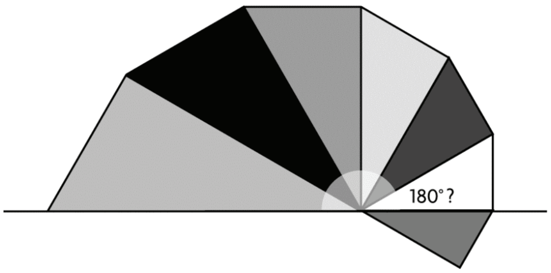
but it was difficult to be sure that the angle was exactly 180°.



I could use the measurement to make an estimate.

$\alpha \doteq \dfrac{180°}{6}$

$\alpha \doteq 30°$

Area $\doteq$ (10 cos 30°)(10 cos 30°)

Area $\doteq$ (10 · 0.8660)(10 · 0.8660)

Area $\doteq$ 75

The area of the square is about 75 units.

Chapter Self-Test, page 152

1. a)

$$\frac{\sin B}{AC} = \frac{\sin A}{BC}$$
$$\frac{\sin B}{4.1} = \frac{\sin 82°}{6.0}$$
$$4.1\left(\frac{\sin B}{4.1}\right) = 4.1\left(\frac{\sin 82°}{6.0}\right)$$
$$\sin B = 4.1\left(\frac{\sin 82°}{6.0}\right)$$
$$\sin B = 0.6766...$$
$$\angle B = \sin^{-1}(0.6766...)$$
$$\angle B = 42.584...°$$

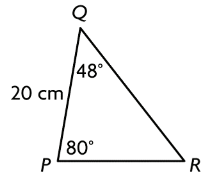
The measure of $\angle B$ is 42.6°.

b)

$$\angle C + \angle A + \angle B = 180°$$
$$\angle C + 78° + 69° = 180°$$
$$\angle C = 33°$$
$$\frac{c}{\sin C} = \frac{b}{\sin B}$$
$$\frac{c}{\sin 33°} = \frac{4.1}{\sin 69°}$$
$$\sin 33°\left(\frac{c}{\sin 33°}\right) = \sin 33°\left(\frac{4.1}{\sin 69°}\right)$$
$$c = \sin 33°\left(\frac{4.1}{\sin 69°}\right)$$
$$c = 2.391...$$

The length of c is 2.4 cm.

2. Here is the diagram.



$$\angle R + \angle P + \angle Q = 180°$$
$$\angle R + 80° + 48° = 180°$$
$$\angle R = 52°$$

The measure of $\angle R$ is 52°.

$$\frac{p}{\sin P} = \frac{r}{\sin R}$$
$$\frac{p}{\sin 80°} = \frac{20}{\sin 52°}$$
$$\sin 80°\left(\frac{p}{\sin 80°}\right) = \sin 80°\left(\frac{20}{\sin 52°}\right)$$
$$p = \sin 80°\left(\frac{20}{\sin 52°}\right)$$
$$p = 24.994...$$

The length of p is 25.0 cm.

$$\frac{q}{\sin Q} = \frac{r}{\sin R}$$
$$\frac{q}{\sin 48°} = \frac{20}{\sin 52°}$$
$$\sin 48°\left(\frac{q}{\sin 48°}\right) = \sin 48°\left(\frac{20}{\sin 52°}\right)$$
$$q = \sin 48°\left(\frac{20}{\sin 52°}\right)$$
$$q = 18.861...$$

The length of q is 18.9 cm.

3. Let x represent the measure of the angle between the two known sides.

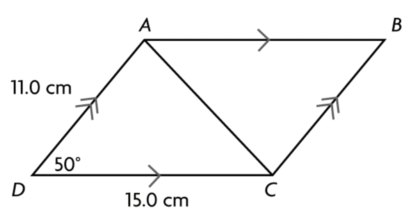
$$x + 45° + 50° = 180°$$
$$x = 85°$$

Let y represent the distance the boats are apart.

$$y^2 = 70^2 + 100^2 – 2(70)(100) \cos 85°$$
$$y^2 = 4900 + 10\,000 – 14\,000(0.0871…)$$
$$y^2 = 13\,679.819…$$
$$y = 116.960…$$

The boats are 117.0 km apart.

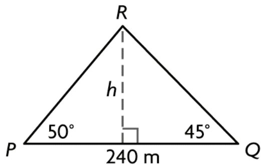
4.



$$AC^2 = 11.0^2 + 15.0^2 + – 2(11.0)(15.0) \cos 50°$$
$$AC^2 = 121.0 + 225.0 – 330(0.642…)$$
$$AC^2 = 133.880…$$
$$AC = 11.570…$$

The length of the shorter diagonal is 11.6 cm.

5.



Let h represent the height of the tower.

$$\angle R + \angle P + \angle Q = 180°$$
$$\angle R + 50° + 45° = 180°$$
$$\angle R = 85°$$

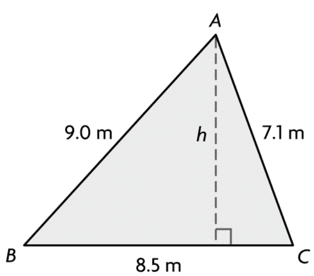
$$\frac{QR}{\sin P} = \frac{PQ}{\sin R}$$
$$\frac{QR}{\sin 50°} = \frac{240}{\sin 85°}$$
$$\sin 50°\left(\frac{QR}{\sin 50°}\right) = \sin 50°\left(\frac{240}{\sin 85°}\right)$$
$$QR = \sin 50°\left(\frac{240}{\sin 85°}\right)$$
$$QR = 184.552...$$

Determine the length of h:

$$\sin Q = \frac{h}{QR}$$
$$\sin 45° = \frac{h}{184.552...}$$
$$184.552\ldots(\sin 45°) = 184.552\ldots\left(\frac{h}{184.552...}\right)$$
$$130.498\ldots = h$$

The height of the tower is 130.5 m.

6.



$$c^2 = a^2 + b^2 - 2ab \cos C$$
$$9.0^2 = 8.5^2 + 7.1^2 - 2(8.5)(7.1) \cos C$$
$$81.0 = 72.25 + 50.41 - 120.7 \cos C$$
$$-41.66 = -120.7 \cos C$$
$$\frac{-41.66}{-120.7} = \cos C$$
$$0.345\ldots = \cos C$$
$$\angle C = \cos^{-1}(0.345\ldots)$$
$$\angle C = 69.808\ldots°$$

Determine the length of h:

$$\sin C = \frac{h}{AC}$$
$$\sin 69.808\ldots° = \frac{h}{7.1}$$
$$7.1(\sin 69.808\ldots°) = 7.1\left(\frac{h}{7.1}\right)$$
$$6.663\ldots = h$$

Area = $\frac{1}{2}BC(h)$

Area = $\frac{1}{2}(8.5)(6.663\ldots)$

Area = 28.320…

The area of the patio is 28.3 cm^2.

7. e.g., If the angle is the contained angle, then use the cosine law. If it is one of the other angles, use the sine law to determine the other non-contained angle, calculate the contained angle by subtracting the two angles you know from 180°, then use either the sine law or the cosine law.

8. e.g., When two angles and a side are given, the sine law must be used to determine side lengths. When two sides and the contained angle are given, the cosine law must be used to determine the third side.

Chapter Review, page 154

1. No. e.g., $\angle C = 90°$, so this will be a right triangle.

2. Part d) is incorrect. It should be the same as part a).

3. a) $\angle X + 67° + 58° = 180°$

$$\angle X = 55°$$
$$\frac{x}{\sin 55°} = \frac{24.5}{\sin 58°}$$
$$\sin 55°\left(\frac{x}{\sin 55°}\right) = \sin 55°\left(\frac{24.5}{\sin 58°}\right)$$
$$x = \sin 55°\left(\frac{24.5}{\sin 58°}\right)$$
$$x = 23.665...$$

The length of x is 23.7 m.

b) $\frac{\sin\theta}{35.4} = \frac{\sin 51°}{31.2}$

$$35.4\left(\frac{\sin\theta}{35.4}\right) = 35.4\left(\frac{\sin 51°}{31.2}\right)$$
$$\sin\theta = 35.4\left(\frac{\sin 51°}{31.2}\right)$$
$$\sin\theta = 0.881...$$
$$\theta = \sin^{-1}(0.881...)$$
$$\theta = 61.855...°$$

The measure of θ is 61.9°.