Learning Intentions:

- Draw and interpret scale diagrams that represent reductions.

Example 1: Maps

What is a **MAP**? A diagram or other visual representation that shows the relative position of the parts of something.

Each map has a SCALE. In the textbook, scales are written as **diagram : original**

Example 1: Interpret what the following scales mean.

(a) 1: 300 → original (diagram)

- The diagram is 300 times smaller than the original.

(b) 1: 2 500 000 → original (diagram)

The original is 2500 000 times larger than the diagram.

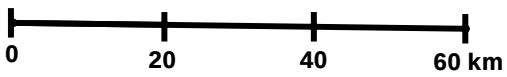
The number in (b) is quite big. There is another way we can represent the scale.

1 : 2 500 000 can be written as **1 cm : 25 km**

$1\text{ cm} : 2500\,000\text{ cm}$

$$2500000\text{ cm} \times \frac{1\text{ m}}{100\text{ cm}} \times \frac{1\text{ km}}{1000\text{ m}} = 25\text{km}$$

Some scales are shown as pictures:



This scale shows that 1 cm on the map represents 1 km Written as a ratio: 1 : 100000 (diagram : original)

Examples Solve for the missing measurement for each example.

(a) St. John's is 2125 km from Toronto. How far apart are they on a map with a scale of 1:50 000 000? (diagram : original)

$$\frac{1}{50\,000\,000} = \frac{x}{2125\text{ km}}$$

$$\frac{2125\text{km}}{50\,000\,000} = \frac{x \times 50\,000\,000}{50\,000\,000} = 0.0000425\text{ km} = 4.25\text{ cm}$$

(b) If the distance between two cities on a map is 8cm, and the map uses a scale of 1cm: 100km, find the actual distance on the Earth.

$$\frac{1\text{cm}}{100\text{km}} \overset{\times 8}{=} \frac{8\text{cm}}{800\text{ km}}$$

(×8)

Application 1: When working with maps that represent large area, we will use a ruler to measure the distances that cities lie apart from each other.

Scale: 1cm : 460 km

(a) If the scale of the map of Canada is 1cm = 460km, what is the actual distance between Calgary and Halifax?

$\frac{1\text{cm}}{460\text{km}} \xrightarrow{\times 8} \frac{8\text{cm}}{3680\text{ km}}$

(b) If the scale of the map of Canada is 1cm = 460km, how much farther in kilometres is it between Calgary and Halifax than between Vancouver and Winnipeg?

$\frac{1\text{cm}}{460\text{km}} \xrightarrow{\times 3.2} \frac{3.2\text{cm}}{1472\text{ km}}$

$3680\text{km} - 1472\text{km} = 2208\text{km}$

(c) If the distance between Fort McMurray and Winnipeg is 1200km, what is the scale of the map of Canada?

$3\text{cm} : 1200\text{km} = 1\text{cm} : 400\text{km}$

(d) If it is 2600km between Saskatoon and Montreal, how far is it between Vancouver and Toronto?

$5.5\text{cm} : 2600\text{km}$

$1\text{cm} : 472.72\text{km}$

$\frac{1\text{cm}}{472.72\text{km}} \xrightarrow{7.5\text{cm}} \frac{7.5\text{cm}}{3545.4\text{km}}$

Application #2: Road Maps

1. The official road map of Ontario has a scale of 1:700 000. Explain what this ratio means.

The map is 700 000 times smaller

2. How many kilometres does 1 cm on the map represent?

1cm = 700 000cm on the map. $700\,000\text{cm} \times \frac{1\text{ m}}{100\text{cm}} \times \frac{1\text{ km}}{1000\text{ m}} = 7\text{km}$

3. Calculate the actual distances represented on the official Ontario road map by:

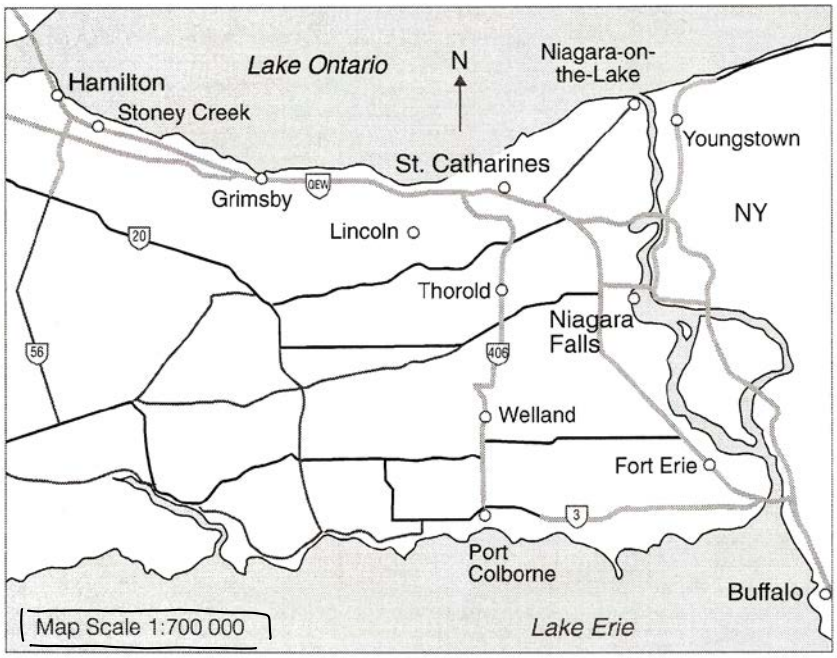
(a) 3 cm

$\frac{1\text{ cm}}{700\,000\text{cm}} = \frac{3\text{ cm}}{2\,100\,000\text{ cm}}$ (×3)

(b) 0.8 cm

$\frac{1\text{cm}}{700\,000\text{cm}} = \frac{0.8\text{cm}}{875\,000\text{cm}}$ (×0.8)

4. Use this map to complete the table of driving distances.



Hint
A piece of string is a handy tool for measuring distances on the map when the roads are not straight.

Trip	Distance on Map (nearest 0.1 cm)	Actual Driving Distance (nearest km)
St. Catharines to Fort Erie		
Niagara-on-the-Lake to Welland		
Thorold to Youngstown, NY		
Port Colborne to Grimsby		