



Western Technical College

## 10804116 College Technical Math (CTM) 2

### Course Outcome Summary

#### Course Information

<b>Description</b>	Topics include: vectors; trigonometric functions and their graphs; identities; exponential and logarithmic functions and equations; radical equations; equations with rational exponents; dimension of a circle; velocity; sine and cosine graphs; complex numbers in polar and rectangular form; trigonometric equations; conic sections; and analysis of statistical data. Emphasis will be on the application of skills to technical problems.
<b>Instructional Level</b>	Associate Degree Courses
<b>Total Credits</b>	4
<b>Total Hours</b>	72

#### Textbooks

*Basic Technical Mathematics (Looseleaf)*. 11th Edition. Copyright 2018. Washington, Allyn J. Publisher: Pearson. **ISBN-13:** 978-0-13-443579-4. Required.

#### Learner Supplies

Scientific calculator - \$10-20. **Vendor:** Campus Shop. Required.

#### Success Abilities

1. Cultivate Passion: Expand a Growth-Mindset
2. Live Responsibly: Develop Resilience
3. Live Responsibly: Foster Accountability
4. Refine Professionalism: Improve Critical Thinking

#### Course Competencies

1. **Graph exponential and logarithmic functions.**

##### Assessment Strategies

- 1.1. in an oral, written, or graphic product

## Criteria

*You will know you are successful when*

- 1.1. you graph exponential functions.
- 1.2. you graph logarithmic functions.
- 1.3. you relate logarithmic functions to its inverse function.
- 1.4. you graph functions on logarithmic or semi-logarithmic scales.
- 1.5. you apply skill to technical problems.
- 1.6. you use appropriate technology.
- 1.7. you apply the process for solving technical problems according to the problem-solving criteria (i.e. you show work in a clear and logical manner, you verify the solution, solution is within stated range and reflects appropriate accuracy or precision, solution is labeled with appropriate units).

## Learning Objectives

- 1.a. Graph exponential and logarithmic functions.
- 1.b. Relate logarithmic function to its inverse function.
- 1.c. Graph functions on logarithmic or semi-logarithmic scales.
- 1.d. Solve technical problems.

## 2. Solve exponential and logarithmic equations.

### Assessment Strategies

- 2.1. in an oral, written, or graphic product

### Criteria

*You will know you are successful when*

- 2.1. you solve exponential equations.
- 2.2. you solve logarithmic equations.
- 2.3. you solve applied problems involving exponential or logarithmic equations, such as growth and decay.
- 2.4. you use appropriate technology
- 2.5. you apply the process for solving technical problems according to the problem-solving criteria (i.e. you show work in a clear and logical manner, you verify the solution, solution is within stated range and reflects appropriate accuracy or precision, solution is labeled with appropriate units).

## Learning Objectives

- 2.a. Solve exponential and logarithmic equations.
- 2.b. Solve applied problems involving exponential or logarithmic equations, such as growth and decay.

## 3. Perform operations with exponents and radicals.

### Assessment Strategies

- 3.1. in an oral, written, or graphic product

### Criteria

*You will know you are successful when*

- 3.1. you evaluate an expression containing rational powers on numbers with rational roots.
- 3.2. you convert between rational powers and radical notation.
- 3.3. you simplify radical expressions.

## Learning Objectives

- 3.a. Evaluate an expression containing rational powers on numbers with rational roots.
- 3.b. Convert between rational powers and radical notation.
- 3.c. Simplify radical expressions.

## 4. Solve equations with radicals and rational exponents.

### Assessment Strategies

- 4.1. in an oral, written, or graphic product

### Criteria

*You will know you are successful when*

- 4.1. you convert between radical and fractional exponent form.

- 4.2. you solve radical equations involving one variable.
- 4.3. you solve equations with fractional exponents.
- 4.4. you verify solutions by substitution into the original equation.
- 4.5. you apply skill to technical problems.
- 4.6. you use appropriate technology.
- 4.7. you apply the process for solving technical problems according to the problem-solving criteria (i.e. you show work in a clear and logical manner, you verify the solution, solution is within stated range and reflects appropriate accuracy or precision, solution is labeled with appropriate units).

#### **Learning Objectives**

- 4.a. Convert from radical to fractional exponent form.
- 4.b. Convert from fractional exponent form to radical.
- 4.c. Solve radical equations with one variable.
- 4.d. Solve equations with fractional exponents.
- 4.e. Check solutions by substitution into the original equation.
- 4.f. Solve related technical problems.

### **5. Use formulas involving radicals and exponents.**

#### **Assessment Strategies**

- 5.1. in an oral, written, or graphic product

#### **Criteria**

*You will know you are successful when*

- 5.1. you choose appropriate formula.
- 5.2. you identify unknown value(s).
- 5.3. you relate the given values to the variables in the formula formed after given values are substituted into a formula that includes radical expressions.
- 5.4. you transform a formula by isolating a variable which is contained in a radical expression.
- 5.5. you solve equations formed after given values are substituted into a formula that includes radical expressions.
- 5.6. you apply skill to technical problems.
- 5.7. you use appropriate technology.
- 5.8. you apply the process for solving technical problems according to the problem-solving criteria (i.e. you show work in a clear and logical manner, you verify the solution, solution is within stated range and reflects appropriate accuracy or precision, solution is labeled with appropriate units).

#### **Learning Objectives**

- 5.a. Identify appropriate formulas for the problem.
- 5.b. Identify unknown value(s).
- 5.c. Assign values to variables and substitute into formula.
- 5.d. Isolate a variable to solve.
- 5.e. Solve equations formed after given values are substituted into a formula that includes.
- 5.f. Solve radical expressions.
- 5.g. solve related technical problems

### **6. Calculate unknown dimensions as related to a circle.**

#### **Assessment Strategies**

- 6.1. in an oral, written, or graphic product

#### **Criteria**

*You will know you are successful when*

- 6.1. you calculate the length of a circular arc, given the radius and central angle.
- 6.2. you calculate the central angle and the chord depth, given the radius and chord length of a circle.
- 6.3. you calculate the area of a sector of a circle, given the radius and central angle.
- 6.4. you calculate the area of a segment of a circle, given the radius, central angle, and area of sector to which the segment belongs.
- 6.5. you calculate the length of a chord, given the radius and the angle between the chord and a tangent at one end of the chord.
- 6.6. you calculate the angle between two tangents, given the radius of a circle and the length of the segments attached to the circle.

- 6.7. you apply skill to technical problems.
- 6.8. you use appropriate technology.
- 6.9. you apply the process for solving technical problems according to the problem-solving criteria (i.e. you show work in a clear and logical manner, you verify the solution, solution is within stated range and reflects appropriate accuracy or precision, solution is labeled with appropriate units).

#### Learning Objectives

- 6.a. Identify and define circular arc, radius, central angle, chord depth, chord length, sector of circle, and tangent.
- 6.b. Calculate the length of a circular arc, given the radius and central angle.
- 6.c. Calculate the central angle and the chord depth, given the radius and chord length of a circle.
- 6.d. Calculate the area of a sector of a circle, given the radius and central angle.
- 6.e. Calculate the area of a segment of a circle, given the radius, central angle, and area of the sector to which the segment belongs.
- 6.f. Calculate the length of a chord, given the radius and the angle between the chord and a tangent at one end of the chord.
- 6.g. Calculate the angle between two tangents, given the radius of a circle and the length of the segments attached to the circle.
- 6.h. Solve related technical problems.

### 7. Solve rotational, linear, and angular velocity problems.

#### Assessment Strategies

- 7.1. in an oral, written, or graphic product

#### Criteria

*You will know you are successful when*

- 7.1. you calculate the linear velocity of a point on the circumference of a wheel, given either the diameter or radius and the angular velocity.
- 7.2. you calculate the angular velocity of a point on the circumference of a wheel when given either the diameter or radius and the linear velocity.
- 7.3. you convert between radians over time and revolutions over time.
- 7.4. you apply skill to technical problems.
- 7.5. you use appropriate technology.
- 7.6. you apply the process for solving technical problems according to the problem-solving criteria (i.e. you show work in a clear and logical manner, you verify the solution, solution is within stated range and reflects appropriate accuracy or precision, solution is labeled with appropriate units).

#### Learning Objectives

- 7.a. Calculate the linear velocity.
- 7.b. Calculate the angular velocity.
- 7.c. Convert between radians over time and revolutions over time.
- 7.d. Solve related technical problems.

### 8. Solve vector operation problems.

#### Assessment Strategies

- 8.1. in an oral, written, or graphic product

#### Criteria

*You will know you are successful when*

- 8.1. you determine the resultant of two or more vectors.
- 8.2. you resolve vectors by components.
- 8.3. you apply skill to technical problems.
- 8.4. you use appropriate technology.
- 8.5. you apply the process for solving technical problems according to the problem-solving criteria (i.e. you show work in a clear and logical manner, you verify the solution, solution is within stated range and reflects appropriate accuracy or precision, solution is labeled with appropriate units).

#### Learning Objectives

- 8.a. Determine the resultant of two or more vectors.
- 8.b. Resolve vectors by components.

8.c. Solve related technical problems.

## 9. Solve application problems using complex numbers in both polar, rectangular, and exponential forms

### Assessment Strategies

9.1. in an oral, written, or graphic product

### Criteria

*You will know you are successful when*

- 9.1. you add, subtract, multiply, and divide in rectangular form.
- 9.2. you multiply and divide in polar form.
- 9.3. you apply skill to technical problems.
- 9.4. you use appropriate technology.
- 9.5. you apply the process for solving technical problems according to the problem-solving criteria (i.e. you show work in a clear and logical manner, you verify the solution, solution is within stated range and reflects appropriate accuracy or precision, solution is labeled with appropriate units).

### Learning Objectives

- 9.a. Add, subtract, multiply, and divide in rectangular form.
- 9.b. Multiply and divide in polar form.
- 9.c. Solve related technical problems.

## 10. Relate complex (rectangular) notation to polar notation.

### Assessment Strategies

10.1. in an oral, written, or graphic product

### Criteria

*You will know you are successful when*

- 10.1. you convert between polar and rectangular form.
- 10.2. you use the quadratic equation to find non-real solutions.
- 10.3. you apply skill to technical problems.
- 10.4. you use appropriate technology.
- 10.5. you apply the process for solving technical problems according to the problem-solving criteria (i.e. you show work in a clear and logical manner, you verify the solution, solution is within stated range and reflects appropriate accuracy or precision, solution is labeled with appropriate units).

### Learning Objectives

- 10.a. Convert between polar and rectangular form.
- 10.b. Use the quadratic equation to find non-real solutions.
- 10.c. Solve related technical problems.

## 11. Interpret sine/cosine graphs.

### Assessment Strategies

11.1. in an oral, written, or graphic product

### Criteria

*You will know you are successful when*

- 11.1. you identify the amplitude from a sine or cosine wave graph.
- 11.2. you identify the phase shift.
- 11.3. you write the equation of a sine/cosine graph.
- 11.4. you label amplitude, period, phase shift, and frequency for graph.
- 11.5. you apply skill to technical problems.
- 11.6. you use appropriate technology.
- 11.7. you apply the process for solving technical problems according to the problem-solving criteria (i.e. you show work in a clear and logical manner, you verify the solution, solution is within stated range and reflects appropriate accuracy or precision, solution is labeled with appropriate units).

### Learning Objectives

- 11.a. Identify the amplitude from a sine or cosine wave graph.

- 11.b. Identify the phase shift.
- 11.c. Write the equation of a sine/cosine graph.
- 11.d. Label amplitude, period, phase shift, and frequency for graph.
- 11.e. Solve related technical problems.

## 12. Graph sine/cosine waves.

### Assessment Strategies

- 12.1. in an oral, written, or graphic product

### Criteria

*You will know you are successful when*

- 12.1. you plot a graph of sine/cosine wave from an equation.
- 12.2. you plot a graph of sine/cosine wave given the amplitude, frequency, and phase shift.
- 12.3. you apply skill to technical problems.
- 12.4. you use appropriate technology.
- 12.5. you apply the process for solving technical problems according to the problem-solving criteria (i.e. you show work in a clear and logical manner, you verify the solution, solution is within stated range and reflects appropriate accuracy or precision, solution is labeled with appropriate units).

### Learning Objectives

- 12.a. Graph sine/cosine wave from an equation.
- 12.b. Graph sine/cosine wave given the amplitude, frequency, and phase shift.
- 12.c. Solve related technical problems.

## 13. Solve trigonometric equations.

### Assessment Strategies

- 13.1. in an oral, written, or graphic product

### Criteria

*You will know you are successful when*

- 13.1. you manipulate identities.
- 13.2. you factor trigonometric expressions.
- 13.3. you write a trigonometric expression in terms of sine and cosine.
- 13.4. you solve trigonometric equations with multiple solutions.
- 13.5. you apply skill to technical problems.
- 13.6. you utilize appropriate technology.
- 13.7. you apply the process for solving technical problems according to the problem-solving criteria (i.e. you show work in a clear and logical manner, you verify the solution, solution is within stated range and reflects appropriate accuracy or precision, solution is labeled with appropriate units).

### Learning Objectives

- 13.a. Apply trig identities.
- 13.b. Factor trigonometric expressions.
- 13.c. Write a trigonometric expression in terms of sine and cosine.
- 13.d. Solve trigonometric equations with multiple solutions.
- 13.e. Solve related technical problems.

## 14. Analyze the equations of conic sections and their graphs.

### Assessment Strategies

- 14.1. in an oral, written, or graphic product

### Criteria

*You will know you are successful when*

- 14.1. you determine, by inspection, whether a given second-degree equation represents a circle, ellipse, parabola, or hyperbola.
- 14.2. you write the equation of a circle, ellipse, parabola, or hyperbola from given information.
- 14.3. you construct a graph of any of the conic sections from equation(s).
- 14.4. you apply skill to technical problems.
- 14.5. you use appropriate technology.

- 14.6. you apply the process for solving technical problems according to the problem-solving criteria (i.e. you show work in a clear and logical manner, you verify the solution, solution is within stated range and reflects appropriate accuracy or precision, solution is labeled with appropriate units).

#### **Learning Objectives**

- 14.a. Identify whether a given second-degree equation represents a circle, ellipse, parabola, or hyperbola.  
14.b. Write the equation of a circle, ellipse, parabola, or hyperbola from given information.  
14.c. Construct a graph of any of the conic sections from equation(s).  
14.d. Solve related technical problems.

### **15. Analyze data statistically.**

#### **Assessment Strategies**

- 15.1. in an oral, written, or graphic product

#### **Criteria**

*You will know you are successful when*

- 15.1. you calculate measures of central tendency.  
15.2. you calculate measures of dispersion.  
15.3. you construct a graph that describes data.  
15.4. you interpret data in terms of statistics.  
15.5. you apply skill to technical problems.  
15.6. you use appropriate technology.  
15.7. you apply the process for solving technical problems according to the problem-solving criteria (i.e. you show work in a clear and logical manner, you verify the solution, solution is within stated range and reflects appropriate accuracy or precision, solution is labeled with appropriate units).

#### **Learning Objectives**

- 15.a. Calculate measures of central tendency.  
15.b. Calculate measures of dispersion.  
15.c. Construct a graph that describes data.  
15.d. Interpret data in terms of statistics.  
15.e. Solve related technical problems.