Introduction to Construction Math Module 00102-09
Upon completion of this module, you will be able to:

1. Add, subtract, multiply, and divide whole numbers, with and without a calculator.
2. Use a standard ruler, a metric ruler, and a measuring tape to measure.
3. Add, subtract, multiply, and divide fractions.
4. Add, subtract, multiply, and divide decimals, with and without a calculator.
5. Convert decimals to percentages and percentages to decimals.
6. Convert fractions to decimals and decimals to fractions.
7. Explain what the metric system is and how it is important in the construction trade.
8. Recognize and use metric units of length, weight, volume, and temperature.
9. Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
Figure 1 – Place values

<table>
<thead>
<tr>
<th></th>
<th>MILLIONS</th>
<th>HUNDRED THOUSANDS</th>
<th>TEN THOUSANDS</th>
<th>THOUSANDS</th>
<th>HUNDREDS</th>
<th>TENS</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

102F01.EPS
Figure 2 – Foundation A

FOUNDATION A

52'

33'
Figure 3 – Foundation B

FOUNDATION B

46' × 30'

38' × 20'

8' × 10'

8' × 8'
Figure 4 – Concrete block
Figure 6 – Types of measurement tools

- **The Standard, or English, Ruler**
- **Architect's Scale**
- **The Metric Ruler**
Figure 7 – Standard ruler showing 1/16-inch increments
Figure 8 – 1/8-inch ruler

1. ____  
2. ____  
3. ____  
4. ____  
5. ____
Figure 9 – 1/16-inch ruler

6. _____  
7. _____  
8. _____  
9. _____  
10. _____
Figure 10 – Distances on a metric ruler

0.4 CENTIMETERS (OR 4 MILLIMETERS)

2.7 CENTIMETERS (OR 27 MILLIMETERS)
Figure 11 – Metric ruler study problem

1. ____  2. ____  3. ____  4. ____  5. ____

CM 1 2 3 4
Figure 12 – Measuring tape showing English and metric measurements
Figure 13 – Wall framing markings on a tape measure

A  Every 24 inches is marked with a contrasting black background. 24-inch spacing on center is used most commonly for nonbearing walls.

B  Every 16 inches is marked with a red background. 16-inch spacing on center is used most commonly for loadbearing walls.

C  Every 19.2 inches is marked with a small black diamond. 19.2-inch spacing on center is an alternate, less-commonly used spacing scheme for loadbearing walls.
Figure 15 – Metric and English measuring tape

1. 
2. 
3. 

10F15.EPS
Figure 16 – Metric and English measuring tape

4. ____  5. ____
Figure 17 – The architect’s scale

READ FROM LEFT TO RIGHT
18' ON ¼" 5 1'-0" SCALE
57" ON ½" 5 1'-0" SCALE
READ FROM RIGHT TO LEFT

INCHES  FEET  INCHES
Figure 18 – Measuring a section of duct with an architect’s scale
Figure 19 – Metric architect’s scale

[Image of aMetric architect’s scale with markings for 50 mm and 10 m.]
Figure 20 – The engineer’s scale
Figure 21 – Duct measurement using 1/8 scale
Figure 22 – Duct measurement using 1/4 scale
Figure 23 – Meter measurements
Figure 24 – Engineer’s scale measurements
Figure 25 – Converting inches to yards
Figure 26 – Converting centimeters to meters
Figures 28 and 29 – Four and eight sections of a 2 x 4
Figure 30 – Drilling a sill plate for an anchor bolt

ANCHOR BOLT HOLE

5½"
Figure 32 – Determining the sidewalk slope

SIDEWALK SLOPE
1/8” PER FT.

11’

FRONT DOOR

SOIL

FOOTING

102F32.EPS
Figure 33 – Using a machinist’s rule to measure tenths
Figure 34 – First floor plan

Slide 34

KITCHEN

DINING ROOM

PANTRY

4' DOORWAY

HALL

LIVING ROOM

MASTER BEDROOM

BEDROOM 3

BEDROOM 2

National Center for Construction Education and Research

Core Curriculum
Module 00102-09

Copyright © by NCCER, Published by Pearson Education, Inc.
## PLUMBING FIXTURES

<table>
<thead>
<tr>
<th>ITEMS</th>
<th>QTY.</th>
<th>UNIT COST</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>KITCHEN SINK</td>
<td></td>
<td>$142.76</td>
<td>$142.76</td>
</tr>
<tr>
<td>BATHTUB</td>
<td></td>
<td>$437.95</td>
<td>$437.95</td>
</tr>
<tr>
<td>SUMP PUMP</td>
<td></td>
<td>$205.31</td>
<td>$205.31</td>
</tr>
<tr>
<td>WATER PUMP</td>
<td></td>
<td>$375.10</td>
<td>$375.10</td>
</tr>
<tr>
<td>WATER HEATER</td>
<td></td>
<td>$232.00</td>
<td>$232.00</td>
</tr>
<tr>
<td>WATER SOFTENER</td>
<td></td>
<td>$429.99</td>
<td>$429.99</td>
</tr>
<tr>
<td>LAVATORY</td>
<td></td>
<td>$231.34</td>
<td>$231.34</td>
</tr>
<tr>
<td>TOILET</td>
<td></td>
<td>$86.59</td>
<td>$86.59</td>
</tr>
<tr>
<td>LAUNDRY TUBS</td>
<td></td>
<td>$137.43</td>
<td>$137.43</td>
</tr>
<tr>
<td><strong>TOTAL ITEMS</strong></td>
<td></td>
<td></td>
<td><strong>TOTAL COST</strong></td>
</tr>
</tbody>
</table>

102F36.EPS
Figure 37 – HVAC elevation drawing

CEIL. LN. 155.60'

BM 151.99'

FIN. FLR. 147.40'

DUCT

3.61'

4.59'

9.27'

?
Figure 39 – Office floor plan

OFFICE 1

OFFICE 2

WAITING ROOM

Dimensions:
- 27' x 16' x 15'-9"
- 24' x 16' x 16'
- 22'-8'' x 8'' x 9'-6''
- 32' x 20' x 5'-11''
Figure 41 – Types of angles

- **ACUTE**
- **RIGHT**
- **OBTUSE**
- **STRAIGHT**
- **ADJACENT**
- **OPPOSITE**
Figure 44 – Cutting a rectangle on the diagonal produces two right triangles.
Figure 45 – Cutting a square on the diagonal produces two right triangles.
Figure 46 – The sum of a triangle’s three angles always equals 180 degrees.

- **Right Triangle**: 
  \[30^\circ + 60^\circ + 90^\circ = 180^\circ\]

- **Equilateral Triangle**: 
  \[60^\circ + 60^\circ + 60^\circ = 180^\circ\]

- **Isosceles Triangle**: 
  \[48^\circ + 66^\circ + 66^\circ = 180^\circ\]

- **Scalene Triangle**: 
  \[108^\circ + 22^\circ + 50^\circ = 180^\circ\]
Figure 47 – Measurements that apply to circles

- Circumference
- Diameter
- Radius

Diameter: 3.14" (π or p)

Radius: 1"

Note: π (pi) is approximately 3.14.
Figure 48 – Volume of a rectangle

4 INCHES = 20 FEET

8 FEET

102F48.EPS
Figure 49 – Volume of a cube

- Volume of a cube is calculated by the formula $V = a^3$, where $a$ is the length of a side.
- For this cube, each side measures 8 FEET, so the volume would be $V = 8^3 = 512$ cubic feet.
Figure 50 – Volume of a cylinder
Figure 51 – Volume of a triangle

\[
\text{Volume of a triangle} = \frac{1}{2} \times \text{base} \times \text{height}
\]

For the given triangle with base 6 and height 12:

\[
\text{Volume} = \frac{1}{2} \times 6 \times 12 = 36
\]
Figure 52 – Finding the area of a pipe
Figure 53 – Removing topsoil for a sidewalk

- **HOUSE**
- **GARAGE**
- **SIDEWALK**
- **18’ OVERHEAD DOOR**
- **DRIVEWAY**

Dimensions:
- HOUSE: 26'-0" x 56'-0"
- SIDEWALK: 6'-0" x 26'-0"
- GARAGE: 5'-0" x 22'-0"
- DRIVEWAY: 26'-4" x 11'-0"
Figure 54 – Estimating concrete for a sidewalk

4"-THICK CONCRETE SIDEWALK

40'-4"
11'-9"
13'-6"
6'
4'
This course map shows all of the modules in the Core Curriculum: Introductory Core Skills. The suggested training order begins at the bottom and proceeds up. Skill levels increase as you advance on the course map. The local Training Program Sponsor may adjust the training order.

Note that Module 00106-09, Basic Rigging, is an elective. It is not a requirement for level completion, but it may be included as part of your training program.
RECTANGLE

90° 360° 90°
90° 90° 90°

SQUARE

90° 90°
360°
90° 90°

TRIANGLE

A + B + C = 180°

CIRCLE

360°
**BASE UNIT:** GRAM (WEIGHT), METER (LENGTH), LITER ( VOLUME) \(10^0 = 1\)

<table>
<thead>
<tr>
<th>MULTIPLIER</th>
<th>PREFIX</th>
<th>MEANING</th>
<th>PREFIX</th>
<th>MEANING</th>
<th>MULTIPLIER</th>
</tr>
</thead>
<tbody>
<tr>
<td>(10^1) = 10</td>
<td>deka-</td>
<td>ten</td>
<td>deci-</td>
<td>tenth</td>
<td>(10^{-1} = 0.1)</td>
</tr>
<tr>
<td>(10^2) = 100</td>
<td>hecto-</td>
<td>hundred</td>
<td>centi-</td>
<td>hundredth</td>
<td>(10^{-2} = 0.01)</td>
</tr>
<tr>
<td>(10^3) = 1,000</td>
<td>kilo-</td>
<td>thousand</td>
<td>milli-</td>
<td>thousandth</td>
<td>(10^{-3} = 0.001)</td>
</tr>
<tr>
<td>(10^6) = 1,000,000</td>
<td>mega-</td>
<td>million</td>
<td>micro-</td>
<td>millionth</td>
<td>(10^{-6} = 0.000001)</td>
</tr>
<tr>
<td>(10^9) = 1,000,000,000</td>
<td>giga-</td>
<td>billion</td>
<td>nano-</td>
<td>billionth</td>
<td>(10^{-9} = 0.000000001)</td>
</tr>
<tr>
<td>(10^{12}) = 1,000,000,000,000</td>
<td>tera-</td>
<td>trillion</td>
<td>pico-</td>
<td>trillionth</td>
<td>(10^{-12} = 0.000000000001)</td>
</tr>
</tbody>
</table>
6"-THICK SLAB
Supplemental Art

(A) 50° 40°
(B) 60° 60°
(C) 40° 40° 70°
(D) 120° 45° 15°
(E) 10° 150° 20°
**Slide 73**

**Supplemental Art**

**Step 1:**
- Radius: 5 feet
- Area: \( \pi r^2 \)
  - \( 3.14 \times 5^2 = 78.5 \) square feet

**Step 2:**
- Diameter: 10 feet
- Circumference: \( \pi d \)
  - \( 3.14 \times 10 = 31.4 \) feet

**Step 3:**
- Height: 20 feet
- Area: 628 square feet

**Step 4:**
- Total area: 706.5 square feet