TRADE MATH ESSENTIALS

Practical Math for Skilled Trades

The math you need on the job site

Global Sovereign University

Building a Bridge to Freedom Through Education

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Section 1: Reading Tape Measures

Every tradesperson must read a tape measure accurately. In the U.S., we typically use feet and inches with fractional divisions.

Understanding Inch Divisions

Line Length	Represents	Count
Longest (1")	Full inches	1, 2, 3...
Second longest	Half inches (1/2")	2 per inch
Third longest	Quarter inches (1/4")	4 per inch
Fourth longest	Eighth inches (1/8")	8 per inch
Shortest	Sixteenth inches (1/16")	16 per inch

Reading the Tape

Example: A measurement falls on the 3rd line past the 5-inch mark, where lines are in 1/8" intervals.

Answer: 5 3/8"

Tip: Count the divisions to determine the denominator. If there are 16 lines per inch, each line is 1/16". If 8 lines, each is 1/8".

Converting Fractions

Always reduce fractions to simplest form:

• 2/16 = 1/8

• 4/16 = 2/8 = 1/4

• 8/16 = 4/8 = 2/4 = 1/2

• 12/16 = 6/8 = 3/4

Reading Feet and Inches

On most tapes, feet are marked in red. Between foot marks are 12 inches.

Example: 3' 7 1/2" means 3 feet, 7 and one-half inches

Converting to inches only: (3 × 12) + 7.5 = 43.5 inches

Practice: Tape Measure Reading

1. How many 1/16" marks are in one inch? _____

2. Reduce 6/16 to simplest form: _____

3. Convert 5' 4" to inches only: _____

4. Convert 52 inches to feet and inches: _____

5. Add: 3 5/8" + 2 3/8" = _____

6. Subtract: 8 3/4" – 3 1/2" = _____

Section 2: Linear Measurement Conversions

U.S. Customary Units

Conversion	Equivalent
1 foot (ft)	12 inches (in)
1 yard (yd)	3 feet = 36 inches
1 mile (mi)	5,280 feet = 1,760 yards

Metric Units

Conversion	Equivalent
1 centimeter (cm)	10 millimeters (mm)
1 meter (m)	100 centimeters = 1,000 mm
1 kilometer (km)	1,000 meters

U.S. to Metric Conversions

U.S. Unit	Metric Equivalent
1 inch	2.54 cm (exactly)
1 foot	30.48 cm ≈ 0.3048 m
1 yard	0.9144 m
1 mile	1.609 km

Converting Between Units

To convert to smaller units: MULTIPLY

Example: 4 feet to inches = 4 × 12 = 48 inches

To convert to larger units: DIVIDE

Example: 84 inches to feet = 84 ÷ 12 = 7 feet

Working with Mixed Measurements

To add or subtract: Convert to same units, calculate, then convert back.

Example: 3' 8" + 2' 7" = ?

3' 8" = 44" and 2' 7" = 31"

44" + 31" = 75"

75" = 6' 3" (75 ÷ 12 = 6 R3)

Practice: Linear Conversions

1. Convert 7 feet to inches: _____

2. Convert 96 inches to feet: _____

3. Convert 5 yards to feet: _____

4. Convert 10 inches to centimeters: _____

5. Add: 4' 9" + 3' 8" = _____

6. A board is 10' 4". You cut off 3' 9". What remains? _____

Section 3: Calculating Area

Area is the surface space inside a shape, measured in square units (sq ft, sq m, etc.).

Area Formulas

Shape	Formula	Example
Rectangle	A = length × width	12' × 10' = 120 sq ft
Square	A = side²	8' × 8' = 64 sq ft
Triangle	A = ½ × base × height	½ × 10' × 6' = 30 sq ft
Circle	A = π × radius²	π × 5² = 78.54 sq ft
Trapezoid	A = ½(b■ + b■) × h	½(8 + 12) × 5 = 50 sq ft

Trade Applications: Flooring

Example: A room is 15' × 12'. Flooring costs $4.50/sq ft. What's the total cost?

Area = 15 × 12 = 180 sq ft

Cost = 180 × $4.50 = $810

Pro tip: Add 10% for waste: 180 × 1.10 = 198 sq ft needed

Trade Applications: Painting

Example: Paint a wall 14' wide × 9' tall with a 3' × 7' door. One gallon covers 350 sq ft.

Wall area = 14 × 9 = 126 sq ft

Door area = 3 × 7 = 21 sq ft

Paintable area = 126 – 21 = 105 sq ft

Gallons needed = 105 ÷ 350 = 0.3 gallons (1 gallon is sufficient)

Trade Applications: Roofing

Roofing is measured in squares. One square = 100 sq ft

Example: A roof is 40' × 25'. How many squares?

Area = 40 × 25 = 1,000 sq ft

Squares = 1,000 ÷ 100 = 10 squares

Complex Shapes

Break complex shapes into rectangles and triangles, calculate each, then add.

L-shaped room example:

• Main rectangle: 20' × 15' = 300 sq ft

• Added section: 8' × 10' = 80 sq ft

• Total: 380 sq ft

Practice: Area Calculations

1. Find the area of a rectangle 18' × 14': _____

2. Find the area of a circle with radius 4': _____

3. A room is 16' × 12'. Carpet costs $8/sq ft. Total cost? _____

4. A rectangular roof is 35' × 28'. How many roofing squares? _____

5. Paint 4 walls (each 12' × 9'). Coverage is 400 sq ft/gallon. Gallons needed? _____

Section 4: Calculating Volume

Volume is the space inside a 3D object, measured in cubic units (cu ft, cu yd, etc.).

Volume Formulas

Shape	Formula	Example
Rectangular box	V = L × W × H	10' × 8' × 2' = 160 cu ft
Cube	V = side³	3' × 3' × 3' = 27 cu ft
Cylinder	V = π × r² × h	π × 3² × 10' = 282.7 cu ft
Cone	V = ■ × π × r² × h	■ × π × 4² × 9' = 150.8 cu ft

Converting Cubic Feet to Cubic Yards

1 cubic yard = 27 cubic feet (3' × 3' × 3' = 27)

To convert: cu ft ÷ 27 = cu yd

Example: 135 cu ft = 135 ÷ 27 = 5 cu yd

Trade Application: Concrete

Concrete is ordered in cubic yards.

Example: A driveway slab is 20' × 10' × 4" thick. How much concrete?

Convert 4" to feet: 4 ÷ 12 = 0.333 ft

Volume = 20 × 10 × 0.333 = 66.6 cu ft

Convert: 66.6 ÷ 27 = 2.47 cu yd

Order 3 cu yd (always round up, add 10% for waste)

Trade Application: Fill Dirt/Gravel

Example: Fill a trench 50' long × 2' wide × 1.5' deep.

Volume = 50 × 2 × 1.5 = 150 cu ft

Convert: 150 ÷ 27 = 5.56 cu yd

Order 6 cu yd

Trade Application: Tank Capacity

Example: A cylindrical tank has radius 3' and height 6'. Find capacity in gallons.

Volume = $\pi \times 3^2 \times 6 = 169.6$ cu ft

1 cu ft = 7.48 gallons

Capacity = 169.6 × 7.48 = 1,269 gallons

Practice: Volume Calculations

1. Find volume: 12' × 8' × 3' = _____

2. Convert 189 cu ft to cu yd: _____

3. A patio slab is 15' × 12' × 6" thick. How many cu yd of concrete? _____

4. A cylindrical tank has radius 2' and height 4'. Volume in cu ft? _____

5. How many gallons does that tank hold? _____

Section 5: The Pythagorean Theorem

The Pythagorean Theorem relates the sides of a right triangle. Essential for squaring corners and calculating diagonal distances.

The Formula

$a^2 + b^2 = c^2$

Where:

• a and b are the legs (shorter sides)

• c is the hypotenuse (longest side, opposite the right angle)

Finding the Hypotenuse

Example: A right triangle has legs of 6' and 8'. Find the hypotenuse.

$a^2 + b^2 = c^2$

$6^2 + 8^2 = c^2$

$36 + 64 = c^2$

$100 = c^2$

$c = \sqrt{100} = 10'$

The 3-4-5 Rule (and Multiples)

Common right triangle ratios to memorize:

• 3-4-5 (and multiples: 6-8-10, 9-12-15, 12-16-20)

• 5-12-13

• 8-15-17

• 7-24-25

Trade Application: Squaring Corners

The 3-4-5 method for checking if a corner is square:

1. Measure 3 feet along one wall from the corner

2. Measure 4 feet along the other wall from the corner

3. The diagonal between these points should be exactly 5 feet

If it's not 5 feet, the corner is not square!

Trade Application: Rafter Length

Example: A roof has a run of 12' and a rise of 5'. Find the rafter length.

$12^2 + 5^2 = c^2$

144 + 25 = 169

$c = \sqrt{169} = 13'$

Trade Application: Stair Stringers

Example: Stairs have a total rise of 9' and a total run of 12'. Find stringer length.

$9^2 + 12^2 = c^2$

81 + 144 = 225

$c = \sqrt{225} = 15'$

Practice: Pythagorean Theorem

1. Find c if a = 5 and b = 12: _____

2. Find c if a = 8 and b = 15: _____

3. A ladder reaches 16' up a wall and sits 12' from the base. How long is the ladder? _____

4. Is a triangle with sides 7, 24, 25 a right triangle? _____

5. A roof has a run of 15' and rise of 8'. Find the rafter length: _____

Section 6: Working with Angles

Types of Angles

Type	Degrees	Description
Acute	Less than 90°	Sharp angle
Right	Exactly 90°	Square corner
Obtuse	90° to 180°	Wide angle
Straight	Exactly 180°	A straight line

Key Angle Relationships

• **Complementary angles** add up to 90°

• **Supplementary angles** add up to 180°

• **Triangle angles** always sum to 180°

• **Quadrilateral angles** always sum to 360°

Common Angles in Construction

• **45°** — Miter cuts for corners (45° + 45° = 90° corner)

• **90°** — Square corners, perpendicular cuts

• **22.5°** — Octagon corners (8 × 45° ÷ 2)

• **30°-60°-90°** — Common in stair construction

Roof Pitch and Angles

Pitch is expressed as rise over run.

• 4/12 pitch means 4" rise for every 12" run

• Common pitches: 3/12, 4/12, 6/12, 8/12, 12/12

• 12/12 pitch = 45° angle

Practice: Angles

1. Two angles are complementary. One is 35°. What's the other? _____

2. Two angles are supplementary. One is 110°. What's the other? _____

3. A triangle has angles of 45° and 90°. What's the third angle? _____

4. What miter angle is needed to join two boards at a 90° corner? _____

Section 7: Ratios and Mixing

Ratios are essential for mixing concrete, paint, fuel, and other materials.

Understanding Ratios

A ratio of 3:1 means 3 parts of one thing to 1 part of another.

Total parts = 3 + 1 = 4 parts

Concrete Mix Ratios

Standard concrete mix: 1:2:3 (cement : sand : gravel)

Total parts = 1 + 2 + 3 = 6 parts

Example: Mix 18 cu ft of concrete at 1:2:3 ratio.

Each part = 18 ÷ 6 = 3 cu ft

Cement: 1 × 3 = 3 cu ft

Sand: 2 × 3 = 6 cu ft

Gravel: 3 × 3 = 9 cu ft

Two-Stroke Fuel Mix

Common ratio: 50:1 (gasoline : oil)

Example: How much oil for 2 gallons of gas?

2 gallons = 256 oz (2 × 128 oz)

Oil = 256 ÷ 50 = 5.12 oz

Paint Mixing

Example: Mix paint at 4:1 ratio (paint : thinner). Need 5 quarts total.

Total parts = 4 + 1 = 5

Each part = 5 qt ÷ 5 = 1 qt

Paint: 4 qt, Thinner: 1 qt

Scaling Ratios

Example: A recipe calls for 2:5 ratio of A to B. If you have 8 cups of A, how much B?

Set up proportion: 2/5 = 8/x

Cross multiply: 2x = 40

x = 20 cups of B

Practice: Ratios and Mixing

1. A mortar mix is 1:3 (cement:sand). For 20 cu ft total, how much cement? _____

2. Fuel mix is 40:1. How much oil for 3 gallons (384 oz) of gas? _____

3. Paint mix is 3:1. You need 8 quarts total. How much of each? _____

4. Concrete is 1:2:4. For 35 cu ft, how much of each component? _____

Section 8: Percentages: Markup, Discount, Tax

Calculating Markup

Markup is the amount added to cost to set a selling price.

Selling Price = Cost + Markup

Selling Price = Cost × (1 + Markup %)

Example: Materials cost $500. Apply 25% markup.

Selling Price = $500 × 1.25 = $625

OR: Markup = $500 × 0.25 = $125; Selling Price = $500 + $125 = $625

Calculating Discount

Discount is the amount subtracted from a price.

Sale Price = Original × (1 – Discount %)

Example: A $800 tool is 15% off.

Sale Price = $800 × 0.85 = $680

OR: Discount = $800 × 0.15 = $120; Sale Price = $800 – $120 = $680

Calculating Sales Tax

Total = Price × (1 + Tax Rate)

Example: Materials cost $450. Tax rate is 8%.

Total = $450 × 1.08 = $486

Finding Percent Increase/Decrease

% Change = (Amount of Change ÷ Original) × 100

Example: Lumber went from $400 to $520. What's the % increase?

Change = $520 – $400 = $120

% Increase = ($120 ÷ $400) × 100 = 30%

Job Bidding: Cost + Profit

Example: Job costs $3,500 (materials + labor). You want 20% profit.

Bid = $3,500 × 1.20 = $4,200

Practice: Percentages

1. Materials cost $1,200. Apply 30% markup. Selling price? _____

2. A $650 tool is 20% off. Sale price? _____

3. Purchase is $875. Tax is 7.5%. Total? _____

4. Steel went from $500 to $625. Percent increase? _____

5. Job costs $5,000. You want 25% profit. What's your bid? _____

Section 9: Time, Labor, and Wages

Converting Time

Minutes to decimal hours: Divide by 60

45 minutes = 45 ÷ 60 = 0.75 hours

Minutes	Decimal Hours
15 min	0.25 hr
30 min	0.50 hr
45 min	0.75 hr

Calculating Wages

Regular Pay = Hours × Rate

Overtime (over 40 hrs) = Hours × Rate × 1.5

Example: Rate is $28/hr. Worked 48 hours.

Regular: 40 × $28 = $1,120

Overtime: 8 × $28 × 1.5 = $336

Total: $1,120 + $336 = $1,456

Labor Cost Estimating

Labor Cost = Hours × Rate × Number of Workers

Example: Job takes 24 hours. 2 workers at $35/hr.

Labor Cost = 24 × $35 × 2 = $1,680

Production Rates

Example: A worker installs 200 sq ft of flooring in 4 hours.

Rate = 200 ÷ 4 = 50 sq ft/hour

Time for 800 sq ft = 800 ÷ 50 = 16 hours

Practice: Time and Labor

1. Convert 2 hours 20 minutes to decimal hours: _____

2. Pay rate is $32/hr. Worked 45 hours. Calculate total wages with OT: _____

3. Job takes 36 hours. 3 workers at $30/hr. Total labor cost? _____

4. A painter covers 400 sq ft in 5 hours. Rate per hour? _____

5. At that rate, how long to paint 1,000 sq ft? _____

Section 10: Estimating Materials

General Estimating Process

1. Calculate the area or volume needed

2. Determine coverage per unit of material

3. Divide to find quantity needed

4. Add waste factor (usually 10-15%)

5. Round UP to the nearest whole unit you can buy

Lumber Estimating

Board Foot = (Thickness × Width × Length) ÷ 144 (all in inches)

Example: A 2" × 6" × 10' board

Board Feet = (2 × 6 × 120) ÷ 144 = 1,440 ÷ 144 = 10 board feet

Drywall Estimating

Standard sheet: 4' × 8' = 32 sq ft

Example: Walls total 480 sq ft. How many sheets?

Sheets = 480 ÷ 32 = 15 sheets

With 10% waste: 15 × 1.10 = 16.5 → Order 17 sheets

Brick Estimating

Standard: about 7 bricks per sq ft of wall (with mortar joints)

Example: Wall is 120 sq ft.

Bricks = 120 × 7 = 840 bricks

With 5% waste: 840 × 1.05 = 882 bricks

Common Coverage Rates

Material	Coverage
Paint	350-400 sq ft/gallon

Roofing shingles	3 bundles = 1 square (100 sq ft)
Concrete	1 cu yd covers 81 sq ft at 4" thick
Mulch	1 cu yd covers 160 sq ft at 2" deep
Insulation batt	Check bag for sq ft coverage

Practice: Materials Estimating

1. Walls total 640 sq ft. How many 4×8 drywall sheets (with 10% waste)? _____

2. A wall is 200 sq ft. How many bricks at 7/sq ft (with 5% waste)? _____

3. Paint 1,200 sq ft of walls. Coverage is 400 sq ft/gallon. Gallons needed? _____

4. Roof is 2,400 sq ft. How many bundles of shingles? _____

Section 11: Conversion Reference Charts

Length Conversions

From	To	Multiply By
inches	feet	÷ 12
feet	inches	× 12
feet	yards	÷ 3
yards	feet	× 3
inches	centimeters	× 2.54
centimeters	inches	÷ 2.54
feet	meters	× 0.3048
meters	feet	× 3.281

Area Conversions

From	To	Multiply By
sq inches	sq feet	÷ 144
sq feet	sq yards	÷ 9
sq feet	sq meters	× 0.0929
sq meters	sq feet	× 10.764
acres	sq feet	× 43,560

Volume Conversions

From	To	Multiply By
cu feet	cu yards	÷ 27
cu yards	cu feet	× 27
cu feet	gallons	× 7.48
gallons	cu feet	÷ 7.48
liters	gallons	÷ 3.785

Decimal-Fraction Equivalents

Fraction	Decimal	Fraction	Decimal
1/16	0.0625	9/16	0.5625
1/8	0.125	5/8	0.625
3/16	0.1875	11/16	0.6875
1/4	0.25	3/4	0.75
5/16	0.3125	13/16	0.8125
3/8	0.375	7/8	0.875
7/16	0.4375	15/16	0.9375
1/2	0.5	1	1.0

Answer Key

Section 1: Tape Measures

1) 16 2) 3/8 3) 64" 4) 4' 4" 5) 6" 6) 5 1/4"

Section 2: Linear Conversions

1) 84" 2) 8' 3) 15' 4) 25.4 cm 5) 8' 5" 6) 6' 7"

Section 3: Area

1) 252 sq ft 2) 50.27 sq ft 3) $1,536 4) 9.8 squares 5) 2 gallons (432 sq ft ÷ 400)

Section 4: Volume

1) 288 cu ft 2) 7 cu yd 3) 3.33 cu yd (order 4) 4) 50.27 cu ft 5) 376 gallons

Section 5: Pythagorean Theorem

1) 13 2) 17 3) 20' 4) Yes (49+576=625) 5) 17'

Section 6: Angles

1) 55° 2) 70° 3) 45° 4) 45°

Section 7: Ratios and Mixing

1) 5 cu ft 2) 9.6 oz 3) 6 qt paint, 2 qt thinner 4) 5 cement, 10 sand, 20 gravel

Section 8: Percentages

1) $1,560 2) $520 3) $940.63 4) 25% 5) $6,250

Section 9: Time and Labor

1) 2.33 hrs 2) $1,520 3) $3,240 4) 80 sq ft/hr 5) 12.5 hrs

Section 10: Materials Estimating

1) 22 sheets 2) 1,470 bricks 3) 3 gallons 4) 72 bundles

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