Lesson 2.6 Applying the Trigonometric Ratios Exercises (pages 111–112)

A

3. a) In right $\triangle$ABC, the lengths of AC and BC are given.
AC is the hypotenuse and BC is the side opposite $\angle$A.
So, I would use the sine ratio.

b) In right $\triangle$DEF, the lengths of DE and EF are given.
DE is the side adjacent to $\angle$D and EF is the side opposite $\angle$D.
So, I would use the tangent ratio.

c) In right $\triangle$GHJ, the lengths of GH and GJ are given.
GJ is the hypotenuse and GH is the side adjacent to $\angle$G.
So, I would use the cosine ratio.

d) In right $\triangle$XYZ, the lengths of XZ and YZ are given.
YZ is the side adjacent to $\angle$Y and XZ is the side opposite $\angle$Y.
So, I would use the tangent ratio.

4. a) In right $\triangle$KMN, the length of KM is given and I need to determine the length of KN.
KM is the hypotenuse and KN is the side adjacent to $\angle$K.
So, I will use the cosine ratio.

$$\cos K = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\cos K = \frac{\text{KN}}{\text{KM}}$$

$$\cos 37° = \frac{m}{5.8} \qquad \text{Solve for } m.$$

$$5.8 \cos 37° = \frac{m(5.8)}{5.8}$$

$$5.8 \cos 37° = m$$

$$m = 4.6320\ldots$$

KN is approximately 4.6 cm long.

b) In right △PQR, the length of QR is given and I need to determine the length of PQ.
QR is the side adjacent to ∠R and PQ is the side opposite ∠R.
So, I will use the tangent ratio.

$$\tan R = \frac{\text{opposite}}{\text{adjacent}}$$

$$\tan R = \frac{PQ}{QR}$$

$$\tan 52° = \frac{r}{3.7} \qquad \text{Solve for } r.$$

$$3.7 \times \tan 52° = \frac{r}{3.7} \times 3.7$$

$$3.7 \tan 52° = r$$

$$r = 4.7357\ldots$$

PQ is approximately 4.7 cm long.

c) In right △AYZ, the length of YZ is given and I need to determine the length of AY.
AY is the hypotenuse and YZ is the side opposite ∠A.
So, I will use the sine ratio.

$$\sin A = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\sin A = \frac{YZ}{AY}$$

$$\sin 62° = \frac{10.4}{z} \qquad \text{Solve for } z.$$

$$z \sin 62° = \frac{10.4z}{z}$$

$$z \sin 62° = 10.4$$

$$\frac{z \sin 62°}{\sin 62°} = \frac{10.4}{\sin 62°}$$

$$z = \frac{10.4}{\sin 62°}$$

$$z = 11.7787\ldots$$

AY is approximately 11.8 cm long.

d) In right $\triangle$BCD, the length of CD is given and I need to determine the length of BD.
BD is the hypotenuse and CD is the side adjacent to $\angle$D.
So, I will use the cosine ratio.

$$\cos D = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\cos D = \frac{CD}{BD}$$

$$\cos 55^\circ = \frac{8.3}{c} \qquad \text{Solve for } c.$$

$$c\cos 55^\circ = \frac{8.3c}{c}$$

$$c\cos 55^\circ = 8.3$$

$$\frac{c\cos 55^\circ}{\cos 55^\circ} = \frac{8.3}{\cos 55^\circ}$$

$$c = \frac{8.3}{\cos 55^\circ}$$

$$c = 14.4706\ldots$$

BD is approximately 14.5 cm long.

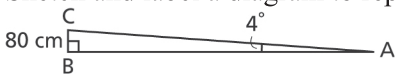
5. a) In right $\triangle$EFG, the lengths of the legs, EF and FG, are given.
So, I would use the Pythagorean Theorem to determine the length of the hypotenuse, EG.

b) In right $\triangle$HJK, the length of HK and the measure of $\angle$J are given.
HK is the side opposite $\angle$J, and HJ is the hypotenuse.
So, I would use the sine ratio to determine the length of HJ.

c) In right $\triangle$MNP, the lengths of one leg, MN, and the hypotenuse, MP, are given. So, I would use the Pythagorean Theorem to determine the length of the other leg, PN.

d) In right $\triangle$QRS, the lengths of the legs, RS and QS, are given.
So, I would use the Pythagorean Theorem to determine the length of the hypotenuse, QR.

7. Sketch and label a diagram to represent the information in the problem.



AC is the length of the ramp.
AB is the horizontal distance the ramp will take up.
BC is the maximum height of the ramp.
∠A is the angle of elevation of the ramp.

a) In right △ABC, AC is the hypotenuse and BC is the side opposite ∠A.

$$\sin A = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\sin A = \frac{BC}{AC}$$

$$\sin 4° = \frac{80}{AC} \qquad \text{Solve for AC.}$$

$$AC \sin 4° = 80$$

$$AC = \frac{80}{\sin 4°}$$

$$AC = 1146.8469\ldots$$

The length of the ramp is approximately 1147 cm.

b) In right △ABC, AC is the hypotenuse and BC and AB are the legs.
Use the Pythagorean Theorem.

$$AC^2 = AB^2 + BC^2 \qquad \text{Solve for the unknown.}$$

$$AB^2 = AC^2 - BC^2$$

$$AB^2 = (1146.8469\ldots)^2 - 80^2$$

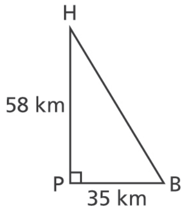
$$= 1\,308\,857.954\ldots$$

$$AB = \sqrt{1\,308\,857.954\ldots}$$

$$= 1144.0533\ldots$$

The ramp will take up a horizontal distance of approximately 1144 cm.

9. Sketch and label a diagram to represent the information in the problem.



BP is the distance from the base to the sick person.
PH is the distance from the sick person to the hospital.
BH is the distance from the base to the hospital.
∠H is the angle between the path the helicopter took due north and the path it will take to return directly to its base.

a) In right △BHP, BH is the hypotenuse and BP and PH are the legs.
Use the Pythagorean Theorem.

$$BH^2 = BP^2 + PH^2$$
$$BH^2 = 35^2 + 58^2$$
$$= 4589$$
$$BH = \sqrt{4589}$$
$$= 67.7421\ldots$$

The distance between the hospital and the base is approximately 68 km.

b) In right △BHP, BP is the side opposite ∠H and PH is the side adjacent to ∠H.

$$\tan H = \frac{\text{opposite}}{\text{adjacent}}$$
$$\tan H = \frac{BP}{PH}$$
$$\tan H = \frac{35}{58}$$
$$\angle H = 31.1088\ldots°$$

The angle between the path the helicopter took due north and the path it will take to return directly to its base is approximately 31°.