In this chapter, we will be working with right triangles (triangles that have one right, or 90°, angle).

**Pythagorean Theorem:** $a^2 + b^2 = c^2$

✓ use to find missing side length if you know the other two lengths

**Sine/Cosine/Tangent Ratios:** **SOH CAH TOA** (set calculator to Degrees)

✓ use to find missing angle measures or side lengths

- $\sin \theta = \text{opposite} \over \text{hypotenuse}$
- $\cos \theta = \text{adjacent} \over \text{hypotenuse}$
- $\tan \theta = \text{opposite} \over \text{adjacent}$

**use sin/cos/tan to find sides**

**use sin$^{-1}$/cos$^{-1}$/tan$^{-1}$ to find angles**

**Angles of Inclination, Elevation, and Depression:** the acute angles between lines and the horizon.

*Do not assume the diagrams are drawn to scale.

**Examples for Lesson 2.1 & 2.4**

1. Determine $\sin G$, $\cos G$, and $\tan G$, and then determine $\sin J$, $\cos J$, and $\tan J$.

- $\sin G = \text{opp} \over \text{hyp} = \frac{8}{17}$
- $\sin J = \text{opp} \over \text{hyp} = \frac{15}{17}$
- $\cos G = \text{adj} \over \text{hyp} = \frac{15}{17}$
- $\cos J = \text{adj} \over \text{hyp} = \frac{8}{17}$
- $\tan G = \text{opp} \over \text{adj} = \frac{8}{15}$
- $\tan J = \text{opp} \over \text{adj} = \frac{15}{8}$
2. Determine the measures of $<K$ and $<N$ to the nearest tenth of a degree.

$$\tan K = \frac{9}{13} \quad \tan N = \frac{13}{9}$$

$$K = \tan^{-1} \left( \frac{9}{13} \right) \quad N = \tan^{-1} \left( \frac{13}{9} \right)$$

$$K = 34.7^\circ \quad N = 55.3^\circ$$

check: $90 + 34.7 + 55.3 = 180^\circ$ ✓

3. Determine the measures of $<K$ and $<M$ to the nearest tenth of a degree.

$$\sin K = \frac{3}{8} \quad \cos M = \frac{3}{8}$$

$$K = \sin^{-1} \left( \frac{3}{8} \right) \quad M = \cos^{-1} \left( \frac{3}{8} \right)$$

$$K = 22.0^\circ \quad M = 68.0^\circ$$

check: $90 + 22 + 68 = 180^\circ$ ✓

**Examples for Lesson 2.2 & 2.5**

4. Determine the length of $PQ$ to the nearest tenth of a centimeter.

$$10.4 \times \sin 67^\circ = \frac{x}{10.4} \times 10.4$$

$$x = 9.6 \text{ cm}$$

5. Determine the length of $VX$ to the nearest tenth of a centimeter.

$$x \times \tan 42^\circ = \frac{7.2}{x} \times x$$

$$x \tan 42^\circ = \frac{7.2}{\tan 42^\circ} \times \tan 42^\circ$$

$$x = \frac{7.2}{\tan 42^\circ}$$

$$x = 8.0 \text{ cm}$$
Examples for Lesson 2.6

1. Solve this triangle. Give the measures to the nearest tenth.

\[ \tan N = \frac{7}{11} \]
\[ N = \tan^{-1} \left( \frac{7}{11} \right) \]
\[ N = 32.5^\circ \]

\[ 7^2 + 11^2 = c^2 \]
\[ 49 + 121 = c^2 \]
\[ \sqrt{170} = c \]
\[ c = KN = 13.0 \text{ cm} \]

2. Solve this triangle. Give the measures to the nearest tenth where necessary.

\[ J = 180 - 90 - 39 \]
\[ J = 51^\circ \]

\[ 9 \times \tan 51^\circ = \frac{GH}{y} \times y \]
\[ \sin 39^\circ = \frac{9}{HJ} \]

\[ GH = 9 \tan 51^\circ \]
\[ GH = 11.1 \text{ cm} \]

\[ HJ = \frac{9}{\sin 39^\circ} \]
\[ HJ = 14.3 \text{ cm} \]
Examples for Lesson 2.7

1. Calculate the length of XY to the nearest tenth of a centimeter.

\[ 8.4 \times \sin 20^\circ = \frac{x}{y} \times 8.4 \]

\[ x = 2.9 \text{ cm} \]

\[ \cos 22^\circ = \frac{2.9}{y} \]

\[ y = \frac{2.9}{\cos 22^\circ} = \boxed{3.1 \text{ cm}} \]

2. A surveyor stands at a window on the 9th floor of an office tower. He uses a clinometer to measure the angles of elevation and depression of the top and the base of a taller building. The surveyor sketches this plan of his measurements. Determine the height of the taller building to the nearest tenth of a metre.

\[ \tan 42^\circ = \frac{39}{y} \]

\[ y = \frac{39}{\tan 42^\circ} \]

\[ y = 43.3 \text{ m} \]

\[ \tan 31^\circ = \frac{x}{43.3} \]

\[ x = 43.3 \times \tan 31^\circ \]

\[ x = 26.0 \text{ m} \]

\[ h = 39 + 26 = \boxed{65 \text{ m}} \]