Chapters 1 and 2 Summary and Review

This document provides a quick summary and review for Chapters 1 and 2.

Chapter 1: Rates and Unit Conversion

Key Formulas

- Speed: $\text{speed} = \frac{\text{dist}}{\text{time}}$
- Rate: $\text{rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}}$
- Conversions:
  - Distance (imperial): 12 in = 1 ft, 3 ft = 1 yd, 5280 ft = 1 mi
  - Distance (metric): 100 cm = 1 m, 1000 m = 1 km
  - Time: 60 s = 1 min, 60 min = 1 hr, 24 hr = 1 day

Tips: "Given-and-Want" Method

- Identify *what we want*
- Identify *what we are given*
- *Fact finding*: label variables and units; write related formulas
- *Solve systematically*, check units and reasonableness

Example: Lead Sphere (Problem 1.3)

Lead has a density of 11.34 g/cm^3. Find the radius of a lead sphere with a mass of 50 kg.

Solution:

- Want: r = radius
- Given: $d = 11.34$ g/cm^3, $m = 50$ kg
- Fact finding:
  - $\text{density} = \frac{\text{mass}}{\text{volume}}$
  - $V = \frac{4}{3}\pi r^3$
- Solve:
  - Convert mass: 50 kg = 50000 g
  - Volume: $V = \frac{50000}{11.34} \approx 4409.17$ cm^3
  - Radius: $r^3 = \frac{4409.17}{4/3\pi} \approx 1052.61 \implies r \approx 10.17$ cm

Chapter 2: Distance and Coordinate Systems

Key Formulas

- Distance: $\text{dist} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
- Speed: $\text{speed} = \frac{\text{dist}}{\text{time}}$
- Quadratic formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Tips: V.E.T.S. Method

- Visualize: Draw axes, label points, assign variables
- Equations: Write equations for lines, curves, or paths
- Translate: Convert words into math expressions
- Solve: Compute distances/intersections; check answers

Example: Steve & Elsie Walking (Problem 2.3)

Steve and Elsie start at the same campsite. Steve heads north at 3 mph starting at 6 AM; Elsie sleeps in then walks west at 3.5 mph starting at 8 AM. Find when distance between them is 25 miles.

Solution:

- Visualize:
  - Draw axes, origin at campsite
  - Positive y-axis north, negative x-axis west
  - Label times: t_1 = time since 6 AM, t_2 = time since 8 AM
  - Locations: Steve $(0, 3t_1)$, Elsie $(-3.5t_2, 0)$
- Equations:
$$\sqrt{(3t_1)^2 + (3.5t_2)^2} = 25$$
- Translate: Steve has been walking 2 hours longer, so $t_1 = t_2 + 2$:
$$\sqrt{(3(t_2 + 2))^2 + (3.5t_2)^2} = 25$$
- Solve:
$$9(t_2 + 2)^2 + 12.25t_2^2 = 625$$
$$21.25t_2^2 + 36t_2 - 589 = 0$$
Solve for t_2, then $t_1 = t_2 + 2$. I am going to leave that to you. Or ask me on the discussion board if you need a review.

Observations:

- Draw diagrams and label distances to help you get started.
- Define variables clearly, in this problem that was vital.
- At the end check that your answer is reasonable.