



Western Technical College

31804337 Applied Math - HVAC/Refrigeration

Course Outcome Summary

Course Information

Description	The student will develop mathematical problem solving skills necessary to be successful in industry. The student will apply geometric, numeric, and measurement concepts to problems related to the fields of heating, air-conditioning, ventilation and refrigeration. Knowledge of fractions, percents, and geometry will be used to gain a deeper understanding of heat load, the gas laws, ductwork stretch-outs, electric power consumption, and basic trigonometry.
Instructional Level	Technical Diploma Courses
Total Credits	2
Total Hours	72

Textbooks

Practical Problems In Math for Heating and Cooling Tech. 6th Edition. Copyright 2013. DeVore, Russell. Publisher: Cengage Learning. **ISBN-13:** 978-1-111-54135-4. 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. Calculate with real numbers

Assessment Strategies

- 1.1. Skill Demonstration
- 1.2. Written Objective Test

Criteria

Performance will be satisfactory when:

- 1.1. learner can perform all critical steps for each algorithm in the right order
- 1.2. learner can recognize which fractional operations require common denominators
- 1.3. learner can recognize which fractional operations require mixed numbers to be written as improper
- 1.4. learner can recognize how to handle the decimal point for all decimal operations
- 1.5. learner uses correct spelling, comma, and hyphen placement to express decimal numbers using words
- 1.6. learner can perform calculations with at least 70% accuracy

Learning Objectives

- 1.a. Convert between improper fractions and mixed numbers
- 1.b. Reduce fractions to lowest terms
- 1.c. Apply operations of addition, subtraction, multiplication and division to fractions
- 1.d. Convert numbers between fraction and decimal form
- 1.e. Convert decimals between written (word) and numeric form
- 1.f. Round decimal values to a specified precision
- 1.g. Apply operations of addition, subtraction, multiplication and division to decimal numbers
- 1.h. Compute arithmetic expressions using proper rules of order
- 1.i. Solve applied problems related to the transportation trades involving fractions and decimals

2. Apply ratio and proportion concepts to solve problems

Assessment Strategies

- 2.1. Skill Demonstration
- 2.2. Written Objective Test

Criteria

Performance will be satisfactory when:

- 2.1. learner uses decimal approximation and correct units to write a ratio as a unit rate
- 2.2. learner can perform any numeric or unit cancelling necessary to write a ratio in lowest terms
- 2.3. learner can solve proportions containing decimals using cross-multiplication and conventional rounding techniques
- 2.4. learner can solve proportions containing fractions by using proper fractional multiplication and division techniques
- 2.5. learner can perform all calculations with at least 70% accuracy

Learning Objectives

- 2.a. Write the ratio between given quantities as a unit rate and in lowest terms
- 2.b. Solve for the unknown quantity in a given proportion containing decimals
- 2.c. Solve for the unknown quantity in a given proportion containing fractions
- 2.d. Find the missing information in Gas Law formulas

3. Apply percent concepts to solve problems

Assessment Strategies

- 3.1. Skill Demonstration
- 3.2. Written Objective Test

Criteria

Performance will be satisfactory when:

- 3.1. learner can convert between decimal numbers and percents by moving the decimal point appropriately
- 3.2. learner can convert between fractions and percents by dividing or treating percents as fractions appropriately
- 3.3. learner can identify base, rate, and amount in a percent problem, and use the $a = br$ relationship or percent proportions to solve for an unknown in such problems
- 3.4. learner can calculate the value of a percent discount, percent markup, sales tax, or any combination of these, and round the answer appropriately
- 3.5. learner can perform all calculations with at least 70% accuracy

Learning Objectives

- 3.a. Convert between decimal, fraction, and percent form of a number

- 3.b. Identify the base, rate and amount within a percent application
- 3.c. Use proportions or decimal equivalents to solve problems involving percent markup, percent discount, and sales tax

4. Change units on measurements

Assessment Strategies

- 4.1. Skill Demonstration
- 4.2. Written Objective Test

Criteria

Performance will be satisfactory when:

- 4.1. learner can interpret all metric prefixes between milli and kilo as the correct power of ten
- 4.2. learner can convert one metric prefix to another by moving the decimal point in the measurement appropriately
- 4.3. learner can set-up conversions using the unit-fraction method and show how unwanted units cancel to yield desired units
- 4.4. learner can convert any temperature measurement between the Kelvin, Centigrade, Fahrenheit, and Rankin scales by identifying and using the correct formula or formulas
- 4.5. learner can perform all calculations with at least 70% accuracy

Learning Objectives

- 4.a. Convert metric measurements from one prefix to another within the micro to mega range
- 4.b. Use the unit-fraction conversion method to convert measurements within the U.S. customary system and between the U.S. customary and metric systems
- 4.c. Apply the unit-conversion fraction method to conversions involving rates
- 4.d. Convert temperature measurements between the Celcius, Fahrenheit, Rankin and Kelvin scales

5. Solve problems involving geometric concepts

Assessment Strategies

- 5.1. Skill Demonstration
- 5.2. Written Objective Test

Criteria

Performance will be satisfactory when:

- 5.1. learner knows the equation of and can use the Pythagorean theorem to determine hypotenuse length given both legs, and leg length given the length of the other leg and the hypotenuse
- 5.2. learner knows formulas for and can calculate areas of triangles, rectangles, parallelograms, circles, and composite shapes containing simpler shapes, using the pythagorean theorem to find critical dimensions when necessary
- 5.3. learner knows formulas for and can calculate the volume of prisms, cylinders, spheres, and composite solids composed of simpler parts
- 5.4. learner can perform all calcuations with at least 70% accuracy

Learning Objectives

- 5.a. Apply the Pythagorean Theorem to determine unkown side lengths in right triangles
- 5.b. Calculate the perimeter of simple and compound geometric figures with consistent or inconsistent unit measures
- 5.c. Calculate the area of geometric figures including quadrilaterals, triangles, circles, and composite figures
- 5.d. Calculate the volume of various geometric solids including spheres, rectangular solids, cylinders, prisms, and composite solids.
- 5.e. Calculate the lengths and widths of stretch-out's
- 5.f. Calculate the heat load for a room or a building

6. Solve applications in the refrigeration field

Assessment Strategies

- 6.1. Skill Demonstration
- 6.2. Written Objective Test

Criteria

- 6.1. learner will use the correct formulas to solve the application

- 6.2. learner will state answer using correct units
- 6.3. learner can perform all calculations with at least 70% accuracy

Learning Objectives

- 6.a. Use Ohm's Law in application situations
- 6.b. Use electrical formulas in application situations
- 6.c. Use the arc length formulas to solve for the radius, interior angle, or arc length

7. Apply trigonometry to solve application situations in the refrigeration field

Assessment Strategies

- 7.1. Skill Demonstration
- 7.2. Written Objective Test

Criteria

- 7.1. learner will use the correct trigonometric function to find a length of a missing side
- 7.2. learner will use the correct trigonometric function to find the missing angle
- 7.3. learner will use a table or calculator to find values or angles
- 7.4. Learner can perform all calculations with at least 70% accuracy

Learning Objectives

- 7.a. Compute the missing side using trigonometric formulas when given an angle and one other side in a right triangle
- 7.b. Compute the measure of a missing angle given the lengths of two sides of a right triangle