Sections 5.1 to 5.3

Measurement

-always an approximation
Significant Digits or Significant Figures

- Digits other than 0 are always significant

- A zero is significant when:
  - it appears between two significant digits
  - it is at the right end of a decimal number
  - it is marked as significant with an overbar

- A zero is NOT significant when:
  - it is at the right end of a whole number
  - it is at the left end of a number

### Examples

- 2.03 ft → 2 sd
- 12.000 in → 5 sd
- 2.560.35 cm → 3 sd
- 3,000 ft → 1 sd
- 3.001 ft → 4 sd
- 3.0025 cm → 5 sd
- 0.0025 cm → 2 sd
- 1.0025 cm → 5 sd
- 13,000,000 mi → 5 sd
- .00350 min → 3 sd
- 150 → 2 sd
Precision and Accuracy

Precision is figured by the right most significant digit

35.3 in $\rightarrow$ precise to tenth of inch.
25,000 ft $\rightarrow$ precise to thousand feet

Accuracy goes with significant digits...more sig digs, more accurate

Addition and Subtraction of Measurements

\[ 3.2 \text{ ft} + 5.18 \text{ ft} = 8.38 \text{ ft} \]
\[ 2 \quad 3 \quad \text{sd} \rightarrow 8.4 \text{ ft} \]

ten\-hundred\-th precision $\rightarrow$ 8.4 ft

\[ 4.760 \text{ cm} - 3.201 \text{ cm} = 1.559 \text{ cm} \]
\[ 4 \quad 1.559 \text{ cm} \]
	hundredths 1.559 cm

\[ 0.0023 \text{ mm} + 1.46 \text{ mm} = 1.4623 \text{ mm} \]
\[ 2 \quad 3 \quad \text{sd} \rightarrow 1.5 \text{ mm} \]
ten\-thousandths hundredths precision $\rightarrow$ 1.46 mm
Multiplication and Division with measurements

\[
2.3 \text{ ft} \times 1.75 \text{ ft} = 4.025 \text{ ft}^2
\]  
\[
\frac{2}{10} \times \frac{3}{100} \text{ ft} \rightarrow 4.0 \text{ ft}^2
\]

\[
2.000 \text{ cm} \div 1.46 \text{ cm} \rightarrow 1.369863014
\]  
\[
\frac{4}{3} \text{ cm} \div \frac{3}{1} \text{ cm} \rightarrow 1.37
\]

\[
.0037 \text{ m} \times 13 \text{ m} = .0481 \text{ m}^2
\]  
\[
\frac{2}{10000} \times \frac{2}{1} \text{ m} \rightarrow .048 \text{ m}^2
\]

\[
15.75 \text{ m} \div 4.2 \text{ m} = 3.75
\]  
\[
\frac{4}{1} \text{ m} \div \frac{2}{1} \text{ m} \rightarrow 3.8
\]

units

\[
\text{feet}^3
\]

\[
\text{feet}^2
\]
We traveled 475 miles over 6.3 hours. How many miles per hour did we travel?

\[
\frac{475 \text{ mi}}{6.3 \text{ hr}} \rightarrow 75.3948254 \text{ mph}
\]

sd \rightarrow 75 \text{ mph}

prec \rightarrow 75 \text{ mph}

---

Decimal Approximations

round to the nearest 16th

\[
\frac{.56}{16} (16) = \frac{8.96}{16} = \frac{9}{16}
\]

.325 to 32nds

\[
\frac{.325}{32} \rightarrow \frac{10.4}{32} = \frac{10}{32} = \frac{5}{16}
\]
5.2 English Units

Converting

Unity Fraction Method or Dimensional Analysis

\[
\frac{6}{3} = \frac{2}{1} = 2 = \frac{12}{6} \\
3 \times 1 = 3 \\
3 \times \frac{5}{3} = 3
\]

6.48 ft = ___________ in

\[
\frac{6.48 \text{ ft}}{1} \times \frac{12 \text{ in}}{1 \text{ ft}} = 77.76 \text{ in} \\
77.8 \text{ in}
\]

2815.7 yd = __________ mi

\[
\frac{2815.7 \text{ yd}}{1} \times \frac{1 \text{ mi}}{1760 \text{ ft}} = 1.599829 \text{ mi} \\
1.5998 \text{ mi}
\]
115 in = \( 9 \text{ ft } \frac{7}{12} \text{ in } \)

\[
\frac{115 \text{ in}}{1} \cdot \frac{1 \text{ ft}}{12 \text{ in}} = 9.583 \text{ ft}
\]

\[
\frac{9 \text{ ft}}{1} \cdot \frac{12 \text{ in}}{1 \text{ ft}} = 108 \text{ in}
\]

**Compound Units - making a fraction of simple units of measurement**

examples

\[
\frac{\text{mi}}{\text{hr}} \quad \frac{\text{lbers}}{\text{in}^2}
\]

\[
\frac{\text{rev}}{\text{min}}
\]
A support beam has a total weight of 10000 pounds on it. If it touches the ground with 150 square inches of area, what is the force excerpted?

\[
\frac{10000 \text{ lbs}}{150 \text{ in}^2} = 66.666 \text{ lbs/in}^2
\]

\[
\rightarrow 70 \text{ lbs/in}^2
\]

Area - second dimension also called square

\[
2.4 \text{ ft}^2 = \boxed{\text{in}^2}
\]
If a farmer has fields that are 120 acres, 155 acres, and 60 acres. How many square feet of land does that farmer own?

So what if the farmer in the previous problem is spraying and charged $.02 per square foot, what is the total cost?
Volume - third dimension also called cubic

\[ 254.7 \text{ ft}^3 = \underline{\text{________________}} \text{ yd}^3 \]

Board Feet = (thickness in inches) \( \times \) (width in feet) \( \times \) (length in feet)

How many board feet of lumber would we need if we are resurfacing the side of a building with 1/2 in x 4 x 8 sheets of plywood and will need 12 sheets.
A camel spider can run 1.75 feet per second, how many miles per hour is that?

5.3 Metric Units

Metric units

- Kilo (k) 1000 units
- Hecto (h) 100 units
- Deka (D) 10 units
- Base unit meter (m), liter (l), gram (g)
- deci (d) tenth of a unit
- centi (c) hundredth of a unit
- milli (m) thousandth of a unit
In Canada the sign says 150 km to the next city, how many miles is that?
How many liters are there in 15.2 gallons?

What car is performing better: one at 15km/liter or one at 22mpg?