Applied Mathematics – Part 2

Michigan State Mathematics Content Expectations

Course Description

Applied Mathematics, Part 2 will introduce students to all phases of carpentry construction.

Text Book

Judy, Kathryn B. and Webster, Alfred P. *Mathematics for Carpentry and the Construction Trades, Second Edition*. New Jersey: Prenctice Hall, 2002.

Unit 1 Description

This unit will introduce students to the metric system, temperature, board feet, linear feet, pricing systems, and concrete.

Essential Content and Skills

The learner will:

- Convert from one metric unit to another metric unit.
- Convert from metric units of measure to American units of measure.
- Convert temperature from Celsius to Fahrenheit.
- Convert temperature from Fahrenheit to Celsius.
- Calculate board feet.
- Determine how to find linear feet.
- Analyze pricing systems.
- Analyze price conversions.
- Analyze how to calculate the amount of concrete needed.
- Analyze concrete footings.
- Identify the steps taken to pour a concrete slab.

Unit 1 Michigan State Content Expectations

Click here to view the Michigan DOE Curriculum Content Standards.

Unit 1 Lesson 1: Metric-Metric Conversions

State Standard	Description
M.TE.04.05	Carry out the following conversions from one unit of measure to a larger or smaller unit of measure: meters to centimeters, kilograms to grams, liters to milliliters, hours to minutes, minutes to seconds, years to months, weeks to days, feet to inches, ounces to pounds (using numbers that involve only simple calculations).
M.UN.05.04	Convert measurements of length, weight, area, volume, and time within a given system using easily manipulated numbers.

Unit 1 Lesson 2: Metric-American Conversions

State Standard	Description
M.TE.04.05	Carry out the following conversions from one unit of measure to a larger or smaller unit of measure: meters to centimeters, kilograms to grams, liters to milliliters, hours to minutes, minutes to seconds, years to months, weeks to days, feet to inches, ounces to pounds (using numbers that involve only simple calculations).
M.UN.05.04	Convert measurements of length, weight, area, volume, and time within a given system using easily manipulated numbers.

Unit 1 Lesson 3: Temperature Conversions

State Standard	Description
M.UN.03.04	Know benchmark temperatures such as freezing (32oF, 0oC); boiling (212oF, 100oC); and compare temperatures to these, e.g., cooler, warmer.

Unit 1 Lesson 4: Finding the Number of Board Feet

State Standard	Description
M.TE.06.03	Compute the volume and surface area of cubes and rectangular prisms given the lengths of their sides, using formulas.
G.SR.08.06	Know the volume formulas for generalized cylinders (area of base) x height), generalized cones and pyramids ((area of base) x height), and spheres (p (radius) 3) and apply them to solve problems.
G.SR.08.07	Understand the concept of surface area, and find the surface area of prisms, cones, spheres, pyramids, and cylinders.

Unit 1 Lesson 5: Finding Linear Feet

State Standard	Description
M.TE.04.06	Know and understand the formulas for perimeter and area of a square and a rectangle; calculate the perimeters and areas of these shapes and combinations of these shapes using the formulas.
M.TE.05.07	Understand and know how to use the area formula for a parallelogram: A = bh, and represent using models and manipulatives.

Unit 1 Lesson 6: Pricing Systems

State Standard	Description
M.TE.04.05	Carry out the following conversions from one unit of measure to a larger or smaller unit of measure: meters to centimeters, kilograms to grams, liters to milliliters, hours to minutes, minutes to seconds, years to months, weeks to days, feet to inches, ounces to pounds (using numbers that involve only simple calculations).
M.UN.05.04	Convert measurements of length, weight, area, volume, and time within a given system using easily manipulated numbers.

Unit 1 Lesson 7: Pricing Conversions

State Standard	Description
M.TE.04.05	Carry out the following conversions from one unit of measure to a larger or smaller unit of measure: meters to centimeters, kilograms to grams, liters to milliliters, hours to minutes, minutes to seconds, years to months, weeks to days, feet to inches, ounces to pounds (using numbers that involve only simple calculations).
M.UN.05.04	Convert measurements of length, weight, area, volume, and time within a given system using easily manipulated numbers.

Unit 1 Lesson 8: Calculating the Amount of Concrete Needed

State Standard	Description
M.TE.06.03	Compute the volume and surface area of cubes and rectangular prisms given the lengths of their sides, using formulas.
G.SR.08.06	Know the volume formulas for generalized cylinders (area of base) x height), generalized cones and pyramids ((area of base) x height), and spheres (p (radius) 3) and apply them to solve problems.
G.SR.08.07	Understand the concept of surface area, and find the surface area of prisms, cones, spheres, pyramids, and cylinders.

Unit 1 Lesson 9: Footings

State Standard	Description
M.TE.06.03	Compute the volume and surface area of cubes and rectangular prisms given the lengths of their sides, using formulas.
G.SR.08.06	Know the volume formulas for generalized cylinders (area of base) x height), generalized cones and pyramids ((area of base) x height), and spheres (p (radius) 3) and apply them to solve problems.
G.SR.08.07	Understand the concept of surface area, and find the surface area of prisms, cones, spheres, pyramids, and cylinders.

Unit 1 Lesson 10: Slabs

State Standard	Description
M.TE.06.03	Compute the volume and surface area of cubes and rectangular prisms given the lengths of their sides, using formulas.
G.SR.08.06	Know the volume formulas for generalized cylinders (area of base) x height), generalized cones and pyramids ((area of base) x height), and spheres (p (radius) 3) and apply them to solve problems.
G.SR.08.07	Understand the concept of surface area, and find the surface area of prisms, cones, spheres, pyramids, and cylinders.

Unit 2 Description

This unit will introduce students to girders, sills, floor joists, floor covering, walls, and roofs.

Essential Content and Skills

The learner will:

- Identify the purpose of girders.
- Analyze types of girders.
- Analyze sills.
- Analyze floor joists.
- Identify when bridging is to be used.
- Analyze floor covering.
- Analyze shoes and plates.
- Analyze wall studs and sheathing.
- Analyze interior walls.
- Analyze window and door headers.
- Identify different types of roofs and their designated slope.

Unit 2 Michigan State Content Expectations

Unit 2 Lesson 1: The Girder

State Standard	Description
CE2.1.3	Determine the meaning of unfamiliar words, specialized vocabulary, figurative language, idiomatic expressions, and technical meanings of terms through context clues, word roots and affixes, and the use of appropriate resource materials such as print and electronic dictionaries.

Unit 2 Lesson 2: Sill Plates

State Standard	Description
CE2.1.3	Determine the meaning of unfamiliar words, specialized vocabulary, figurative language, idiomatic expressions, and technical meanings of terms through context clues, word roots and affixes, and the use of appropriate resource materials such as print and electronic dictionaries.

Unit 2 Lesson 3: Floor Joists

State Standard	Description
CE2.1.3	Determine the meaning of unfamiliar words, specialized vocabulary, figurative language, idiomatic expressions, and technical meanings of terms through context clues, word roots and affixes, and the use of appropriate resource materials such as print and electronic dictionaries.

Unit 2 Lesson 4: Bridging

State Standard	Description
CE2.1.3	Determine the meaning of unfamiliar words, specialized vocabulary, figurative language, idiomatic expressions, and technical meanings of terms through context clues, word roots and affixes, and the use of appropriate resource materials such as print and electronic dictionaries.

Unit 2 Lesson 5: Floor Covering

State Standard	Description
CE2.1.3	Determine the meaning of unfamiliar words, specialized vocabulary, figurative language, idiomatic expressions, and technical meanings of terms through context clues, word roots and affixes, and the use of appropriate resource materials such as print and electronic dictionaries.

Unit 2 Lesson 6: Shoes and Plates – Exterior Walls

State Standard	Description
CE2.1.3	Determine the meaning of unfamiliar words, specialized vocabulary, figurative language, idiomatic expressions, and technical meanings of terms through context clues, word roots and affixes, and the use of appropriate resource materials such as print and electronic dictionaries.

Unit 2 Lesson 7: Exterior Wall Studs

State Standard	Description
CE2.1.3	Determine the meaning of unfamiliar words, specialized vocabulary, figurative language, idiomatic expressions, and technical meanings of terms through context clues, word roots and affixes, and the use of appropriate resource materials such as print and electronic dictionaries.

Unit 2 Lesson 8: Interior Walls

State Standard	Description
CE2.1.3	Determine the meaning of unfamiliar words, specialized vocabulary, figurative language, idiomatic expressions, and technical meanings of terms through context clues, word roots and affixes, and the use of appropriate resource materials such as print and electronic dictionaries.

Unit 2 Lesson 9: Headers

State Standard	Description
CE2.1.3	Determine the meaning of unfamiliar words, specialized vocabulary, figurative language, idiomatic expressions, and technical meanings of terms through context clues, word roots and affixes, and the use of appropriate resource materials such as print and electronic dictionaries.

Unit 2 Lesson 10: Roof Slope

State Standard	Description
CE2.1.3	Determine the meaning of unfamiliar words, specialized vocabulary, figurative language, idiomatic expressions, and technical meanings of terms through context clues, word roots and affixes, and the use of appropriate resource materials such as print and electronic dictionaries.

Unit 3 Description

This unit will introduce students to hip rafters, valley rafters, overhangs, flashing, and roof slope.

Essential Content and Skills

The learner will:

- Analyze rafters.
- Analyze overhangs and flashing.
- Analyze rafter patterns.
- Determine a roof's slope.
- Be introduced to the framing square.
- Identify the purpose of roof overhangs.
- Calculate hip rafter length.
- Analyze types of valley rafters.
- Calculate the length of a conventional valley rafter.
- Analyze valley rafter end cuts.

Unit 3 Michigan State Content Expectations

Unit 3 Lesson 1: Rafters

State Standard	Description
CE2.1.3	Determine the meaning of unfamiliar words, specialized vocabulary, figurative language, idiomatic expressions, and technical meanings of terms through context clues, word roots and affixes, and the use of appropriate resource materials such as print and electronic dictionaries.

Unit 3 Lesson 2: Overhangs

State Standard	Description
CE2.1.3	Determine the meaning of unfamiliar words, specialized vocabulary, figurative language, idiomatic expressions, and technical meanings of terms through context clues, word roots and affixes, and the use of appropriate resource materials such as print and electronic dictionaries.

Unit 3 Lesson 3: Rafter Patterns

State Standard	Description
CE2.1.3	Determine the meaning of unfamiliar words, specialized vocabulary, figurative language, idiomatic expressions, and technical meanings of terms through context clues, word roots and affixes, and the use of appropriate resource materials such as print and electronic dictionaries.

Unit 3 Lesson 4: Determining Slope of an Existing Roof

State Standard	Description
G.GS.03.01	Identify points, line segments, lines, and distance.
G.TR.05.01	Associate an angle with a certain amount of turning; know that angles are measured in degrees; understand that 90°, 180°, 270°, and 360° are associated respectively, with **14** , **12** , and **34** , and full turns.
G.GS.05.02	Measure angles with a protractor and classify them as acute, right, obtuse, or straight.
G.GS.05.03	Identify and name angles on a straight line and vertical angles.
G.GS.05.04	Find unknown angles in problems involving angles on a straight line, angles surrounding a point, and vertical angles.
G.GS.05.05	Know that angles on a straight line add up to 180° and angles surrounding a point add up to 360°; justify informally by “surrounding” a point with angles.
G.GS.05.06	Understand why the sum of the interior angles of a triangle is 180° and the sum of the interior angles of a quadrilateral is 360°, and use these properties to solve problems.

Unit 3 Lesson 5: Introduction to the Framing Square

State Standard	Description
G.GS.03.01	Identify points, line segments, lines, and distance.
G.TR.05.01	Associate an angle with a certain amount of turning; know that angles are measured in degrees; understand that 90°, 180°, 270°, and 360° are associated respectively, with **14** , **12** , and **34** , and full turns.
G.GS.05.02	Measure angles with a protractor and classify them as acute, right, obtuse, or straight.
G.GS.05.03	Identify and name angles on a straight line and vertical angles.
G.GS.05.04	Find unknown angles in problems involving angles on a straight line, angles surrounding a point, and vertical angles.
G.GS.05.05	Know that angles on a straight line add up to 180° and angles surrounding a point add up to 360°; justify informally by “surrounding” a point with angles.
G.GS.05.06	Understand why the sum of the interior angles of a triangle is 180° and the sum of the interior angles of a quadrilateral is 360°, and use these properties to solve problems.

Unit 3 Lesson 6: Overhang

State Standard	Description
G.GS.03.01	Identify points, line segments, lines, and distance.
G.TR.05.01	Associate an angle with a certain amount of turning; know that angles are measured in degrees; understand that 90°, 180°, 270°, and 360° are associated respectively, with **14** , **12** , and **34** , and full turns.
G.GS.05.02	Measure angles with a protractor and classify them as acute, right, obtuse, or straight.
G.GS.05.03	Identify and name angles on a straight line and vertical angles.
G.GS.05.04	Find unknown angles in problems involving angles on a straight line, angles surrounding a point, and vertical angles.
G.GS.05.05	Know that angles on a straight line add up to 180° and angles surrounding a point add up to 360°; justify informally by “surrounding” a point with angles.
G.GS.05.06	Understand why the sum of the interior angles of a triangle is 180° and the sum of the interior angles of a quadrilateral is 360°, and use these properties to solve problems.

Unit 3 Lesson 7: Calculating Hip Rafter Length

State Standard	Description
G.GS.03.01	Identify points, line segments, lines, and distance.
G.TR.05.01	Associate an angle with a certain amount of turning; know that angles are measured in degrees; understand that 90°, 180°, 270°, and 360° are associated respectively, with **14** , **12** , and **34** , and full turns.
G.GS.05.02	Measure angles with a protractor and classify them as acute, right, obtuse, or straight.
G.GS.05.03	Identify and name angles on a straight line and vertical angles.
G.GS.05.04	Find unknown angles in problems involving angles on a straight line, angles surrounding a point, and vertical angles.
G.GS.05.05	Know that angles on a straight line add up to 180° and angles surrounding a point add up to 360°; justify informally by “surrounding” a point with angles.
G.GS.05.06	Understand why the sum of the interior angles of a triangle is 180° and the sum of the interior angles of a quadrilateral is 360°, and use these properties to solve problems.

Unit 3 Lesson 8: Type of Valley Rafters

State Standard	Description
G.GS.03.01	Identify points, line segments, lines, and distance.
G.TR.05.01	Associate an angle with a certain amount of turning; know that angles are measured in degrees; understand that 90°, 180°, 270°, and 360° are associated respectively, with **14** , **12** , and **34** , and full turns.
G.GS.05.02	Measure angles with a protractor and classify them as acute, right, obtuse, or straight.
G.GS.05.03	Identify and name angles on a straight line and vertical angles.
G.GS.05.04	Find unknown angles in problems involving angles on a straight line, angles surrounding a point, and vertical angles.
G.GS.05.05	Know that angles on a straight line add up to 180° and angles surrounding a point add up to 360°; justify informally by “surrounding” a point with angles.
G.GS.05.06	Understand why the sum of the interior angles of a triangle is 180° and the sum of the interior angles of a quadrilateral is 360°, and use these properties to solve problems.

Unit 3 Lesson 9: Calculating the Length of a Conventional Valley Rafter

State Standard	Description
G.GS.03.01	Identify points, line segments, lines, and distance.
G.TR.05.01	Associate an angle with a certain amount of turning; know that angles are measured in degrees; understand that 90°, 180°, 270°, and 360° are associated respectively, with **14** , **12** , and **34** , and full turns.
G.GS.05.02	Measure angles with a protractor and classify them as acute, right, obtuse, or straight.
G.GS.05.03	Identify and name angles on a straight line and vertical angles.
G.GS.05.04	Find unknown angles in problems involving angles on a straight line, angles surrounding a point, and vertical angles.
G.GS.05.05	Know that angles on a straight line add up to 180° and angles surrounding a point add up to 360°; justify informally by “surrounding” a point with angles.
G.GS.05.06	Understand why the sum of the interior angles of a triangle is 180° and the sum of the interior angles of a quadrilateral is 360°, and use these properties to solve problems.

Unit 3 Lesson 10: End Cuts

State Standard	Description
G.GS.03.01	Identify points, line segments, lines, and distance.
G.TR.05.01	Associate an angle with a certain amount of turning; know that angles are measured in degrees; understand that 90°, 180°, 270°, and 360° are associated respectively, with **14** , **12** , and **34** , and full turns.
G.GS.05.02	Measure angles with a protractor and classify them as acute, right, obtuse, or straight.
G.GS.05.03	Identify and name angles on a straight line and vertical angles.
G.GS.05.04	Find unknown angles in problems involving angles on a straight line, angles surrounding a point, and vertical angles.
G.GS.05.05	Know that angles on a straight line add up to 180° and angles surrounding a point add up to 360°; justify informally by “surrounding” a point with angles.
G.GS.05.06	Understand why the sum of the interior angles of a triangle is 180° and the sum of the interior angles of a quadrilateral is 360°, and use these properties to solve problems.

Unit 4 Description

This unit will introduce students to jack rafters, unconventional rafters, stairway construction, gables, siding, drywall, and roof covering.

Essential Content and Skills

The learner will:

- Analyze jack rafters.
- Analyze unconventional rafters.
- Calculate rise height, stairway length, and tread width.
- Identify how to frame gable ends.
- Determine materials needed for exterior trim.
- Analyze the estimating process.
- Estimate exterior sheathing.
- Determine how to install siding.
- Determine how to install soffit and fascia.
- Determine the steps taken to hang drywall.
- Determine the process for applying roof covering.

Unit 4 Michigan State Content Expectations

Unit 4 Lesson 1: Jack Rafters

State Standard	Description
N.FL.07.05	Solve proportion problems using such methods as unit rate, scaling, finding equivalent fractions, and solving the proportion equation a/b = c/d; know how to see patterns about proportional situations in tables.

Unit 4 Lesson 2: Calculating Unconventional Rafters

State Standard	Description
N.FL.07.05	Solve proportion problems using such methods as unit rate, scaling, finding equivalent fractions, and solving the proportion equation a/b = c/d; know how to see patterns about proportional situations in tables.

Unit 4 Lesson 3: Stairs

State Standard	Description
N.FL.07.05	Solve proportion problems using such methods as unit rate, scaling, finding equivalent fractions, and solving the proportion equation a/b = c/d; know how to see patterns about proportional situations in tables.

Unit 4 Lesson 4: Framing and Covering Gable Ends

State Standard	Description
G.GS.03.01	Identify points, line segments, lines, and distance.
G.TR.05.01	Associate an angle with a certain amount of turning; know that angles are measured in degrees; understand that 90°, 180°, 270°, and 360° are associated respectively, with **14** , **12** , and **34** , and full turns.
G.GS.05.02	Measure angles with a protractor and classify them as acute, right, obtuse, or straight.
G.GS.05.03	Identify and name angles on a straight line and vertical angles.
G.GS.05.04	Find unknown angles in problems involving angles on a straight line, angles surrounding a point, and vertical angles.
G.GS.05.05	Know that angles on a straight line add up to 180° and angles surrounding a point add up to 360°; justify informally by “surrounding” a point with angles.
G.GS.05.06	Understand why the sum of the interior angles of a triangle is 180° and the sum of the interior angles of a quadrilateral is 360°, and use these properties to solve problems.

Unit 4 Lesson 5: Exterior Trim

State Standard	Description
M.TE.04.06	Know and understand the formulas for perimeter and area of a square and a rectangle; calculate the perimeters and areas of these shapes and combinations of these shapes using the formulas.
G.GS.05.06	Understand why the sum of the interior angles of a triangle is 180° and the sum of the interior angles of a quadrilateral is 360°, and use these properties to solve problems. Solve problems about geometric shapes
G.GS.05.07	Find unknown angles and sides using the properties of: triangles, including right, isosceles, and equilateral triangles; parallelograms, including rectangles and rhombuses; and trapezoids.

Unit 4 Lesson 6: The Estimating Process

State Standard	Description
N.FL.04.34	Estimate the answers to calculations involving addition, subtraction, or multiplication.
N.FL.04.35	Know when approximation is appropriate and use it to check the reasonableness of answers; be familiar with common place-value errors in calculations.
N.FL.04.36	Make appropriate estimations and calculations fluently with whole numbers using mental math strategies.

Unit 4 Lesson 7: Estimating Exterior Sheathing

State Standard	Description
N.FL.04.34	Estimate the answers to calculations involving addition, subtraction, or multiplication.
N.FL.04.35	Know when approximation is appropriate and use it to check the reasonableness of answers; be familiar with common place-value errors in calculations.
N.FL.04.36	Make appropriate estimations and calculations fluently with whole numbers using mental math strategies.

Unit 4 Lesson 8: Siding

State Standard	Description
M.TE.04.06	Know and understand the formulas for perimeter and area of a square and a rectangle; calculate the perimeters and areas of these shapes and combinations of these shapes using the formulas.
G.GS.05.06	Understand why the sum of the interior angles of a triangle is 180° and the sum of the interior angles of a quadrilateral is 360°, and use these properties to solve problems. Solve problems about geometric shapes
G.GS.05.07	Find unknown angles and sides using the properties of: triangles, including right, isosceles, and equilateral triangles; parallelograms, including rectangles and rhombuses; and trapezoids.

Unit 4 Lesson 9: Drywall

State Standard	Description
M.TE.04.06	Know and understand the formulas for perimeter and area of a square and a rectangle; calculate the perimeters and areas of these shapes and combinations of these shapes using the formulas.
G.GS.05.06	Understand why the sum of the interior angles of a triangle is 180° and the sum of the interior angles of a quadrilateral is 360°, and use these properties to solve problems. Solve problems about geometric shapes
G.GS.05.07	Find unknown angles and sides using the properties of: triangles, including right, isosceles, and equilateral triangles; parallelograms, including rectangles and rhombuses; and trapezoids.

Unit 4 Lesson 10: Roof Covering

State Standard	Description
G.GS.03.01	Identify points, line segments, lines, and distance.
G.TR.05.01	Associate an angle with a certain amount of turning; know that angles are measured in degrees; understand that 90°, 180°, 270°, and 360° are associated respectively, with **14** , **12** , and **34** , and full turns.
G.GS.05.02	Measure angles with a protractor and classify them as acute, right, obtuse, or straight.
G.GS.05.03	Identify and name angles on a straight line and vertical angles.
G.GS.05.04	Find unknown angles in problems involving angles on a straight line, angles surrounding a point, and vertical angles.
G.GS.05.05	Know that angles on a straight line add up to 180° and angles surrounding a point add up to 360°; justify informally by “surrounding” a point with angles.
G.GS.05.06	Understand why the sum of the interior angles of a triangle is 180° and the sum of the interior angles of a quadrilateral is 360°, and use these properties to solve problems.