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?

   It takes 2½ cm to make 1 inch.

   4 of the larger unit = 10 of the smaller unit. Yes! That makes sense.

   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?

   set up fractions so units cancel

   divide by #s on bottom

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

   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?

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

   don't know or forget a common conversion? search online or ask someone

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

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

   A yard is about 91% of a meter; less than 100%.

   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.

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

   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.

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

   $1.5\text{m} * \frac{1\text{ yard}}{.9144\text{m}} * \frac{3\text{ feet}}{1\text{ yard}} * \frac{12\text{ inches}}{1\text{ foot}} = 1.5 \div .9144 \times 3 \times 12 = 59.05 \approx 59\text{in}$

   Towel is 39" x 59"

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

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

   It takes more than 1 km to be a mile.

   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.*

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

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

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

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

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

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

$44\text{in} * \frac{1\text{ft}}{12\text{in}} = 44 \div 12 = 3.66\ldots\text{ft}$ 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 bottles full of water does she need to drink each day?

see how we're using the info as if it were unit conversions?

$$8 \text{ glasses} * \frac{8 \text{ ounces}}{\text{glass}} * \frac{1 \text{ bottle}}{20 \text{ ounces}} = 8 \times 8 \div 20 = 3.2$$

⇒ Ingrid should drink 3+ bottles/day

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

$$8 \text{ glasses} * \frac{8 \text{ ounces}}{\text{glass}} * \frac{1 \text{ quart}}{32 \text{ ounces}} * \frac{1 \text{ liter}}{1.057 \text{ quarts}} * \frac{1 \text{ bottle}}{.6 \text{ liters}}$$

$$= 8 \times 8 \div 32 \div 1.057 \div .6 = 3.153\ldots$$

Siri should also drink 3+ bottles/day

hey-notice

$$.6 \text{ liters} * \frac{32 \text{ ounces}}{\text{liter}}$$

$= .6 \times 32 = 19.2$

≈ 20 ounces

So Siri's bottle is about the same size as Ingrid's

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

$$1 \text{ year} * \frac{365 \text{ days}}{\text{year}} * \frac{8 \text{ glasses}}{1 \text{ day}} * \frac{8 \text{ ounces}}{1 \text{ glass}} * \frac{1 \text{ quart}}{32 \text{ ounces}} * \frac{1 \text{ gal}}{4 \text{ quarts}}$$

$$= 365 \times 8 \times 8 \div 32 \div 4 = 182.5 \text{ gallons}$$

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

(a) She 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)? Use 1 mile ≈ 1.609 km.

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

The speed limit is 62 mph.

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

$62\,\ell * \frac{1.057\text{ qt}}{1\,\ell} * \frac{1\text{ gal}}{4\text{ qts}} = 62 \times 1.057 \div 4 = 16.38... \approx 16.4\text{ gal}$

Her car holds 16.4 gallons of gasoline.

(c) Her car gets 7.6 km/liter. Convert to miles per gallon (mpg).

$\frac{7.6\text{ km}}{\ell} * \frac{1\text{ mile}}{1.609\text{ km}} * \frac{1\,\ell}{1.057\text{ qt}} * \frac{4\text{ qts}}{1\text{ gal}} = 76 \div 1.609 \div 1.057 \times 4 = 17.87... \approx 17.9\text{ mpg}$

Jenna's car gets about 17.9mpg.

not very good fuel efficiency by today's standards – but it is an older car.

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

$\frac{1.658\text{€}}{\ell} * \frac{\$1.23}{1\text{€}} * \frac{1\,\ell}{1.507\text{ qt}} * \frac{4\text{ qts}}{1\text{ gal}}$

$= 1.658 \times 1.23 \div 1.507 \times 4 = 7.717.. \approx \$7.72/\text{gal}$

Wow!

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

euros: $\text{full tank} \overset{(b)}{=} 62\,\ell * \frac{1.658\text{€}}{\ell} = 62 \times 1.658 = 102.79 \approx 103\text{€}$

dollars: $102.79\text{€} * \frac{\$1.23}{1\text{€}} = 102.79 \times 1.23 = 126.43.. \approx \$126$

note: $16.4\text{ gal} * \frac{\$7.72}{\text{gal}}$ (b) (d)

$= 16.4 \times 7.72 = 126.60.. \approx 127$

due to round off