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## Wisconsin Indianhead Technical College

# 10804116 College Technical Mathematics 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
<b>Total Credits</b>	4.00
<b>Total Hours</b>	64.00

### Types of Instruction

Instruction Type	Credits/Hours
Classroom Presentation (Lecture/Demonstration/Discussion)	4/64

### Course History

<b>Revised By</b>	Andrea Schullo (andrea.schullo)
<b>Last Approval Date</b>	1/14/2014

### Purpose/Goals

This course outcome summary includes the competencies and criteria for College Technical Mathematics 2 (10-804-116). This course is part of the General Studies Core offered throughout the Wisconsin Technical College System (WTCS). The course competencies are consistent among the colleges and are at baccalaureate level to accommodate student success in transfer to four-year colleges.

### Pre/Corequisites

- Prerequisite 10804113 College Technical Mathematics 1A AND
- Prerequisite 10804114 College Technical Mathematics 1B OR
- Prerequisite 10804115 College Technical Mathematics 1

### Course Competencies

**1. Graph exponential and logarithmic functions**  
*Domain Cognitive Level Applying Status Active*

**Assessment Strategies**

1.1. oral, written, or graphic product

**Criteria**

*Criteria: Performance will be satisfactory 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 utilize 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 functions to its inverse function
- 1.c. Graph functions on logarithmic and semi-logarithmic scales
- 1.d. Utilize appropriate technology
- 1.e. Apply mathematics skills to related technical problems

**2. Solve exponential and logarithmic equations**  
*Domain Cognitive Level Applying Status Active*

**Assessment Strategies**

2.1. oral, written, or graphic product

**Criteria**

*Criteria: Performance will be satisfactory 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 utilize 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 such as growth and decay
- 2.c. Utilize appropriate technology
- 2.d. Apply mathematics skills to related technical problems

**3. Perform operations with exponents and radicals**  
*Domain Cognitive Level Applying Status Active*

**Assessment Strategies**

3.1. oral, written, or graphic product

**Criteria**

*Criteria: Performance will be satisfactory 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 expressions containing rational powers on numbers with rational roots
- 3.b. Convert between rational powers and radical notation
- 3.c. Simplify radical expressions
- 3.d. Utilize appropriate technology

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

*Domain Cognitive Level Applying Status Active*

##### Assessment Strategies

- 4.1. oral, written, or graphic product

##### Criteria

*Criteria: Performance will be satisfactory 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 utilize 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 between radical and fractional exponent forms
- 4.b. Solve radical equations
- 4.c. Solve equations with fractional exponents
- 4.d. Verify solutions by substitution
- 4.e. Utilize appropriate technology
- 4.f. Apply mathematics skills to related technical problems

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

*Domain Cognitive Level Applying Status Active*

##### Assessment Strategies

- 5.1. oral, written, or graphic product

##### Criteria

*Criteria: Performance will be satisfactory when:*

- 5.1. you choose formula when appropriate
- 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 utilize 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. Choose formula when appropriate
- 5.b. Transform a formula by isolating a variable
- 5.c. Solve equations formed after given values are substituted into a formula
- 5.d. Utilize appropriate technology
- 5.e. Apply mathematics skills to related technical problems

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

**Domain**   **Cognitive**   **Level**   **Applying**   **Status**   **Active**

### Assessment Strategies

6.1. oral, written, or graphic product

### Criteria

*Criteria: Performance will be satisfactory 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 utilize 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. Calculate the length of a circular arc, given the radius and central angle
- 6.b. Calculate the area of a sector of a circle, 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 segment of a circle, given the radius, central angle, and area of sector to which the segment belongs
- 6.e. 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.f. Calculate the angle between two tangents, given the radius of a circle and the length of the segments attached to the circle
- 6.g. Utilize appropriate technology
- 6.h. Apply mathematics skills to related technical problems

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

**Domain**   **Cognitive**   **Level**   **Applying**   **Status**   **Active**

### Assessment Strategies

7.1. oral, written, or graphic product

### Criteria

*Criteria: Performance will be satisfactory 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 utilize 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 of a point on the circumference of a wheel, given either the diameter or radius and the angular velocity
- 7.b. 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.c. Convert between radians over time and revolutions over time

- 7.d. Utilize appropriate technology
- 7.e. Apply mathematics skills to related technical problems

## 8. Perform operations with vectors

*Domain Cognitive Level Applying Status Active*

### Assessment Strategies

- 8.1. oral, written, or graphic product

### Criteria

*Criteria: Performance will be satisfactory 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 utilize 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. Utilize appropriate technology
- 8.d. Apply mathematics skills to related technical problems

## 9. Perform arithmetic operations using complex numbers in both polar and rectangular forms

*Domain Cognitive Level Applying Status Active*

### Assessment Strategies

- 9.1. oral, written, or graphic product

### Criteria

*Criteria: Performance will be satisfactory 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 utilize 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. Perform operations on vectors in rectangular form
- 9.b. Perform operations on vectors in polar form
- 9.c. Utilize appropriate technology
- 9.d. Apply mathematics skills to related technical problems

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

*Domain Cognitive Level Applying Status Active*

### Assessment Strategies

- 10.1. oral, written, or graphic product

### Criteria

*Criteria: Performance will be satisfactory 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 utilize 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 formula to find complex solutions
- 10.c. Utilize appropriate technology
- 10.d. Apply mathematics skills to related technical problems

### 11. Interpret sine/cosine graphs

*Domain Cognitive Level Analyzing Status Active*

#### Assessment Strategies

- 11.1. oral, written, or graphic product

#### Criteria

*Criteria: Performance will be satisfactory 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 utilize 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 amplitude, phase shift, period, and frequency from the graph of a trig function
- 11.b. Write the equation of a trig function from its graph
- 11.c. Utilize appropriate technology
- 11.d. Apply mathematics skills to related technical problems

### 12. Graph sine/cosine waves

*Domain Cognitive Level Applying Status Active*

#### Assessment Strategies

- 12.1. oral, written, or graphic product

#### Criteria

*Performance will be satisfactory 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 utilize 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. Plot a graph of sine/cosine wave from an equation
- 12.b. Plot a graph of sine/cosine wave given the amplitude, frequency, and phase shift
- 12.c. Utilize appropriate technology
- 12.d. Apply mathematics skills to related technical problems

### 13. Solve trigonometric equations

*Domain Cognitive Level Applying Status Active*

#### Assessment Strategies

- 13.1. oral, written, or graphic product

## Criteria

*Performance will be satisfactory 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. Manipulate identities to show equivalence
- 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. Utilize appropriate technology
- 13.f. Apply mathematics skills to related technical problems

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

*Domain Cognitive Level Analyzing Status Active*

### Assessment Strategies

- 14.1. oral, written, or graphic product

## Criteria

*Performance will be satisfactory 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 utilize 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. Determine, by inspection, 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. Utilize appropriate technology
- 14.e. Apply mathematics skills to related technical problems

## 15. Analyze data statistically

*Domain Cognitive Level Analyzing Status Active*

### Assessment Strategies

- 15.1. oral, written, or graphic product

## Criteria

*Performance will be satisfactory 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 utilize 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. Apply mathematics skills to related technical problems