Chapter 4 Task Level 3 Sample Solution

a) Sarnia to Niagara Falls is 1.6 cm. The map I used has a scale of 1:18 000 000.
So actual distance = 1.6 × 180 km
= 288 km
b) From the web link, the distance is 275 km.
c) Percent error = 3/275 × 100
= +1.09
d) Iqaluit to Yellowknife is 12 cm on the map.
So the actual distance is 12 × 180 or 2160 km.
From the web link, the distance is 2271 km.
Percent error = −111/2271 × 100
= −4.89
e) The error was greater for the Northern cities. This might be due to the map giving a slightly distorted image, but it might also just be a measuring error as the Northern cities are further apart.
f) The map I worked from used Lambert Conformal Conical Projection.

$$\tan\left(45° + \frac{L°}{2}\right) = \frac{\tan 45° + \tan\frac{L°}{2}}{1 - \tan 45° \tan\frac{L°}{2}}$$

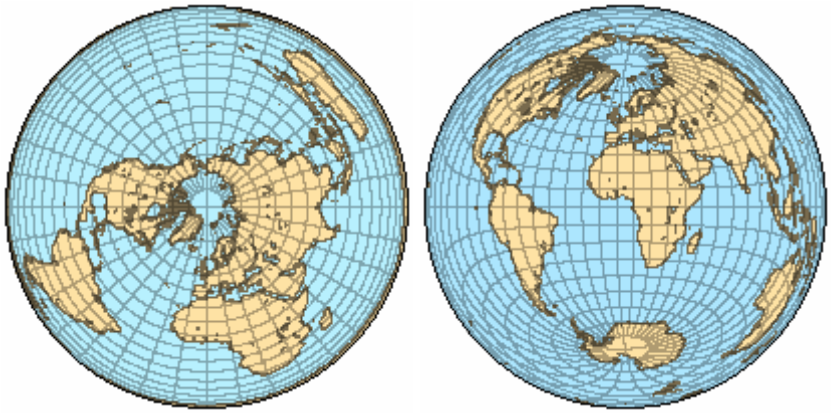
$$= \frac{1 + \tan\frac{L°}{2}}{1 - \tan\frac{L°}{2}}$$

When L is 60, the value $= \frac{1 + \tan 30°}{1 - \tan 30°}$

$\doteq 3.73$

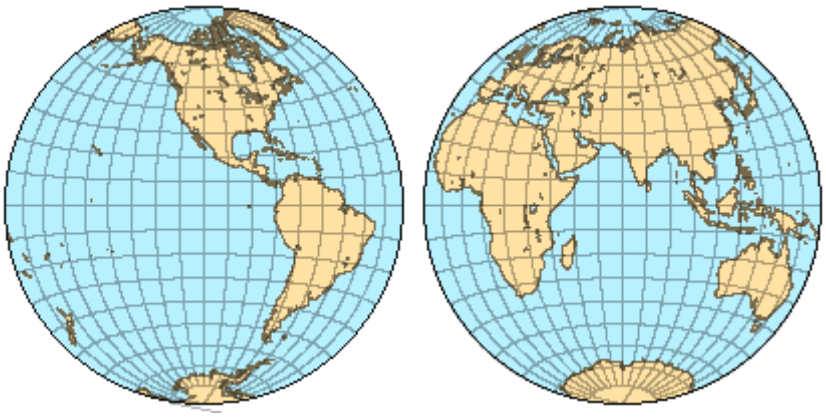
Distance errors occur because the curved land is "flattened out". On maps of Canada, the South is likely to be drawn with distances truest to the given scale.
f) Two other map projections used in the atlases I looked at are Zenithal equidistant and Lambert's Equivalent Azimuthal.
There are many variations on map projections: here is a sample of information that I found on the Internet. A search for "Map projections" yields lots more.

Lambert's Azimuthal Equal-area Projection



North polar aspect

Equatorial aspect, central meridian 5°E



Western hemisphere, central meridian 110°W

Eastern hemisphere, central meridian 70°E

Azimuthal equal-area maps