

# MATH M06: TRIGONOMETRY

**Originator**

pabramoff

**Co-Contributor(s)**
**Name(s)**

Butler, Renee (dbutler)

Terzian, Tammy (tterzian)

**College**

Moorpark College

**Discipline (CB01A)**

MATH - Mathematics

**Course Number (CB01B)**

M06

**Course Title (CB02)**

Trigonometry

**Banner/Short Title**

Trigonometry

**Credit Type**

Credit

**Start Term**

Fall 2023

**Catalog Course Description**

Studies the trigonometric functions, their inverses and their graphs. Covers identities and proofs related to trigonometric expressions and solving trigonometric equations, right triangles, and general triangles using the law of cosines and the law of sines. Provides an introduction to polar coordinates, vectors, and vector operations.

**Course Credit Limitations:**

- 1) MC, CSU - completing MATH M05 and MATH M06 is the same as completing MATH M07.
- 2) MC, CSU - students completing MATH M05, M06, and M07 receive a maximum credit of 7 units.
- 3) UC - students completing MATH M05, M06 and M07 receive a maximum credit of 5 semester units or 7.5 quarter units.

**Taxonomy of Programs (TOP) Code (CB03)**

1701.00 - Mathematics, General

**Course Credit Status (CB04)**

D (Credit - Degree Applicable)

**Course Transfer Status (CB05) (select one only)**

B (Transferable to CSU only)

**Course Basic Skills Status (CB08)**

N - The Course is Not a Basic Skills Course

**SAM Priority Code (CB09)**

E - Non-Occupational

**Course Cooperative Work Experience Education Status (CB10)**

N - Is Not Part of a Cooperative Work Experience Education Program

**Course Classification Status (CB11)**

Y - Credit Course

**Educational Assistance Class Instruction (Approved Special Class) (CB13)**

N - The Course is Not an Approved Special Class

**Course Prior to Transfer Level (CB21)**

Y - Not Applicable

**Course Noncredit Category (CB22)**

Y - Credit Course

**Funding Agency Category (CB23)**

Y - Not Applicable (Funding Not Used)

**Course Program Status (CB24)**

1 - Program Applicable

**General Education Status (CB25)**

B - Satisfies Math/Quantitative Reasoning req (CSUGE-B B4, IGETC 2, or 4-yr)

**Support Course Status (CB26)**

N - Course is not a support course

**Field trips**

Will not be required

**Grading method**

(L) Letter Graded

**Alternate grading methods**

(O) Student Option- Letter/Pass

(P) Pass/No Pass Grading

**Does this course require an instructional materials fee?**

No

**Repeatable for Credit**

No

**Is this course part of a family?**

No

**Units and Hours**

**Carnegie Unit Override**

No

**In-Class**

**Lecture**

**Minimum Contact/In-Class Lecture Hours**

52.5

**Maximum Contact/In-Class Lecture Hours**

52.5

**Activity****Laboratory****Total in-Class****Total in-Class****Total Minimum Contact/In-Class Hours**

52.5

**Total Maximum Contact/In-Class Hours**

52.5

**Outside-of-Class****Internship/Cooperative Work Experience****Paid****Unpaid****Total Outside-of-Class****Total Outside-of-Class****Minimum Outside-of-Class Hours**

105

**Maximum Outside-of-Class Hours**

105

**Total Student Learning****Total Student Learning****Total Minimum Student Learning Hours**

157.5

**Total Maximum Student Learning Hours**

157.5

**Minimum Units (CB07)**

3

**Maximum Units (CB06)**

3

**Prerequisites**

Intermediate Algebra or placement as determined by the college's multiple measures assessment process.

**Entrance Skills****Entrance Skills**

- graph and interpret linear and quadratic functions.
- analyze and solve various equations, inequalities, and systems of equations.

**Requisite Justification****Requisite Type**

Prerequisite

**Requisite**

Intermediate Algebra

**Requisite Description**

Course in a sequence

**Level of Scrutiny/Justification**

Required by 4 year institution

**Student Learning Outcomes (CSLOs)****Upon satisfactory completion of the course, students will be able to:**

- |   |   |
|---|---|
| 1 | apply trigonometric identities and concepts to solve equations and application problems, and to prove identities. |
| 2 | graph and interpret trigonometric functions and their transformations.  |

**Course Objectives****Upon satisfactory completion of the course, students will be able to:**

- |    |   |
|----|---|
| 1  | identify special triangles and their related angle and side measures.   |
| 2  | evaluate the trigonometric function of an angle in degree and radian measure.   |
| 3  | manipulate and simplify a trigonometric expression.   |
| 4  | solve trigonometric equations, triangles, and applications.   |
| 5  | graph the basic trigonometric functions and apply changes in period, phase and vertical shifts, and amplitude to generate new graphs. |
| 6  | evaluate and graph inverse trigonometric functions.   |
| 7  | prove trigonometric identities.   |
| 8  | convert between polar and rectangular coordinates and equations.  |
| 9  | calculate powers and roots of complex numbers using DeMoivre's Theorem.   |
| 10 | graph polar and parametric equations.   |
| 11 | represent a vector (a quantity with magnitude and direction) in the form $\langle a,b \rangle$ and $ai+bj$ .                          |

**Course Content****Lecture/Course Content****30% A. Trigonometric Functions**

1. Rectangular coordinates, angles and circular/radian measure
2. Definitions of the six trigonometric functions according to the right triangle, the unit circle, and the rectangular coordinate system
3. Applications of the right triangle
4. Simplification of trigonometric expressions
5. Graphs of trigonometric functions: period, amplitude, phase shift, vertical shift, asymptotes

**25% B. Trigonometric Identities and Equations**

1. Proofs of trigonometric identities
2. Sum, difference and cofunction identities
3. Double-angle and half-angle identities
4. Identities involving the sum of trigonometric functions
5. Inverse trigonometric functions, their identities, and their graphs
6. Trigonometric equations

**20% C. Applications of Trigonometry**

1. Applications of oblique triangles
2. Law of Sines
3. Law of Cosines

**10% D. Complex Numbers**

1. Complex numbers
2. Trigonometric form of complex numbers
3. DeMoivre's Theorem and applications

**10% E. Polar and Parametric Functions**

1. Introduction to polar coordinates
2. Polar equations and graphs
3. Parametric equations and graphs

**5% F. Vectors**

1. Introduction to vectors
2. Vector operations and applications

**Laboratory or Activity Content**

n/a

**Methods of Evaluation**

**Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):**

Written expression  
 Problem solving exercises  
 Skills demonstrations

**Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):**

Computational homework  
 Individual projects  
 Objective exams  
 Problem-solving exams  
 Problem-solving homework  
 Quizzes  
 Other (specify)  
 Classroom Discussion  
 Projects

**Other**

Quizzes and graded work will be used to evaluate students for the critical thinking skills needed to solve math problems. Problems must require students to demonstrate analytic skills and the step-by-step details required for the solution.

**Instructional Methodology**

**Specify the methods of instruction that may be employed in this course**

Class activities  
 Class discussions  
 Collaborative group work  
 Demonstrations  
 Distance Education  
 Group discussions  
 Instructor-guided interpretation and analysis  
 Instructor-guided use of technology  
 Lecture  
 Problem-solving examples  
 Other (specify)

**Specify other method of instruction**

All instructors will use best practices to provide an inclusive learning environment that respects all forms of racial, ethnic, age, and gender diversity, and provides for the individual needs of students of all learning styles.

**Describe specific examples of the methods the instructor will use:**

1. Use of whiteboard or document camera to demonstrate solutions to calculations, such as identifying exact values of the sine, cosine and tangent functions.
2. Classroom discussion, with student response, such as discussing the methods of solving right triangles and oblique triangles.
3. In-class group activities, such as guided practice on solving and graphing equations including trigonometric, polar and parametric equations.

**Representative Course Assignments****Writing Assignments**

1. Homework problems selected from the trigonometry textbook where answers require a written explanation, such as describing modifications to a graph involving translations, reflections, and changes to the period and amplitude.
2. Short answer problems on exams such as stating the results for an application problem, such as expressing lengths and widths as found by applying the law of sines or the law of cosines to measurements that occur in engineering, architecture or nature.

3. Graded assignments: in-class and/or homework assignments requiring complete solutions using both written English and symbolic mathematical language, such as writing angle measurements in both radian and degree mode.

### Critical Thinking Assignments

1. Describing and applying the algorithmic steps for obtaining the solution to a mathematical problem, such as graphing a trigonometric function using amplitude, period, and phase shift.
2. Comparing and contrasting methods to mathematical problems, such as finding the trigonometric functions for an angle using identities or using the unit circle method.

### Reading Assignments

1. Reading concepts from the textbook, such as the description of the trigonometric functions and their graphs.
2. Reading instructor created materials, such as a prepared handout listing various trigonometric identities and describing their uses.
3. Reading resource materials from the library or online concerning real-life applications of the law of sines and cosines.

### Skills Demonstrations

1. Demonstration of computational skills such as solving trigonometric equations.
2. Demonstration of understanding the construction of the unit circle and how it creates the various values of the six trigonometric functions.

### Problem-Solving and Other Assignments (if applicable)

1. Determine the proper angle of a triangle using the inverse trigonometric operations.
2. Apply analytic techniques to solve mathematical and application problems. For example, solve an oblique triangle problem to answer an application problem in engineering force analysis.

## Outside Assignments

### Representative Outside Assignments

1. Group or individual projects, such as students taking actual measurements of distances, so as to use the trigonometric functions to compute heights of trees, lamp posts, buildings and walls, or the lengths of strings and wires.
2. Assigned reading material and homework problems from the trigonometry textbook, such as viewing diagrams of the unit circle and illustrations of the definitions of the trigonometric functions for general angles.
3. Graded problem solving assignments, such as computations involving complex numbers and the use of De Moivre's Theorem.
4. Additional problem sets provided by the instructor, such as practice on verifying identities.

## Articulation

### C-ID Descriptor Number

MATH 851

### Status

Approved

### Equivalent Courses at 4 year institutions

University	Course ID	Course Title	Units
CSU Stanislaus	MATH 1080	Trigonometry	3
CSU Fresno	MATH 5	Trigonometry	3
CSU Chico	MATH 118	Trigonometry	3
Cal Poly Pomona	MAT 1060	Trigonometry	3

### Comparable Courses within the VCCCD

MATH R116 - College Trigonometry  
MATH V05 - Plane Trigonometry

**Equivalent Courses at other CCCs**

<b>College</b>	<b>Course ID</b>	<b>Course Title</b>	<b>Units</b>
Glendale Community College	MATH 102	Trigonometry	3
LA Pierce College	MATH 240	Trigonometry	3
Rio Hondo College	MATH 175	Plane Trigonometry	3

**District General Education****A. Natural Sciences****B. Social and Behavioral Sciences****C. Humanities****D. Language and Rationality****D2. Communication/Analytical Thinking**

Approved

**E. Health and Physical Education/Kinesiology****F. Ethnic Studies/Gender Studies****Course is CSU transferable**

Yes

**CSU Baccalaureate List effective term:**

F1995

**CSU GE-Breadth****Area A: English Language Communication and Critical Thinking****Area B: Scientific Inquiry and Quantitative Reasoning****B4 Mathematical/Quantitative Reasoning**

Approved

**Area C: Arts and Humanities**

**Area D: Social Sciences**

**Area E: Lifelong Learning and Self-Development**

**Area F: Ethnic Studies**

**CSU Graduation Requirement in U.S. History, Constitution and American Ideals:**

**IGETC**

**Area 1: English Communication**

**Area 2A: Mathematical Concepts & Quantitative Reasoning**

**Area 3: Arts and Humanities**

**Area 4: Social and Behavioral Sciences**

**Area 5: Physical and Biological Sciences**

**Area 6: Languages Other than English (LOTE)**

**Textbooks and Lab Manuals**

**Resource Type**

Textbook

**Classic Textbook**

No

**Description**

Lial, Margaret L., et al. *Trigonometry*. 12th ed., Pearson, 2021.

---

**Resource Type**

Textbook

**Classic Textbook**

No

**Description**

Sullivan, Michael. *Trigonometry: A Unit Circle Approach*. 11th ed., Pearson, 2020.

---

**Resource Type**

Textbook

**Classic Textbook**

No

**Description**

Larson, Ron. *Trigonometry*. 11th ed., Cengage, 2022.

---

**Resource Type**

Textbook

**Description**

Abramson, Jay, et al. *Algebra and Trigonometry*. E-book, OpenStax (Rice University), 2021, <https://openstax.org/details/books/algebra-and-trigonometry>. Accessed 30 Sept 2022.



## Library Resources

### Assignments requiring library resources

Use of Library resources, print and online, to supplement application problems, such as identifying uses of trigonometry in physics, architecture, engineering or astronomy. Use of textbooks on reserve.

### Sufficient Library Resources exist

Yes

### Example of Assignments Requiring Library Resources

Use library resources to identify various examples of trigonometric shapes and wave curves that appear in nature, engineering, and architecture.

## Distance Education Addendum

### Definitions

#### Distance Education Modalities

Hybrid (1%–50% online)  
Hybrid (51%–99% online)  
100% online

### Faculty Certifications

Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.

Yes

Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.

Yes

### Regular Effective/Substantive Contact

#### Hybrid (1%–50% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Asynchronous Dialog (e.g., discussion board)	Use of student discussion boards to discuss concepts from the material, solutions to homework problems, general discussion of techniques in solving problems, study skills, or arranging study groups.
E-mail	Responding to student queries about material, grade information, course policies and procedures, scheduling and due dates, submitting homework assignments, or making general announcements to the class.
Face to Face (by student request; cannot be required)	Students requesting to speak to instructor in person for personal help on material, grade information, or discussion of policies and procedures.
Other DE (e.g., recorded lectures)	Posting of recorded lectures either by the instructor, recorded lessons available through campus resources, or use of public online resources available on the internet.
Synchronous Dialog (e.g., online chat)	Active live discussion with the instructor on material concepts, techniques for problem solving, feedback on solutions to problems, general chat on study skills, or answers to homework problems, quizzes or tests.

**Hybrid (51%–99% online) Modality:**

<b>Method of Instruction</b>	<b>Document typical activities or assignments for each method of instruction</b>
Asynchronous Dialog (e.g., discussion board)	Use of student discussion boards to discuss concepts from the material, solutions to homework problems, general discussion of techniques in solving problems, study skills, or arranging study groups.
E-mail	Responding to student queries about material, grade information, course policies and procedures, scheduling and due dates, submitting homework assignments, or making general announcements to the class.
Face to Face (by student request; cannot be required)	Students requesting to speak to instructor in person for personal help on material, grade information, or discussion of policies and procedures.
Other DE (e.g., recorded lectures)	Posting of recorded lectures either by the instructor, recorded lessons available through campus resources, or use of public online resources available on the internet.
Synchronous Dialog (e.g., online chat)	Active live discussion with the instructor on material concepts, techniques for problem solving, feedback on solutions to problems, general chat on study skills, or answers to homework problems, quizzes or tests.

**100% online Modality:**

<b>Method of Instruction</b>	<b>Document typical activities or assignments for each method of instruction</b>
Asynchronous Dialog (e.g., discussion board)	Use of student discussion boards to discuss concepts from the material, solutions to homework problems, general discussion of techniques in solving problems, study skills, or arranging study groups.
E-mail	Responding to student queries about material, grade information, course policies and procedures, scheduling and due dates, submitting homework assignments, or making general announcements to the class.
Other DE (e.g., recorded lectures)	Posting of recorded lectures either by the instructor, recorded lessons available through campus resources, or use of public online resources available on the internet.
Synchronous Dialog (e.g., online chat)	Active live discussion with the instructor on material concepts, techniques for problem solving, feedback on solutions to problems, general chat on study skills, or answers to homework problems, quizzes or tests.

**Examinations****Hybrid (1%–50% online) Modality**

On campus

**Hybrid (51%–99% online) Modality**

On campus

**Primary Minimum Qualification**

MATHEMATICS

**Review and Approval Dates****Department Chair**

10/14/2022

**Dean**

10/17/2022

**Technical Review**

10/20/2022

**Curriculum Committee**

MM/DD/YYYY

**DTRW-I**

MM/DD/YYYY

**Curriculum Committee**

11/03/2022

**Board**

MM/DD/YYYY

**CCCCO**

MM/DD/YYYY

**Control Number**

CCC000433537

**DOE/accreditation approval date**

MM/DD/YYYY