss at least three discussion quizzes for which you have valid, documentable reasons for your absences. You will be allowed to make up the excused absences that are in excess of two. To be eligible for a make-up you must have received credit for at least half of the lecture participation points. Bring your documentation to your instructor **within one week of your third quiz absence.**
  - 3) you miss because of a religious holiday. You must notify your instructor **within the first week of class** if you will be missing a class due to a religious holiday.
  - 4) you miss because of a court-ordered obligation – see your instructor.
- **Make-up Class Participation Points:** If you have an excused absence, are observing a religious holiday or are participating in a University of Florida sponsored event, you may make up the work if you bring documentation to your instructor within 48 hours.
- **Make-up Written Homework Assignment:** There are no make-ups, unless, you are participating in a UF sponsored event or you are observing a religious holiday. In this case, you must turn in your written assignment to your instructor within one day of returning school along with valid documentation.
- **Make-up WebAssign HW:** There are no make-ups. You can request an extension on WebAssign homework within 1day after the deadline and you will have 24 hours to complete it after extension request. The extension must submit in WebAssign directly. However, there will be a 20% grade penalty for those problems completed after the original due date for the assignment.

**4g 10-MINUTE POLICY:** 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.

**4h INCOMPLETE:** 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 instructor 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/>.

## 5. GENERAL EDUCATION INFORMATION

MAC 2311 has been designated a General Education course that can be counted towards the Mathematical Science (M) requirement.

**Course Objective** – The General Education Objectives for Mathematics courses:

“Courses in mathematics provide instruction in computational strategies in fundamental mathematics including at least one of the following: solving equations and inequalities, logic, statistics, algebra, trigonometry, inductive and deductive reasoning. These courses include reasoning in abstract mathematical systems, formulating mathematical models and arguments, using mathematical models to solve problems and applying mathematical concepts effectively to real-world situations.”

The primary goal of the course is to help students understand and apply the fundamental principles of differential and integral calculus. These objectives are accomplished through the lectures, homework, quizzes and discussion sections.

**Student Learning Outcomes (SLOs)** – The general education student learning outcomes describe the knowledge, skills and attitudes that students are expected to acquire while completing a general education course at the University of Florida.

**I. Content:** Content is knowledge of the concepts, principles, terminology and methodologies used within the discipline. Students demonstrate competence in the terminology, concepts, theories and methodologies used within the discipline.

- Understand the fundamental concept of limit.
- Understand the definition of the derivative and be competent at calculating derivatives using the product, quotient, and chain rules.
- Understand the definition of the definite integral via Riemann sums and gain competence in evaluating them directly from the definition.

**II. Communication:** Communication is the development and expression of ideas in written and oral forms. Students communicate knowledge, ideas and reasoning clearly and effectively in written and oral forms appropriate to the discipline.

- Communicate mathematical findings clearly and effectively using written and/or graphic forms.

**III. Critical Thinking:** Critical thinking is characterized by the comprehensive analysis of issues, ideas, and evidence before accepting or formulating an opinion or conclusion. Students analyze information carefully and logically from multiple perspectives, using discipline-specific methods, and develop reasoned solutions to problems.

- Apply techniques of derivatives and critical thinking effectively to solve applied problems including related rates and optimization problems.
- Analyze properties of functions using derivatives including regions of increase/decrease, inflection points, local maxima/minima.
- Apply the Fundamental Theorem of Calculus to the evaluation of definite integrals and understand the link between differentiation and integration.

These SLOs are assessed through weekly discussions, homework assignments and quizzes, three semester exams and final exam.

## 6. 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>.

## 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 =  $lwh$

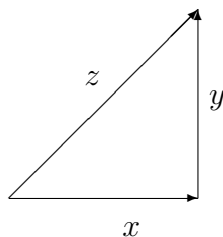
Sphere: volume =  $\frac{4}{3}\pi r^3$ ; surface area =  $4\pi r^2$

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:

$$\begin{array}{l} \sin(A \pm B) = \sin A \cos B \pm \cos A \sin B \\ \cos(A \pm B) = \cos A \cos B \mp \sin A \sin B \\ \tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B} \end{array}$$

### 3. Double Angle Formulas:

$$\begin{array}{l} \sin 2\theta = 2 \sin \theta \cos \theta \\ \cos 2\theta = \cos^2 \theta - \sin^2 \theta = 2 \cos^2 \theta - 1 = 1 - 2 \sin^2 \theta \end{array}$$

### 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