Example 1 Convert Between SI and Imperial Units for Length

Researchers at the Harvard-Smithsonian Center for Astrophysics made an announcement in January, 2001. They stated that they had "frozen light" by using super-cooled vapour to slow the speed of light waves to zero. The speed of light in a vacuum is defined as 299 792 458 m/s.

a) Estimate the speed of light in miles per second.

c) Calculate the answer, to the nearest mile per second.

a) 1 000 m = 0.621 mi

appr. 1000 m = 0.6 mi

$\frac{1000\text{ m}}{0.6\text{ mi}} = \frac{300\,000\,000}{x}$

$x = 180000$ mi/s.

c) 1 000 m = 0.621 mi

$\frac{1000\text{ m}}{0.621\text{ mi}} = \frac{299\,792\,458\text{ m}}{x}$ $\Rightarrow x = 186\,171.1$ mi/s

$= 186171$ mi/s.

Example 2 Solve a Problem Involving Linear Measurements

Your class needs to lay mats on the gymnasium floor for a gymnastics meet. The gym measures 84' by 50'. A scale drawing of one mat is shown. The scale is 1:30.5.

A classmate thinks that 131 mats are needed. Do you agree? Explain.

No, you can cover w/ 126.

Each mat in the scale drawing is 8 cm by 4 cm.

$\ell = 8 \times SF$ $\quad w = 4 \times SF$

$= 8 \times 30.5$ $\quad = 4 \times 30.5$

$= 244$ cm $\quad = 122$ cm

Conversion Rate

100 cm = 3.281 ft

$\frac{100\text{ cm}}{3.281\text{ ft}} = \frac{244\text{ cm}}{\ell}$ $\quad \ell = 8$ ft

$\frac{100\text{ cm}}{3.281\text{ ft}} = \frac{122\text{ cm}}{w}$ $\quad w = 4$ ft.

$84 \div 8 = 10$ mats

$50 \div 4 = 12$ mats

$A = 10 \times 12$

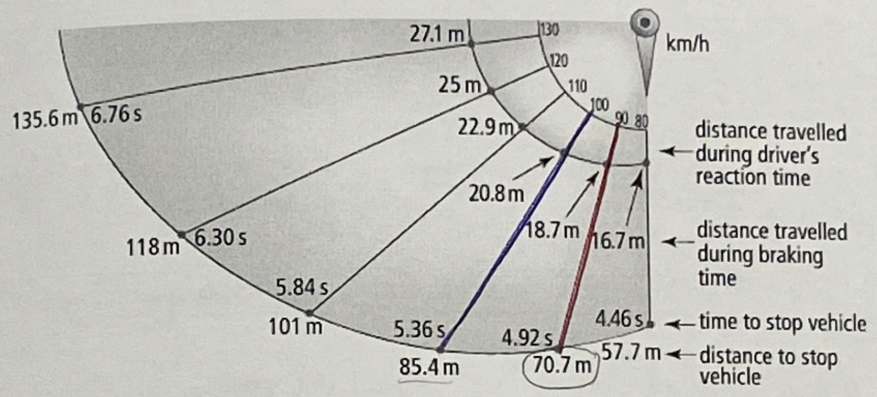
$= 120$ mats

$84 \div 4 = 21$

$50 \div 8 = 6$

$A = 21 \times 6$

$= 126$ mats



Example 3 Determine Stopping Distances

The distance required to stop a moving vehicle is the sum of the distances travelled during the reaction time and the braking time. The diagram shows the theoretical stopping distance at various speeds.

a) What factors might affect the reaction time and braking distances?

b) If a vehicle is travelling at 100 km/h, approximately what distance is travelled while the brakes are being applied?

c) Convert 55 mph into kilometres per hour. What is the approximate stopping distance when a vehicle is travelling at this speed? Express your answer in feet.

a) Road conditions, visibility, tired

b) Total - reaction distance

85.4 m - 20.8 m

= 64.6 m while braking

c) 1 mi = 1.609 km

$\frac{1\text{ mi}}{1.609\text{ km}} = \frac{55\text{ mi}}{x}$

88.5 km/h.

→ 90 km/h

Stopping distance

→ 70.7 m

1 m = 3.281 ft

$\frac{1\text{ m}}{3.281\text{ ft}} = \frac{70.7\text{ m}}{x}$

$x = 232$ ft