5. MOUNTAIN BIKING On a mountain bike trip along the Gemini Bridges Trail in Moab, Utah, Nabuko stopped on the canyon floor to get a good view of the twin sandstone bridges. Nabuko is standing about 60 meters from the base of the canyon cliff, and the natural arch bridges are about 100 meters up the canyon wall. If her line of sight is 5 metres above the ground, what is the angle of elevation to the top of the bridges? Round to the nearest tenth degree.

\[
\tan x = \frac{95}{60}
\]

\[
x = \tan^{-1}\left(\frac{95}{60}\right)
\]
6. SHADOWS Suppose the sun casts a shadow off a 35-foot building. If the angle of elevation to the sun is 60°, how long is the shadow to the nearest tenth of a foot?

\[ x \cdot \tan 60 = \left( \frac{35}{x} \right) x \]

\[ \frac{x \cdot \tan 60}{\tan 60} = \frac{35}{\tan 60} \]

\[ x = 20.2 \text{ ft} \]
7. BALLOONING  Angie sees a hot air balloon in the sky from her spot on the ground. The angle of elevation from Angie to the balloon is 40°. If she steps back 200 feet, the new angle of elevation is 10°. If Angie is 5.5 feet tall, how far off the ground is the hot air balloon?

\[
y \tan 40 = \frac{x}{y + 5.5} \\
\tan 40 \, y = x
\]

\[
(200 + y) \tan 10 = \frac{x}{200 + y}
\]

\[
(200 + y) \tan 10 = x
\]

\[
\tan 40 \, y = (200 + y) \tan 10 \\
\tan 40 \, y = (\tan 10 \times 200) + (\tan 10 \times y)
\]

\[
-tan 10 \, y \\
\tan 40 \, y - tan 10 \, y = (\tan 10 \times 200)
\]

\[
y (\tan 40 - \tan 10) = (\tan 10 \times 200) \\
\tan 40 - \tan 10 \\
y = \frac{53.2}{50.1}
\]

\[
\tan 40 = \frac{x}{53.2} \\
44.6 = x
\]

\[
44.6 + 5.5 = 50.1
\]
8. INDIRECT MEASUREMENT  Kyle is at the end of a pier 30 feet above the ocean. His eye level is 3 feet above the pier. He is using binoculars to watch a whale surface. If the angle of depression of the whale is 20°, how far is the whale from Kyle’s binoculars? Round to the nearest tenth foot.

\[ x \sin 20 = \left( \frac{33}{x} \right) x \]

\[ \frac{\sin 20}{\sin 20} x = \frac{33}{\sin 20} \]

\[ x = 96.5 \text{ ft} \]
7. INDIRECT MEASUREMENT  Mr. Dominguez is standing on a 40-foot ocean bluff near his home. He can see his two dogs on the beach below. If his line of sight is 6 feet above the ground and the angles of depression to his dogs are 34° and 48°, how far apart are the dogs to the nearest foot?

\[
tan\ 48 = \frac{46}{x}
\]

\[
x \cdot tan\ 48 = 46
\]

\[
\frac{x \cdot tan\ 48}{tan\ 48} = \frac{46}{tan\ 48}
\]

\[
x = 41.4
\]

\[
68.2
\]

\[
-41.4
\]

\[
26.8
\]

\[
tan\ 34 = \frac{46}{y}
\]

\[
y \cdot tan\ 34 = 46
\]

\[
\frac{y \cdot tan\ 34}{tan\ 34} = \frac{46}{tan\ 34}
\]

\[
y = 68.2
\]
3. 13.5°
4. about 21 ft
5. about 22.3 ft
6. about 29.6 m
7. about 27 ft
3. WATER TOWERS  A student can see a water tower from the closest point of the soccer field at San Lobos High School. The edge of the soccer field is about 110 feet from the water tower and the water tower stands at a height of 32.5 feet. What is the angle of elevation if the eye level of the student viewing the tower from the edge of the soccer field is 6 feet above the ground? Round to the nearest tenth.

\[ \tan x = \frac{26.5}{110} \]

\[ x = \tan^{-1} \left( \frac{26.5}{110} \right) \]

\[ x = 13.5^\circ \]
6. GEOGRAPHY  Stephan is standing on the ground by a mesa in the Painted Desert. Stephan is 1.8 meters tall and sights the top of the mesa at 29°. Stephan steps back 100 meters and sights the top at 25°. How tall is the mesa?

\[
\begin{align*}
\text{small} & \quad x \tan 29 = \frac{x}{y} \quad y \\
\text{large} & \quad 100y \left( \frac{x}{100+y} \right) 100 + y \\
& \quad (100 + y) \tan 25 = x \\
& \quad (100 + y) \tan 25 = (100 + y) \tan 25 \\
& \quad x \tan 29 = (100 + y) \tan 25 \\
& \quad x \tan 29 = (100 + y) \tan 25 + (y) \tan 25 \\
& \quad y \tan 25 \\
& \quad - (y) \tan 25
\end{align*}
\]
\[
\begin{align*}
X(\tan 29) &= (100)\tan 25 + (y)\tan 25 - y(\tan 25) - (y)\tan 25 \\
X(\tan 29) - X(\tan 25) &= (100)\tan 25 \\
\frac{X(\tan 29) - \tan 25}{(\tan 29 - \tan 25)} &= (100)\tan 25
\end{align*}
\]
page 578

(9, 10, 11)