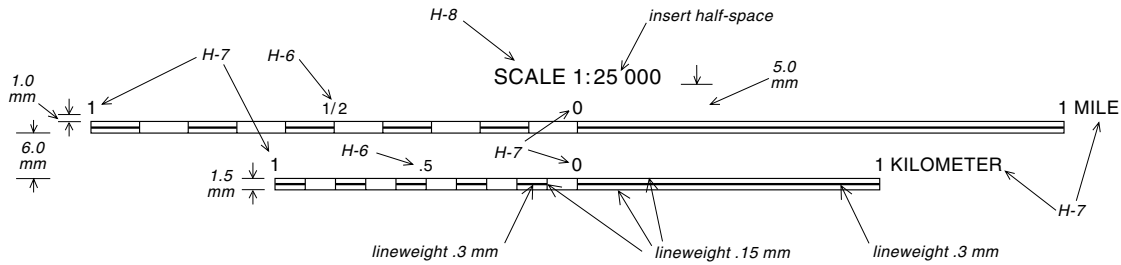


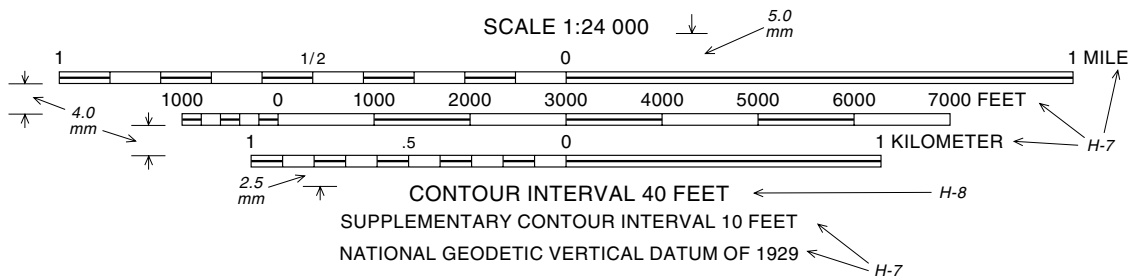
### 35—BAR SCALES

#### CARTOGRAPHIC SPECIFICATIONS

#### 2 UNITS OF MEASUREMENT:



#### 3 UNITS OF MEASUREMENT:



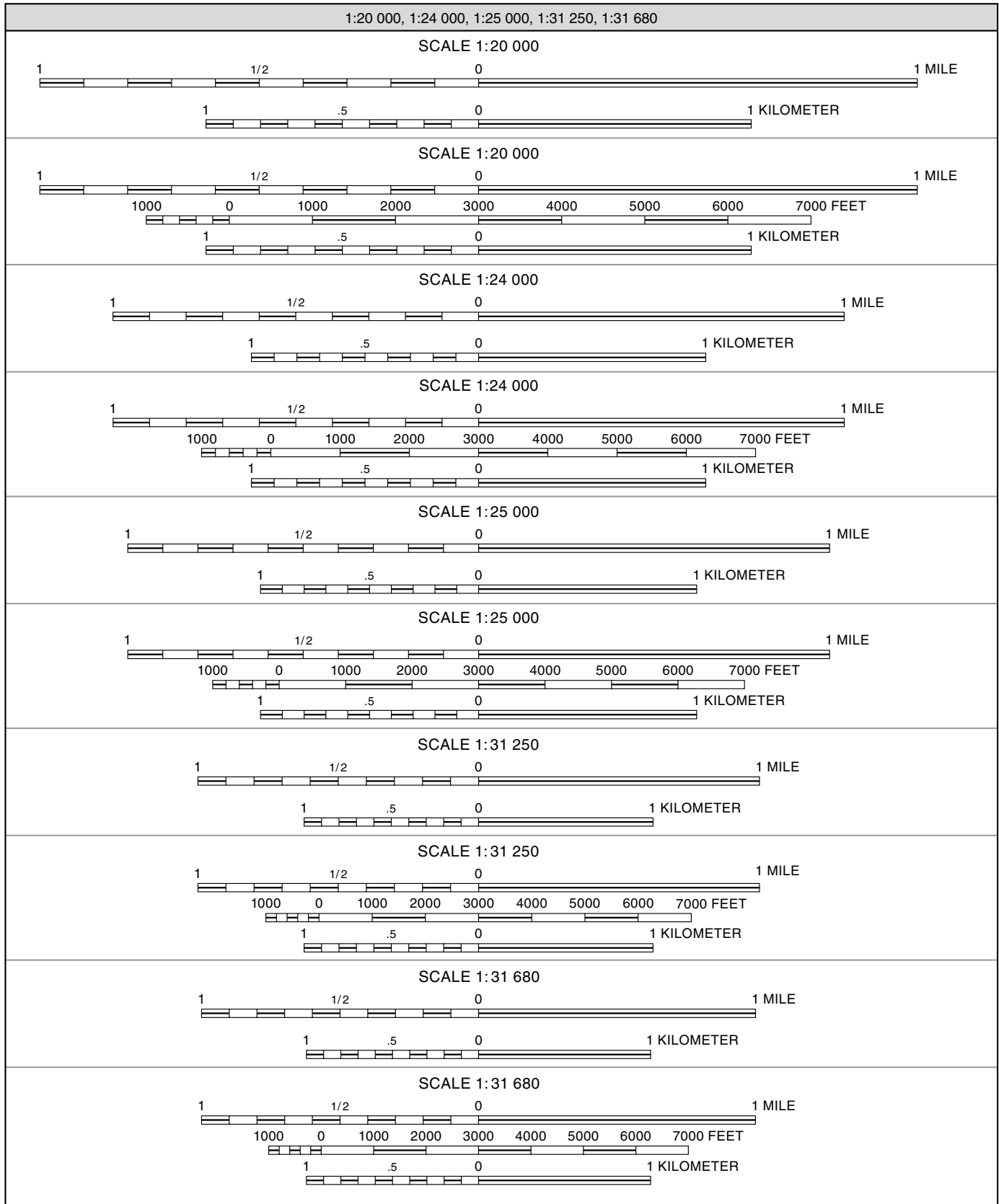
#### DISTANCE MEASURES

#### MEASUREMENT EQUIVALENTS

DISTANCE MEASURES		MEASUREMENT EQUIVALENTS	
		Metric	English
1 mile (mi)	= 63,360 inches (in) = 5,280 feet (ft)	1 millimeter (mm) = 1/10 cm = 1/1000 m	= 0.039 in
1 kilometer (km)	= 3,280.833 ft = 0.62137 mi	1 centimeter (cm) = 10 mm = 1/100 m	= 0.393 in
		1 meter (m) = 100 cm = 1,000 mm = 1/1,000 km	= 39.37 in or 3.28 ft or 0.00062 mi
		1 kilometer (km) = 1,000 m = 100,000 cm = 1,000,000 mm	= 3,280.833 ft or 0.62137 mi

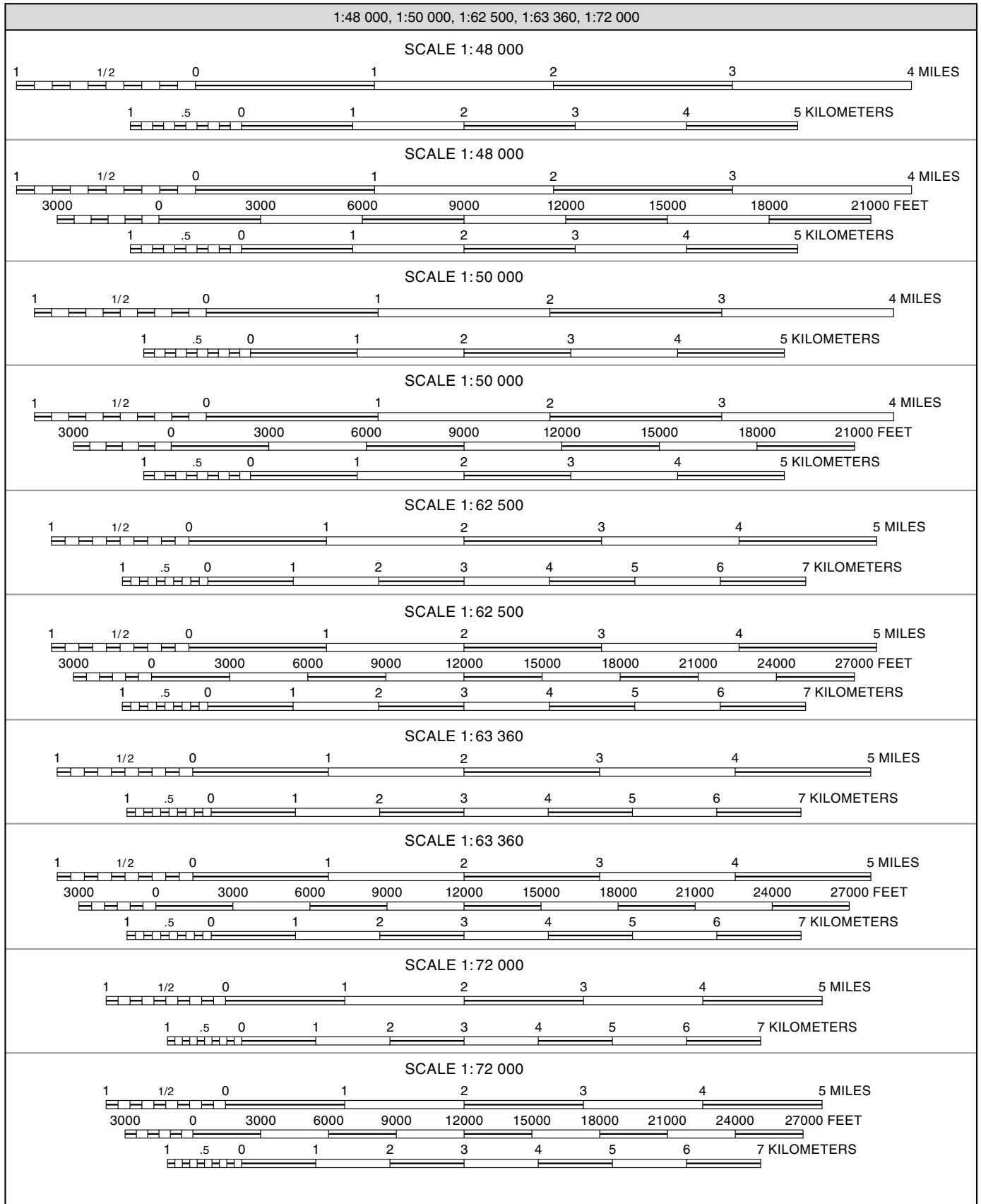
**35—BAR SCALES (continued)**

1:20 000, 1:24 000, 1:25 000, 1:31 250, 1:31 680



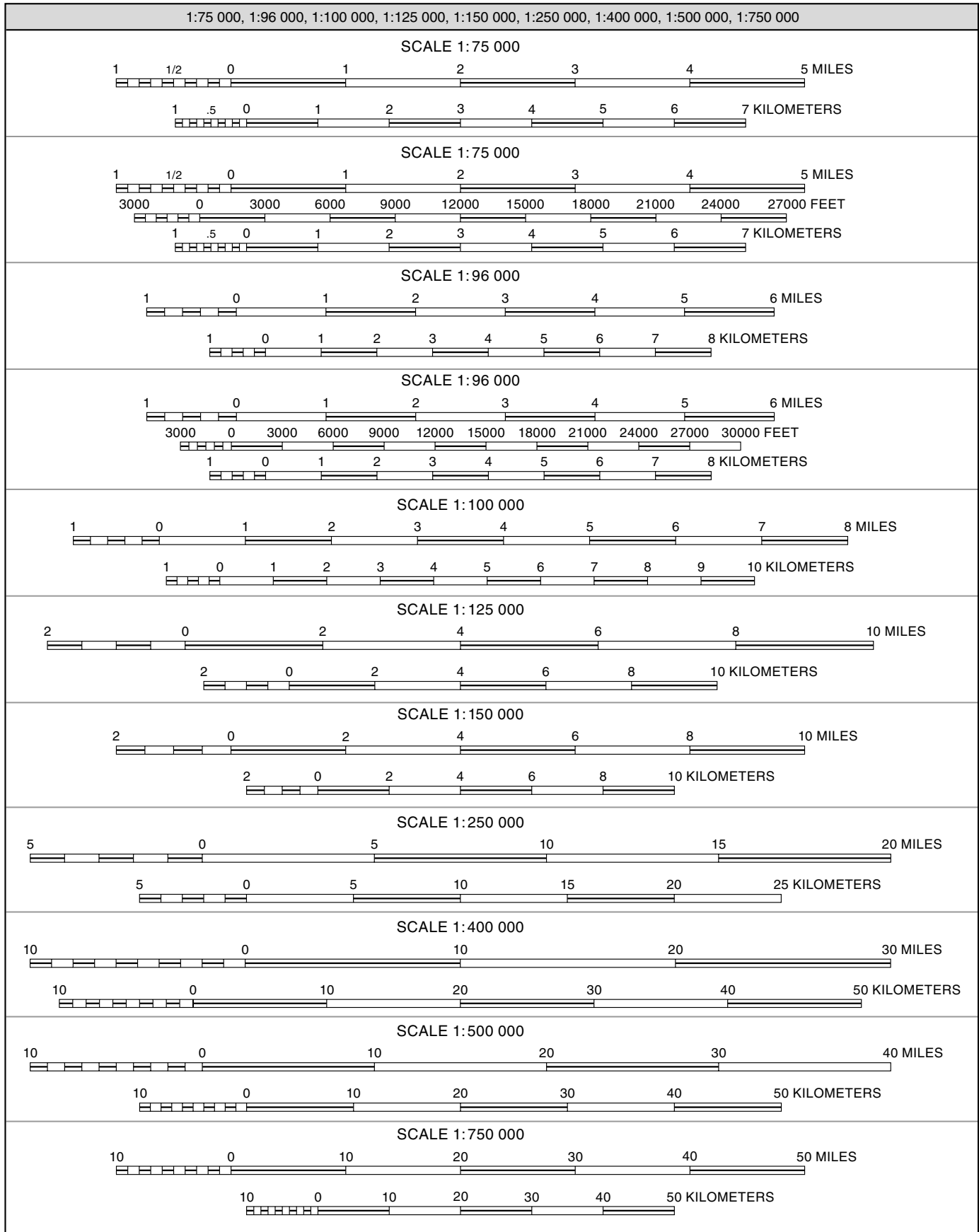
**35—BAR SCALES (continued)**

1:48 000, 1:50 000, 1:62 500, 1:63 360, 1:72 000



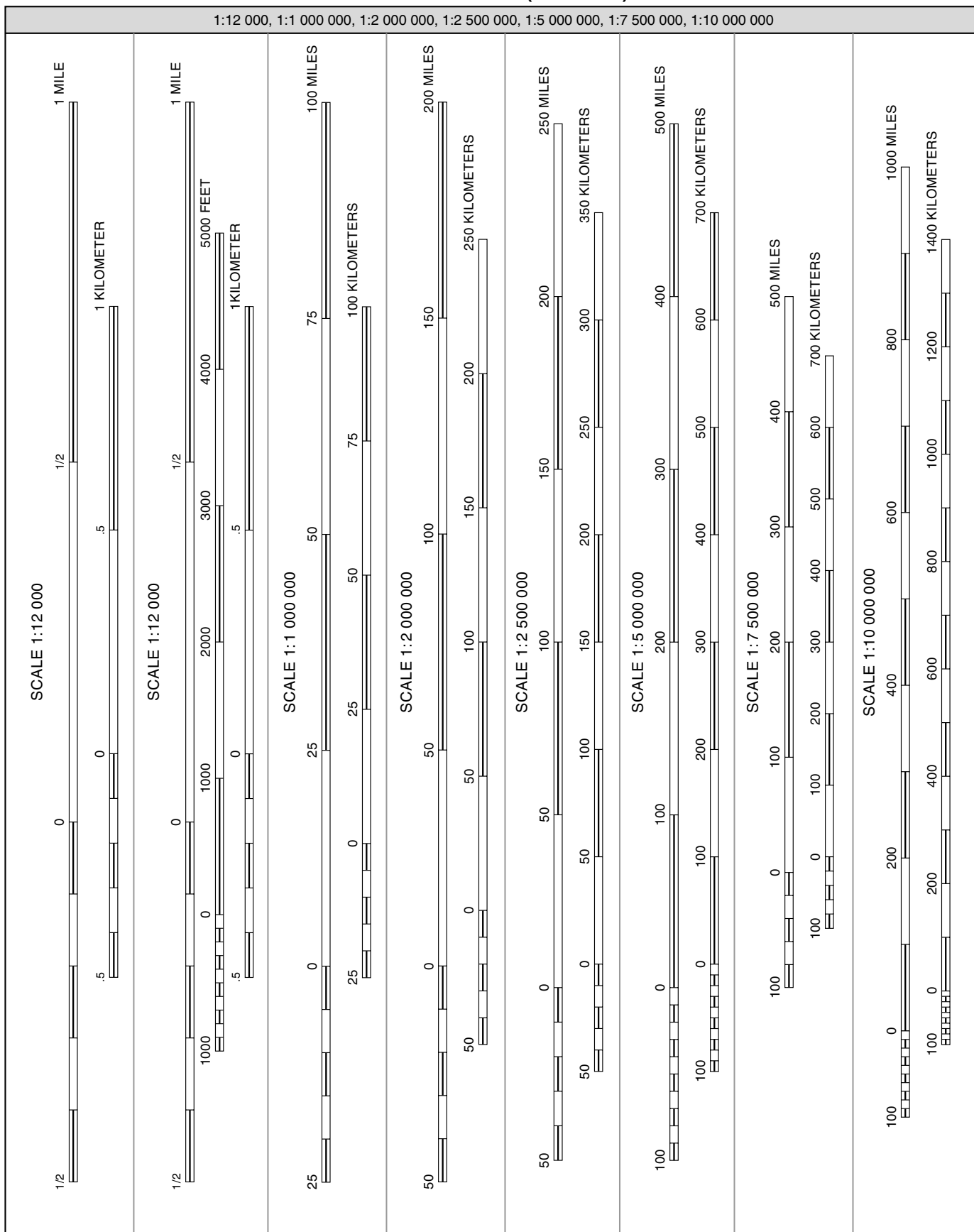
**35—BAR SCALES (continued)**

1:75 000, 1:96 000, 1:100 000, 1:125 000, 1:150 000, 1:250 000, 1:400 000, 1:500 000, 1:750 000



**35—BAR SCALES (continued)**

1:12 000, 1:1 000 000, 1:2 000 000, 1:2 500 000, 1:5 000 000, 1:7 500 000, 1:10 000 000



**35—BAR SCALES (continued)**

BAR SCALE CALCULATIONS — MILES (1 mile = 63,360 inches)							
FRACTIONAL SCALE	SCALE TO MAP REPRESENTATION		TO FIND MILES PER INCH (x in ratio)	MILES PER INCH	TOTAL MILES ON SCALE	TO FIND TOTAL SCALE LENGTH IN INCHES (y in ratio)	TOTAL SCALE LENGTH (INCHES)
	Scale Unit :	represents Map Unit	Use ratio below or $\frac{\text{SCALE}}{63\ 360}$			Use ratio below or $\frac{\text{Miles on scale}}{\text{Miles per inch}}$	
1:12 000	1 inch	12 000 in	$\frac{63\ 360}{1} = \frac{12\ 000}{x}$	0.1893939	1.5	$\frac{0.1893939}{1} = \frac{1.5}{y}$	7.920
1:20 000	1 inch	20 000 in	$\frac{63\ 360}{1} = \frac{20\ 000}{x}$	0.3156565	2	$\frac{0.3156565}{1} = \frac{2}{y}$	6.336
1:24 000	1 inch	24 000 in	$\frac{63\ 360}{1} = \frac{24\ 000}{x}$	0.3787878	2	$\frac{0.3787878}{1} = \frac{2}{y}$	5.280
1:25 000	1 inch	25 000 in	$\frac{63\ 360}{1} = \frac{25\ 000}{x}$	0.3945707	2	$\frac{0.3945707}{1} = \frac{2}{y}$	5.068
1:31 250	1 inch	31 250 in	$\frac{63\ 360}{1} = \frac{31\ 250}{x}$	0.4932133	2	$\frac{0.4932133}{1} = \frac{2}{y}$	4.055
1:31 680	1 inch	31 680 in	$\frac{63\ 360}{1} = \frac{31\ 680}{x}$	0.500	2	$\frac{0.500}{1} = \frac{2}{y}$	4.000
1:48 000	1 inch	48 000 in	$\frac{63\ 360}{1} = \frac{48\ 000}{x}$	0.7575757	5	$\frac{0.7575757}{1} = \frac{5}{y}$	6.600
1:50 000	1 inch	50 000 in	$\frac{63\ 360}{1} = \frac{50\ 000}{x}$	0.7891414	5	$\frac{0.7891414}{1} = \frac{5}{y}$	6.336
1:62 500	1 inch	62 500 in	$\frac{63\ 360}{1} = \frac{62\ 500}{x}$	0.9864267	6	$\frac{0.9864267}{1} = \frac{6}{y}$	6.082
1:63 360	1 inch	63 360 in	$\frac{63\ 360}{1} = \frac{63\ 360}{x}$	1.000	6	$\frac{1.000}{1} = \frac{6}{y}$	6.000
1:72 000	1 inch	72 000 in	$\frac{63\ 360}{1} = \frac{72\ 000}{x}$	1.1363636	6	$\frac{1.1363636}{1} = \frac{6}{y}$	5.280
1:75 000	1 inch	75 000 in	$\frac{63\ 360}{1} = \frac{75\ 000}{x}$	1.1837121	6	$\frac{1.1837121}{1} = \frac{6}{y}$	5.068
1:96 000	1 inch	96 000 in	$\frac{63\ 360}{1} = \frac{96\ 000}{x}$	1.5151515	7	$\frac{1.5151515}{1} = \frac{7}{y}$	4.620
1:100 000	1 inch	100 000 in	$\frac{63\ 360}{1} = \frac{100\ 000}{x}$	1.5782828	9	$\frac{1.5782828}{1} = \frac{9}{y}$	5.702
1:125 000	1 inch	125 000 in	$\frac{63\ 360}{1} = \frac{125\ 000}{x}$	1.9728535	12	$\frac{1.9728535}{1} = \frac{12}{y}$	6.082
1:150 000	1 inch	150 000 in	$\frac{63\ 360}{1} = \frac{150\ 000}{x}$	2.3674242	12	$\frac{2.3674242}{1} = \frac{12}{y}$	5.068

<b>To find miles per inch on 1: 12 000 map . . .</b>		<b>Solution . . .</b>	$63\ 360 \cdot x = 12\ 000 \cdot 1$
63,360 inches = 1 mile Show in ratio as ...	Let SCALE (12 000) be in inches Fractional scale says 1 inch represents 12,000 in Let x be miles that 1 inch represents on map Show in ratio as ...	$\frac{63\ 360}{1} = \frac{12\ 000}{x}$	$\frac{63\ 360 x}{63\ 360} = \frac{12\ 000}{63\ 360}$
$\frac{63\ 360}{1}$ inches miles	$\frac{12\ 000}{x}$ inches miles		$x = \frac{12\ 000}{63\ 360}$ (SCALE)
			$x = 0.1893939$

**35—BAR SCALES (continued)**

BAR SCALE CALCULATIONS — MILES (1 mile = 63,360 inches)—continued							
FRACTIONAL SCALE	SCALE TO MAP REPRESENTATION		TO FIND MILES PER INCH (x in ratio)	MILES PER INCH	TOTAL MILES ON SCALE	TO FIND TOTAL SCALE LENGTH IN INCHES (y in ratio)	TOTAL SCALE LENGTH (INCHES)
	Scale Unit	represents Map Unit	Use ratio below or $\frac{\text{SCALE}}{63\,360}$			Use ratio below or $\frac{\text{Miles on scale}}{\text{Miles per inch}}$	
1:250 000	1 inch	250 000 in	$\frac{63\,360}{1} = \frac{250\,000}{x}$	3.945707	25	$\frac{3.945707}{1} = \frac{25}{y}$	6.336
1:400 000	1 inch	400 000 in	$\frac{63\,360}{1} = \frac{400\,000}{x}$	6.3131313	40	$\frac{6.3131313}{1} = \frac{40}{y}$	6.336
1:500 000	1 inch	500 000 in	$\frac{63\,360}{1} = \frac{500\,000}{x}$	7.8914141	50	$\frac{7.8914141}{1} = \frac{50}{y}$	6.336
1:750 000	1 inch	750 000 in	$\frac{63\,360}{1} = \frac{750\,000}{x}$	11.837121	60	$\frac{11.837121}{1} = \frac{60}{y}$	5.068
1:1 000 000	1 inch	1 000 000 in	$\frac{63\,360}{1} = \frac{1\,000\,000}{x}$	15.782828	125	$\frac{15.782828}{1} = \frac{125}{y}$	7.920
1:2 000 000	1 inch	2 000 000 in	$\frac{63\,360}{1} = \frac{2\,000\,000}{x}$	31.565656	250	$\frac{31.565656}{1} = \frac{250}{y}$	7.920
1:2 500 000	1 inch	2 500 000 in	$\frac{63\,360}{1} = \frac{2\,500\,000}{x}$	39.45707	300	$\frac{39.45707}{1} = \frac{300}{y}$	7.603
1:5 000 000	1 inch	5 000 000 in	$\frac{63\,360}{1} = \frac{5\,000\,000}{x}$	78.914141	600	$\frac{78.914141}{1} = \frac{600}{y}$	7.603
1:7 500 000	1 inch	7 500 000 in	$\frac{63\,360}{1} = \frac{7\,500\,000}{x}$	118.37121	600	$\frac{118.37121}{1} = \frac{600}{y}$	5.068
1:10 000 000	1 inch	10 000 000 in	$\frac{63\,360}{1} = \frac{10\,000\,000}{x}$	157.82828	1100	$\frac{157.82828}{1} = \frac{1100}{y}$	6.969

**To find miles per inch on 1: 250 000 map . . .**

63,360 inches = 1 mile  
 Show in ratio as ...  
 $\frac{63\,360}{1} \frac{\text{inches}}{\text{miles}}$

Let SCALE (250 000) be in inches  
 Fractional scale says 1 inch represents 250,000 in  
 Let x be miles that 1 inch represents on map  
 Show in ratio as ...  
 $\frac{250\,000}{x} \frac{\text{inches}}{\text{miles}}$

**Solution . . .**

$$63\,360 \cdot x = 250\,000 \cdot 1$$

$$\frac{63\,360}{1} = \frac{250\,000}{x}$$

$$\frac{63\,360 x}{63\,360} = \frac{250\,000}{63\,360}$$

$$x = \frac{250\,000}{63\,360} \text{ (SCALE)}$$

$$x = \frac{250\,000}{63\,360}$$

$$x = 3.945707$$

**35—BAR SCALES (continued)**

BAR SCALE CALCULATIONS — FEET (1 foot = 12 inches)							
FRACTIONAL SCALE	SCALE TO MAP REPRESENTATION		TO FIND FEET PER INCH (x in ratio)	FEET PER INCH	TOTAL FEET ON SCALE	TO FIND TOTAL SCALE LENGTH IN INCHES (y in ratio)	TOTAL SCALE LENGTH (INCHES)
	Scale Unit :	represents Map Unit	Use ratio below or $\frac{SCALE}{12}$			Use ratio below or $\frac{Feet\ on\ scale}{Feet\ per\ inch}$	
1:12 000	1 inch	12 000 in	$\frac{12}{1} = \frac{12\ 000}{x}$	1000.000	6000	$\frac{1000.000}{1} = \frac{6000}{y}$	6.000
1:20 000	1 inch	20 000 in	$\frac{12}{1} = \frac{20\ 000}{x}$	1666.6666	8000	$\frac{1666.6666}{1} = \frac{8000}{y}$	4.800
1:24 000	1 inch	24 000 in	$\frac{12}{1} = \frac{24\ 000}{x}$	2000.000	8000	$\frac{2000.000}{1} = \frac{8000}{y}$	4.000
1:25 000	1 inch	25 000 in	$\frac{12}{1} = \frac{25\ 000}{x}$	2083.3333	8000	$\frac{2083.3333}{1} = \frac{8000}{y}$	3.840
1:31 250	1 inch	31 250 in	$\frac{12}{1} = \frac{31\ 250}{x}$	2604.1666	8000	$\frac{2604.1666}{1} = \frac{8000}{y}$	3.072
1:31 680	1 inch	31 680 in	$\frac{12}{1} = \frac{31\ 680}{x}$	2640.000	8000	$\frac{2640.000}{1} = \frac{8000}{y}$	3.030
1:48 000	1 inch	48 000 in	$\frac{12}{1} = \frac{48\ 000}{x}$	4000.000	24 000	$\frac{4000.000}{1} = \frac{24\ 000}{y}$	6.000
1:50 000	1 inch	50 000 in	$\frac{12}{1} = \frac{50\ 000}{x}$	4166.6666	24 000	$\frac{4166.6666}{1} = \frac{24\ 000}{y}$	5.760
1:62 500	1 inch	62 500 in	$\frac{12}{1} = \frac{62\ 500}{x}$	5208.3333	30 000	$\frac{5208.3333}{1} = \frac{30\ 000}{y}$	5.760
1:63 360	1 inch	63 360 in	$\frac{12}{1} = \frac{63\ 360}{x}$	5280.000	30 000	$\frac{5280.000}{1} = \frac{30\ 000}{y}$	5.681
1:72 000	1 inch	72 000 in	$\frac{12}{1} = \frac{72\ 000}{x}$	6000.000	30 000	$\frac{6000.000}{1} = \frac{30\ 000}{y}$	5.000
1:75 000	1 inch	75 000 in	$\frac{12}{1} = \frac{75\ 000}{x}$	6250.000	30 000	$\frac{6250.000}{1} = \frac{30\ 000}{y}$	4.800
1:96 000	1 inch	96 000 in	$\frac{12}{1} = \frac{96\ 000}{x}$	8000.000	33 000	$\frac{8000.000}{1} = \frac{33\ 000}{y}$	4.125

To find feet per inch on 1: 12 000 map . . .

12 inches = 1 foot  
 Show in ratio as ...  
 $\frac{12}{1} \frac{\text{inches}}{\text{feet}}$

Let SCALE (12 000) be in inches  
 Fractional scale says 1 inch represents 12,000 in  
 Let x be feet that 1 inch represents on map  
 Show in ratio as ...  
 $\frac{12\ 000}{x} \frac{\text{inches}}{\text{feet}}$

Solution . . .

$$\frac{12}{1} = \frac{12\ 000}{x}$$

$$12 \cdot x = 12\ 000 \cdot 1$$

$$\frac{12x}{12} = \frac{12\ 000}{12}$$

$$x = \frac{12\ 000}{12} \text{ (SCALE)}$$

$$x = 1000.00$$



**35—BAR SCALES (continued)**

BAR SCALE CALCULATIONS — KILOMETERS (1 kilometer = 100,000 centimeters)								
FRACTIONAL SCALE	SCALE TO MAP REPRESENTATION		TO FIND KILOMETERS PER CENTIMETER (CM) (x in ratio)	KILOMETERS PER CM	TOTAL KILOMETERS ON SCALE	TO FIND TOTAL SCALE LENGTH IN CENTIMETERS (y in ratio)	TOTAL SCALE LENGTH IN	
	Scale Unit	represents Map Unit	Use ratio below or $\frac{\text{SCALE}}{100\,000}$			Use ratio below or $\frac{\text{Kilometers on scale}}{\text{Kilometers per cm}}$	CENTI-METERS	MILLI-METERS
1:12 000	1 cm	12 000 cm	$\frac{100\,000}{1} = \frac{12\,000}{x}$	0.120	1.5	$\frac{0.120}{1} = \frac{1.5}{y}$	12.500	125.00
1:20 000	1 cm	20 000 cm	$\frac{100\,000}{1} = \frac{20\,000}{x}$	0.200	2	$\frac{0.200}{1} = \frac{2}{y}$	10.000	100.00
1:24 000	1 cm	24 000 cm	$\frac{100\,000}{1} = \frac{24\,000}{x}$	0.240	2	$\frac{0.240}{1} = \frac{2}{y}$	8.333	83.33
1:25 000	1 cm	25 000 cm	$\frac{100\,000}{1} = \frac{25\,000}{x}$	0.250	2	$\frac{0.250}{1} = \frac{2}{y}$	8.000	80.00
1:31 250	1 cm	31 250 cm	$\frac{100\,000}{1} = \frac{31\,250}{x}$	0.3125	2	$\frac{0.3125}{1} = \frac{2}{y}$	6.400	64.00
1:31 680	1 cm	31 680 cm	$\frac{100\,000}{1} = \frac{31\,680}{x}$	0.3168	2	$\frac{0.3168}{1} = \frac{2}{y}$	6.313	63.13
1:48 000	1 cm	48 000 cm	$\frac{100\,000}{1} = \frac{48\,000}{x}$	0.480	6	$\frac{0.480}{1} = \frac{6}{y}$	12.500	125.00
1:50 000	1 cm	50 000 cm	$\frac{100\,000}{1} = \frac{50\,000}{x}$	0.500	6	$\frac{0.500}{1} = \frac{6}{y}$	12.000	120.00
1:62 500	1 cm	62 500 cm	$\frac{100\,000}{1} = \frac{62\,500}{x}$	0.625	8	$\frac{0.625}{1} = \frac{8}{y}$	12.800	128.00
1:63 360	1 cm	63 360 cm	$\frac{100\,000}{1} = \frac{63\,360}{x}$	0.6336	8	$\frac{0.6336}{1} = \frac{8}{y}$	12.626	126.26
1:72 000	1 cm	72 000 cm	$\frac{100\,000}{1} = \frac{72\,000}{x}$	0.720	8	$\frac{0.720}{1} = \frac{8}{y}$	11.111	111.11
1:75 000	1 cm	75 000 cm	$\frac{100\,000}{1} = \frac{75\,000}{x}$	0.750	8	$\frac{0.750}{1} = \frac{8}{y}$	10.666	106.66
1:96 000	1 cm	96 000 cm	$\frac{100\,000}{1} = \frac{96\,000}{x}$	0.960	9	$\frac{0.960}{1} = \frac{9}{y}$	9.375	93.75
1:100 000	1 cm	100 000 cm	$\frac{100\,000}{1} = \frac{100\,000}{x}$	1.000	11	$\frac{1.000}{1} = \frac{11}{y}$	11.000	110.00
1:125 000	1 cm	125 000 cm	$\frac{100\,000}{1} = \frac{125\,000}{x}$	1.250	12	$\frac{1.250}{1} = \frac{12}{y}$	9.600	96.00
1:150 000	1 cm	150 000 cm	$\frac{100\,000}{1} = \frac{150\,000}{x}$	1.500	12	$\frac{1.500}{1} = \frac{12}{y}$	8.000	80.00

To find kilometers per centimeter on 1: 12 000 map . . .

100 000 centimeters = 1 kilometer  
 Show in ratio as ...

$$\frac{100\,000 \text{ centimeters}}{1 \text{ kilometers}}$$

Let SCALE (12 000) be in centimeters  
 Fractional scale says 1 centimeter represents  
 12,000 centimeters  
 Let x be kilometers that 1 cm represents on map  
 Show in ratio as ...

$$\frac{12\,000 \text{ centimeters}}{x \text{ kilometers}}$$

Solution . . .

$$100\,000 \cdot x = 12\,000 \cdot 1$$

$$\frac{100\,000}{1} = \frac{12\,000}{x} \quad \frac{100\,000}{100\,000} x = \frac{12\,000}{100\,000}$$

$$x = \frac{12\,000}{100\,000} \text{ (SCALE)}$$

$$x = 0.120$$

**35—BAR SCALES (continued)**

BAR SCALE CALCULATIONS — KILOMETERS (1 kilometer = 100,000 centimeters)—continued								
FRACTIONAL SCALE	SCALE TO MAP REPRESENTATION		TO FIND KILOMETERS PER CENTIMETER (CM) (x in ratio)	KILOMETERS PER CM	TOTAL KILOMETERS ON SCALE	TO FIND TOTAL SCALE LENGTH IN CENTIMETERS (y in ratio)	TOTAL SCALE LENGTH IN	
	Scale Unit	represents Map Unit	Use ratio below or $\frac{\text{SCALE}}{100\,000}$			Use ratio below or $\frac{\text{Kilometers on scale}}{\text{Kilometers per cm}}$	CENTI-METERS	MILLI-METERS
1:250 000	1 cm	250 000 cm	$\frac{100\,000}{1} = \frac{250\,000}{x}$	2.500	30	$\frac{2.500}{1} = \frac{30}{y}$	12.000	120.00
1:400 000	1 cm	400 000 cm	$\frac{100\,000}{1} = \frac{400\,000}{x}$	4.000	60	$\frac{4.000}{1} = \frac{60}{y}$	15.000	150.00
1:500 000	1 cm	500 000 cm	$\frac{100\,000}{1} = \frac{500\,000}{x}$	5.000	60	$\frac{5.000}{1} = \frac{60}{y}$	12.000	120.00
1:750 000	1 cm	750 000 cm	$\frac{100\,000}{1} = \frac{750\,000}{x}$	7.500	60	$\frac{7.500}{1} = \frac{60}{y}$	8.000	80.00
1:1 000 000	1 cm	1 000 000 cm	$\frac{100\,000}{1} = \frac{1\,000\,000}{x}$	10.000	125	$\frac{10.000}{1} = \frac{125}{y}$	12.500	125.00
1:2 000 000	1 cm	2 000 000 cm	$\frac{100\,000}{1} = \frac{2\,000\,000}{x}$	20.000	300	$\frac{20.000}{1} = \frac{300}{y}$	15.000	150.00
1:2 500 000	1 cm	2 500 000 cm	$\frac{100\,000}{1} = \frac{2\,500\,000}{x}$	25.000	400	$\frac{25.000}{1} = \frac{400}{y}$	16.000	160.00
1:5 000 000	1 cm	5 000 000 cm	$\frac{100\,000}{1} = \frac{5\,000\,000}{x}$	50.000	800	$\frac{50.000}{1} = \frac{800}{y}$	16.000	160.00
1:7 500 000	1 cm	7 500 000 cm	$\frac{100\,000}{1} = \frac{7\,500\,000}{x}$	75.000	800	$\frac{75.000}{1} = \frac{800}{y}$	10.666	106.66
1:10 000 000	1 cm	10 000 000 cm	$\frac{100\,000}{1} = \frac{10\,000\,000}{x}$	100.000	1500	$\frac{100.000}{1} = \frac{1500}{y}$	15.000	150.00

**To find kilometers per centimeter on 1: 250 000 map . . .**

**Solution . . .**

$$100\,000 \cdot x = 250\,000 \cdot 1$$

100 000 centimeters = 1 kilometer  
 Show in ratio as ...

$$\frac{100\,000 \text{ centimeters}}{1 \text{ kilometers}}$$

Let SCALE (250 000) be in centimeters  
 Fractional scale says 1 centimeter represents  
 250,000 centimeters  
 Let x be kilometers that 1 cm represents on map  
 Show in ratio as ...

$$\frac{250\,000 \text{ centimeters}}{x \text{ kilometers}}$$

$$\frac{100\,000}{1} = \frac{250\,000}{x} \quad \frac{100\,000}{100\,000} x = \frac{250\,000}{100\,000}$$

$$x = \frac{250\,000}{100\,000} \text{ (SCALE)}$$

$$x = 2.5$$