1.4 Units – Practice exercises

1. (a) Compare centimeters (cm) and inches, using that 1 inch $\approx$ 2.54 cm

   i. Which is longer: 1 inch or 1 centimeter?

   ii. Kamari is shopping at an internationally-based retail store. She's looking at a curtain rod that will project 10 cm from the wall. What is that in inches?

   $10\text{cm} * \frac{1\text{ inch}}{2.54\text{cm}} = 10 \div 2.54 = 3.93\ldots \approx 4\text{ inches}$

   iii. She also wants a basket no more than 1 foot wide or long to fit on her bookcase. How many centimeters are in a foot?

   $1\text{ foot} * \frac{12\text{ inches}}{1\text{ foot}} * \frac{2.54\text{cm}}{\text{inch}} = 12 \times 2.54 = 30.48 \approx 30\text{ cm}$

   (b) Compare meters (m) and yards using that 1 yard $\approx$ .9144 m

   i. Which is longer: 1 yard or 1 meter?

   ii. Princeton was watching the Olympics and noticed everything was measured in meters. He's curious how long a football field (100 yards) is in meters.

   $100\text{ yds} * \frac{.9144\text{m}}{1\text{ yard}} = 100 \times .9144 = 91.44 \approx 91\text{ meters}$

   iii. Kamari found a really big bath towel she likes. It's 1 meter wide and 1.5 meters long. What are the dimensions in inches? Use that 1 yard = 3 feet.

   $1\text{m} * \frac{1\text{ yard}}{.9144\text{m}} * \frac{3\text{ feet}}{1\text{ yard}} * \frac{12\text{ inch}}{1\text{ foot}} = 1 \div .9144 \times 3 \times 12 = 39.37\ldots \approx 39\text{ inches}$

   $1.5\text{m} * \frac{1\text{ yd}}{.9144\text{m}} * \frac{3\text{ ft}}{1\text{ yd}} * \frac{12\text{ in}}{1\text{ ft}} = 1.5 \div .9144 \times 3 \times 12 = 59.05\ldots \approx 59\text{ inches}$

   (c) Compare kilometers (km) and miles using that 1 mile $\approx$ 1.609 km

   i. Which is longer: 1 mile or 1 kilometer?

   ii. This weekend Princeton and Kamari are doing a 5K run. How many miles long is that? Note: **5K** is short for 5 kilometers.

   $5\text{km} * \frac{1\text{ mile}}{1.609\text{km}} = 5 \div 1.609 = 3.107\ldots \approx 3.1\text{ miles}$

   iii. Princeton is actually in training for a marathon. How many kilometers is that? Note: a **marathon** is approximately 26.2 miles.

   $1\text{ marathon} * \frac{26.2\text{ miles}}{1\text{ marathon}} * \frac{1.609\text{km}}{1\text{ mile}} = 26.2 \times 1.609 = 42.15\ldots \approx 42\text{km}$

2. (a) Yesterday Cameron worked for 2 hours and 15 minutes (that's 2:15) and then went home and studied for 7 hours and 57 minutes (that's 7:57). Convert each time into decimal hours.

$2{:}15 = 2\text{hours} + 15\text{min} * \frac{1\text{ hour}}{60\text{min}} = 2 + 15 \div 60 = \boxed{2.25\text{ hours}}$

$7{:}57 = 7\text{ hours} + 57\text{ min} * \frac{1\text{ hour}}{60\text{ min}} = 7 + 57 \div 60 = \boxed{7.95\text{ hours}}$

(b) Ephriam works at a plant that produces very delicate electronic switches. He measured the lifetime for one switch at 4.18 hours. Another had lifetime 19.50 hours. Convert each time into hours and minutes. *That means H:MM format.*

$4.18\text{ hr} = 4\text{ hr} + .18\text{hr} * \frac{60\text{min}}{1\text{ hr}}$ $\quad .18 \times 60 = 10.8 \approx 11\text{ min}$ $\quad \boxed{4{:}11}$

$19.50\text{hr} = 19\text{hr} + .50\text{hr} * \frac{60\text{min}}{1\text{ hr}}$ $\quad .50 \times 60 = 30\text{min}$ $\quad \boxed{19{:}30}$

(c) Phillip measured his office using a digital measure. One wall is 21.8 feet. The other is 10.2 feet. How long is each wall measured in the more usual feet and inches?

21.8ft $\quad .8\text{ft} * \frac{12\text{in}}{1\text{ft}} = .8 \times 12 = 9.6 \approx 10\text{in} \Rightarrow \boxed{21'10''}$

10.2ft $\quad .2\text{ft} * \frac{12\text{in}}{1\text{ft}} = .2 \times 12 = 2.4 \approx 2\text{in} \Rightarrow \boxed{10'2''}$

(d) The couch Stetson wanted to buy is 92" long and 44" tall. Convert the length and height to feet and inches.

$92\text{in} * \frac{1\text{ft}}{12\text{in}} = 92 \div 12 = 7.66\ldots\text{ft}$ $\quad .66\ldots\text{ft} * \frac{12\text{in}}{1\text{ft}} = .66\ldots \times 12 = 8\text{in} \Rightarrow \boxed{7'8''}$

$44\text{in} * \frac{1\text{ft}}{12\text{in}} = 44 \div 12 = 3.66\ldots\text{ft}$ $\quad$ again $8'' \Rightarrow \boxed{3'8''}$

(e) Abdi volunteers at a food bank. He noticed that the shelf on the back wall was bowing so he measured its length at 12'5". The formula for load needs the length written as a decimal. Convert the length to a decimal number of feet.

$12'5'' = 12\text{ft} + 5\text{in} * \frac{1\text{ft}}{12\text{in}} = 12 + 5 \div 12 = 12.416\ldots \approx \boxed{12.4\text{ft}}$

3. Some people say we should drink 8 glasses of water (or other liquids) every day where a glass is defined as 8 (liquid) ounces.

   (a) Ingrid uses a 20 ounce unbreakable plastic bottle. How many of those does she need to drink each day?

$$\star\ \frac{8\ \text{glasses}}{\text{day}} * \frac{8\ \text{oz}}{\text{glass}} = 8 \times 8 = 64\ \text{oz/day}$$

$$64\text{oz} * \frac{1\ \text{bottle}}{20\text{oz}} = 64 \div 20 = 3.2\ \text{bottles/day}$$

$$\Rightarrow \boxed{\text{just over 3 bottles/day}}$$

   (b) Siri carries around a insulated water bottle that holds .6 liters. How many of those does she need to drink each day? Use that 1 liter $\approx$ 1.057 quarts and 1 quart = 32 (liquid) ounces.

$$64\text{oz} * \frac{1\ \text{bottle}}{.6\ \text{liters}} * \frac{1\ \text{liter}}{1.057\ \text{qts}} * \frac{1\ \text{qt}}{32\text{oz}}$$

$$= 64 \div .6 \div 1.057 \div 32 = 3.153\ldots$$

$$\Rightarrow \boxed{\text{just over 3 bottles/day}}$$

   (c) To meet the recommendation, how much water would one person drink in a year? Give the answer in gallons. Use 1 gallon = 4 quarts.

$$\frac{64\text{oz}}{\text{day}} * \frac{365\ \text{days}}{\text{year}} * \frac{1\ \text{qt}}{32\text{oz}} * \frac{1\ \text{gal}}{4\ \text{qts}}$$

$$= 64 \times 365 \div 32 \div 4 = \boxed{182.5\ \text{gal/year}}$$

4. Jenna is studying in Finland this term and rented an older car to drive.

(a) Gas prices in Finland were 1.658 €/liter. What's the equivalent price in \$/gal? Use 1 € ≈ \$1.23. The symbol € stands for euro.

$$\frac{1.658\text{€}}{\text{liter}} * \frac{\$1.23}{1\text{€}} * \frac{1\text{ liter}}{1.057\text{qts}} * \frac{4\text{qts}}{1\text{ gal}}$$

$$= 1.658 \times 1.23 \div 1.057 \times 4 = 7.717\ldots \approx \boxed{\$7.72/\text{gal}}$$

FROM #3:
1 liter ≈ 1.057 qts
1 gallon = 4 qts

(b) Her car holds 62 liters of gasoline in its tank. How many gallons is that? Use that 1 liter ≈ 1.057 quarts and 1 gallon = 4 quarts.

$$62\text{ liters} * \frac{1.057\text{qt}}{1\text{ liter}} * \frac{1\text{ gal}}{4\text{qts}} = 62 \times 1.057 \div 4 = 16.383\ldots \approx \boxed{16.4\text{ gal}}$$

(c) What would it cost, in euros, for a tank full of gas? In dollars?

$$62\text{ liters} * \frac{1.658\text{€}}{\text{liter}} = 62 \times 1.658 = 102.79 \approx \boxed{103\text{€}}$$

$$102.79\text{€} * \frac{\$1.23}{1\text{€}} = 102.79 \times 1.23 = 126.43\ldots \approx \boxed{\$126}$$

(d) Her car gets 7.6 km/liter. Convert to miles per gallon (mpg). Use 1 liter ≈ 1.057 quarts and 1 gallon = 4 quarts.

$$\frac{7.6\text{ km}}{\text{liter}} * \frac{1\text{ mile}}{1.609\text{km}} * \frac{1\text{ liter}}{1.057\text{qt}} * \frac{4\text{qts}}{1\text{ gal}}$$

$$= 7.6 \div 1.609 \div 1.057 \times 4 = 17.874\ldots \approx \boxed{17.9\text{ mpg}}$$

FROM #1c
1 mile ≈ 1.609 km

(e) Jenna learns that no matter what the road signs might say, the maximum speed limit in Finland in winter is never more than 100 km/hr. How fast is that in miles per hour (mph)?

$$\frac{100\text{ km}}{\text{hr}} * \frac{1\text{ mile}}{1.609\text{km}} = 100 \div 1.609 = 62.15\ldots \approx \boxed{62\text{ mph}}$$