CHAPTER 4:
Introduction to Trigonometry

(A) means “refer to Part A,” (B) means “refer to Part B,” etc. (Calculator) means “use a calculator.” Otherwise, do not use a calculator.

Write units in your final answers where appropriate. Try to avoid rounding intermediate results; if you do round off, do it to at least five significant digits.

SECTION 4.1: ANGLES

1) Rewrite the following degree measures using DMS (Degree-Minute-Second) measure. (B)
   a) 48.25°. Hint: 48.25° = 48° + 0.25°.
   b) 341.702°. (Calculator)

2) Rewrite the following DMS (Degree-Minute-Second) measures using degree measure. (B)
   a) 22° 30′
   b) 102° 17′ 54″. Round off to six significant digits. (Calculator)

3) Convert the following degree measures into radians. (D)
   a) 80°
   b) −36°
   c) 271.3°. Round off to four significant digits. (Calculator)

4) Convert the following radian measures into degrees. (D)
   a) \(\frac{\pi}{10}\)
   b) \(-\frac{3\pi}{4}\)
   c) 3.964. Round off to four significant digits. (Calculator)
5) A circle has radius 3 inches. What is the arc length intercepted by a central angle of 1.5 radians? (E)

6) A central angle of a circle has a measure of 2 radians. The angle intercepts an arc of length 8 meters along the circle. What is the radius of the circle? (E)

7) A circle has a radius of 33 feet. A central angle of the circle intercepts an arc of length 11 feet along the circle. What is the radian measure of the central angle? (E)

8) Sort the following radian measures in increasing order. For each radian measure,
   - Identify the quadrant that each corresponding angle lies in; write “Quadrantal” if the angle is quadrantal.
   - Also classify the angle as acute, right, obtuse, or none of these. (F, G)

\[
\frac{\pi}{3} \quad \frac{\pi}{3} \quad \frac{5\pi}{3} \quad \frac{2\pi}{3} \quad \frac{3\pi}{4} \quad \frac{7\pi}{6} \quad \frac{7\pi}{4} \quad \frac{3\pi}{2} \quad \frac{\pi}{6} \quad \frac{\pi}{2}
\]

9) Find the complementary angle measure for each of the following angle measures. (G)
   a) 25°
   b) \(\frac{\pi}{6}\)

10) Find the supplementary angle measure for each of the following angle measures. (G)
    a) 50°
    b) \(\frac{\pi}{4}\)

11) For each angle measure below, give three different coterminal angle measures. Also give the general form for all coterminal angle measures. (H)
    a) \(\frac{\pi}{6}\). Use radian measure.
    b) 45°. Use degree measure.
SECTIONS 4.2-4.4: TRIGONOMETRIC FUNCTIONS
(VALUES AND IDENTITIES)

If you are asked to evaluate an expression that is undefined, write “und.”
Rationalize denominators and simplify wherever appropriate.

1) Assume that \( \sin(\theta) = \frac{3}{5} \) and \( \cos(\theta) = \frac{4}{5} \). (A)
   a) Find \( \csc(\theta) \).
   b) Find \( \sec(\theta) \).
   c) Find \( \tan(\theta) \).
   d) Find \( \cot(\theta) \).
   e) Find \( \sin^2(\theta) + \cos^2(\theta) \).

2) Use the figure below. (A)

   \[
   \begin{array}{c}
   \theta \\
   \hline
   2 \text{ m} \\
   \hline
   5 \text{ m}
   \end{array}
   \]
   a) Find \( \sin(\theta) \).
   b) Find \( \cos(\theta) \).
   c) Find \( \tan(\theta) \).
   d) Find \( \csc(\theta) \).
   e) Find \( \sec(\theta) \).
   f) Find \( \cot(\theta) \).
   g) Find \( \sin^2(\theta) + \cos^2(\theta) \).
3) Assume that \( \sin(\alpha) = \frac{5}{13} \), where \( \alpha \) is acute. (A)
   a) Find \( \cos(\alpha) \).
   b) Find \( \tan(\alpha) \).
   c) Find \( \csc(\alpha) \).
   d) Find \( \sec(\alpha) \).
   e) Find \( \cot(\alpha) \).
   f) Find \( \sin^2(\alpha) + \cos^2(\alpha) \).

4) Use the figure below. (A)
   ![Figure 1](image1.png)
   a) Find \( a \).
   b) Find \( c \).

5) Use the figure below. (A)
   ![Figure 2](image2.png)
   a) Find \( a \).
   b) Find \( c \).

6) According to the Cofunction Identities, what must be equal to \( \sin(20^\circ) \)? (A)
7) Fill out the table below. (B)

<table>
<thead>
<tr>
<th>θ</th>
<th>sin(θ)</th>
<th>cos(θ)</th>
<th>tan(θ)</th>
<th>csc(θ)</th>
<th>sec(θ)</th>
<th>cot(θ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\frac{\pi}{6})</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\frac{\pi}{4})</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\frac{\pi}{3})</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\frac{\pi}{2})</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8) For each pair listed below, identify which has the greater value. Use the Unit Circle. Do **not** use a calculator. (B)

   a) \(\sin(70^\circ)\) vs. \(\sin(80^\circ)\)
   b) \(\cos(70^\circ)\) vs. \(\cos(80^\circ)\)
   c) \(\tan(70^\circ)\) vs. \(\tan(80^\circ)\)
   d) \(\csc(70^\circ)\) vs. \(\csc(80^\circ)\)
   e) \(\sec(70^\circ)\) vs. \(\sec(10^\circ)\)

9) As usual, consider angles in standard position. What quadrant is \(\theta\) in if … (C)

   a) \(\sin(\theta) > 0\) and \(\cos(\theta) < 0\)
   b) \(\sin(\theta) < 0\) and \(\cos(\theta) < 0\)
   c) \(\cos(\theta) > 0\) and \(\tan(\theta) < 0\)
   d) \(\sin(\theta) < 0\) and \(\tan(\theta) > 0\)
10) Let \( \theta = \frac{11\pi}{6} \). (A-C)

a) What is the reference angle for \( \theta \) in radians?

b) What quadrant is \( \theta \) in?

c) Evaluate \( \sin(\theta) \), \( \cos(\theta) \), \( \tan(\theta) \), \( \csc(\theta) \), \( \sec(\theta) \), and \( \cot(\theta) \).

11) Let \( \theta = 135^\circ \). (A-C)

a) What is the reference angle for \( \theta \) in degrees?

b) What quadrant is \( \theta \) in?

c) Evaluate \( \sin(\theta) \), \( \cos(\theta) \), \( \tan(\theta) \), \( \csc(\theta) \), \( \sec(\theta) \), and \( \cot(\theta) \).

12) Let \( \theta = \frac{10\pi}{3} \). (A-C)

a) Find the coterminal angle for \( \theta \) in the interval \([0, 2\pi)\). Give your answer in radians.

b) What is the reference angle for \( \theta \) in radians?

c) What quadrant is \( \theta \) in?

d) Evaluate \( \sin(\theta) \), \( \cos(\theta) \), \( \tan(\theta) \), \( \csc(\theta) \), \( \sec(\theta) \), and \( \cot(\theta) \).

13) Let \( \theta = -570^\circ \). (A-C)

a) Find the coterminal angle for \( \theta \) such that \( 0^\circ \leq \theta < 360^\circ \). Give your answer in degrees.

b) What is the reference angle for \( \theta \) in degrees?

c) What quadrant is \( \theta \) in?

d) Evaluate \( \sin(\theta) \), \( \cos(\theta) \), \( \tan(\theta) \), \( \csc(\theta) \), \( \sec(\theta) \), and \( \cot(\theta) \).
14) Fill out the table below. (A-C)

<table>
<thead>
<tr>
<th>$\theta$</th>
<th>$\sin(\theta)$</th>
<th>$\cos(\theta)$</th>
<th>$\tan(\theta)$</th>
<th>$\csc(\theta)$</th>
<th>$\sec(\theta)$</th>
<th>$\cot(\theta)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{2\pi}{3}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\pi$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\frac{5\pi}{4}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\frac{3\pi}{2}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\frac{11\pi}{6}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\frac{5\pi}{2}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\frac{11\pi}{3}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$9\pi$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15) Evaluate the following. (A-C)

a) $\cot\left(\frac{7\pi}{6}\right)$

b) $\sec\left(\frac{9\pi}{2}\right)$

c) $\tan(-8\pi)$

d) $\csc(-405^\circ)$
16) Consider the Unit Circle. Which one of the following is a true identity for all real values of $\theta$? (B-D)
   
   i. $\sin(\pi - \theta) = \sin(\theta)$
   
   ii. $\sin(\pi - \theta) = -\sin(\theta)$
   
   iii. $\sin(\pi - \theta) = \cos(\theta)$

17) Consider the Unit Circle. Which one of the following is a true identity for all real values of $\theta$ for which the expressions are defined? (B-D)
   
   i. $\tan(\pi - \theta) = \tan(\theta)$
   
   ii. $\tan(\pi - \theta) = -\tan(\theta)$
   
   iii. $\tan(\pi - \theta) = \cot(\theta)$

18) Consider the Unit Circle. Which one of the following is a true identity for all real values of $\theta$? (B-D)
   
   i. $\cos(\pi + \theta) = \cos(\theta)$
   
   ii. $\cos(\pi + \theta) = -\cos(\theta)$
   
   iii. $\cos(\pi + \theta) = \sin(\theta)$
19) Complete the Identities. Fill out the table below so that, for each row, the left side is equivalent to the right side, based on the type of ID given in the last column. (A, D, E)

<table>
<thead>
<tr>
<th>Left Side</th>
<th>Right Side</th>
<th>Type of ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\csc(\theta)$</td>
<td></td>
<td>Reciprocal ID</td>
</tr>
<tr>
<td>$\sec(\theta)$</td>
<td></td>
<td>Reciprocal ID</td>
</tr>
<tr>
<td>$\cot(\theta)$</td>
<td></td>
<td>Reciprocal ID</td>
</tr>
<tr>
<td>$\tan(\theta)$</td>
<td></td>
<td>Quotient ID</td>
</tr>
<tr>
<td>$\cot(\theta)$</td>
<td></td>
<td>Quotient ID</td>
</tr>
<tr>
<td>$\sin\left(\frac{\pi}{2} - \theta\right)$</td>
<td></td>
<td>Cofunction ID</td>
</tr>
<tr>
<td>$\cot\left(\frac{\pi}{2} - \theta\right)$</td>
<td></td>
<td>Cofunction ID</td>
</tr>
<tr>
<td>$\sin(-\theta)$</td>
<td></td>
<td>Even / Odd (Negative-Angle) ID</td>
</tr>
<tr>
<td>$\cos(-\theta)$</td>
<td></td>
<td>Even / Odd (Negative-Angle) ID</td>
</tr>
<tr>
<td>$\tan(-\theta)$</td>
<td></td>
<td>Even / Odd (Negative-Angle) ID</td>
</tr>
<tr>
<td>$\sin^2(\theta) + \cos^2(\theta)$</td>
<td></td>
<td>Pythagorean ID</td>
</tr>
<tr>
<td>$\tan^2(\theta) + 1$</td>
<td></td>
<td>Pythagorean ID</td>
</tr>
<tr>
<td>$1 + \cot^2(\theta)$</td>
<td></td>
<td>Pythagorean ID</td>
</tr>
</tbody>
</table>
20) Assume that \( \sin(\theta) = 0.3 \), where \( \theta \) is acute.

a) Find \( \sin(-\theta) \).

b) Find \( \cos\left(\frac{\pi}{2} - \theta\right) \).

c) Find \( \cos(\theta) \) using the Pythagorean Identities.

21) If \( \sin(\theta) = -\frac{5}{7} \), find \( \csc(-\theta) \).

22) If \( \cos(\theta) = \frac{4}{9} \), find \( \sec(-\theta) \).
SECTION 4.5: GRAPHS OF SINE AND COSINE FUNCTIONS

If you use the Frame Method to graph trigonometric functions,

- Simplify and clearly label all key coordinates next to each corresponding grid line.
- Superimpose the coordinate axes.

If you do not use the Frame Method, make sure you provide all required information.

1) Let \( f(x) = 3\sin(2x) \). (A-F)
   a) Sketch two cycles of the graph of \( y = f(x) \).
   b) What is the amplitude of the graph?
   c) What is the period of \( f \)?
   d) What is the domain of \( f \)?
   e) What is the range of \( f \)?

2) Let \( g(x) = 4\cos(5x) \). (A-F)
   a) Sketch two cycles of the graph of \( y = g(x) \).
   b) What is the amplitude of the graph?
   c) What is the period of \( g \)?
   d) What is the domain of \( g \)?
   e) What is the range of \( g \)?

3) Let \( h(\theta) = \frac{1}{3}\sin\left(-\frac{\theta}{4}\right) \). (A-F)
   a) Sketch one cycle of the graph of \( y = h(\theta) \).
   b) What is the amplitude of the graph?
   c) What is the period of \( h \)?
   d) What is the domain of \( h \)?
   e) What is the range of \( h \)?
4) Let \( f(t) = -5 \cos\left(-\frac{2t}{3}\right) \). (A-F)

   a) Sketch one cycle of the graph of \( y = f(t) \).
   b) What is the amplitude of the graph?
   c) What is the period of \( f \)?
   d) What is the domain of \( f \)?
   e) What is the range of \( f \)?

5) One cycle of the graph of \( y = f(x) \) is below, where \( f(x) = a \sin(bx) \). Find values for \( a \) and \( b \). (A-F)

![Graph of f(x) = a sin(bx)](image)

6) One cycle of the graph of \( y = f(x) \) is below, where \( f(x) = a \cos(bx) \). Find values for \( a \) and \( b \). (A-F)

![Graph of f(x) = a cos(bx)](image)
7) Let \( f(x) = 2 \sin\left(4x - \frac{\pi}{2}\right) + 1. \) (A-G)

   a) Sketch one cycle of the graph of \( y = f(x) \).
   b) What is the amplitude of the graph?
   c) What is the period of \( f \)?
   d) What is the phase shift of \( f \)?
   e) What is the domain of \( f \)?
   f) What is the range of \( f \)?

8) Let \( g(\theta) = \frac{5}{2} \cos\left(3\theta + \frac{\pi}{4}\right) - \frac{3}{2}. \) (A-G)

   a) Sketch one cycle of the graph of \( y = g(\theta) \).
   b) What is the amplitude of the graph?
   c) What is the period of \( g \)?
   d) What is the phase shift of \( g \)?
   e) What is the domain of \( g \)?
   f) What is the range of \( g \)?

9) Let \( h(x) = 6 \sin\left(-2x - \frac{5\pi}{4}\right) - 3. \) (A-G)

   a) Sketch one cycle of the graph of \( y = h(x) \).
   b) What is the amplitude of the graph?
   c) What is the period of \( h \)?
   d) What is the phase shift of \( h \)?
   e) What is the domain of \( h \)?
   f) What is the range of \( h \)?
SECTION 4.6: GRAPHS OF OTHER TRIGONOMETRIC FUNCTIONS

If you use the Frame Method to graph trigonometric functions,

- Simplify and clearly label all key coordinates next to each corresponding grid line.
- Superimpose the coordinate axes.
- Draw vertical asymptotes as dashed lines where appropriate.

If you do not use the Frame Method, make sure you provide all required information.

1) Let \( f(x) = 2 \tan(3x) \). (A-F)
   a) Sketch two cycles of the graph of \( y = f(x) \).
   b) What is the period of \( f \)?
   c) What is the range of \( f \)?

2) Let \( g(x) = \frac{4}{5} \cot\left(\frac{x}{4}\right) \). (A-F)
   a) Sketch one cycle of the graph of \( y = g(x) \).
   b) What is the period of \( g \)?

3) Let \( h(\theta) = -4 \tan\left(2\theta - \frac{\pi}{3}\right) + 1 \). (A-F)
   a) Sketch one cycle of the graph of \( y = h(\theta) \).
   b) What is the period of \( h \)?
   c) What is the phase shift of \( h \)?

4) Let \( f(x) = 5 \cot\left(-4x - \frac{\pi}{2}\right) - 3 \). (A-F)
   a) Sketch one cycle of the graph of \( y = f(x) \).
   b) What is the period of \( f \)?
   c) What is the phase shift of \( f \)?
5) Let \( g(x) = 2 \csc(3x) \). (G-J)
   
a) Sketch two cycles of the graph of \( y = g(x) \).
   
b) What is the period of \( g \)?

6) Let \( h(x) = \frac{1}{2} \sec \left( \frac{x}{3} \right) \). (G-J)
   
a) Sketch one cycle of the graph of \( y = h(x) \).
   
b) What is the period of \( h \)?

7) Fill out the table below. Use interval form except where indicated. (Section 4.5 and Section 4.6: B, D, H )

<table>
<thead>
<tr>
<th>( f(x) )</th>
<th>Domain</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \sin(x) )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \cos(x) )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \tan(x) )</td>
<td>Use set-builder form.</td>
<td></td>
</tr>
<tr>
<td>( \csc(x) )</td>
<td>Use set-builder form.</td>
<td></td>
</tr>
<tr>
<td>( \sec(x) )</td>
<td>Use set-builder form.</td>
<td></td>
</tr>
<tr>
<td>( \cot(x) )</td>
<td>Use set-builder form.</td>
<td></td>
</tr>
</tbody>
</table>
**SECTION 4.7: INVERSE TRIGONOMETRIC FUNCTIONS**

1) Graph \( y = \sin^{-1}(x) \), or \( y = \arcsin(x) \). (A)

2) Graph \( y = \cos^{-1}(x) \), or \( y = \arccos(x) \). (B)

3) Graph \( y = \tan^{-1}(x) \), or \( y = \arctan(x) \). (C)

4) Fill out the table below. Use interval form. (A-C, E)

<table>
<thead>
<tr>
<th>( f(x) )</th>
<th>Domain</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \sin^{-1}(x) )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \cos^{-1}(x) )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \tan^{-1}(x) )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5) Evaluate the following. If an expression is not defined as a real number, write “undefined.” (A-G)

   a) \( \sin^{-1}\left(\frac{1}{2}\right) \), also known as \( \arcsin\left(\frac{1}{2}\right) \)

   b) \( \sin^{-1}\left(-\frac{\sqrt{3}}{2}\right) \), also known as \( \arcsin\left(-\frac{\sqrt{3}}{2}\right) \)

   c) \( \sin^{-1}\left(\frac{\pi}{2}\right) \), also known as \( \arcsin\left(\frac{\pi}{2}\right) \)

   d) \( \cos^{-1}\left(-\frac{\sqrt{2}}{2}\right) \), also known as \( \arccos\left(-\frac{\sqrt{2}}{2}\right) \)

   e) \( \tan^{-1}(-1) \), also known as \( \arctan(-1) \)
(Exercises for Chapter 4: Introduction to Trigonometry) E.4.17

f) \[ \sin \left( \sin^{-1} \left( \frac{2}{7} \right) \right) \], also known as \( \sin \left( \arcsin \left( \frac{2}{7} \right) \right) \)

g) \[ \cos \left( \cos^{-1} (-2) \right) \], also known as \( \cos \left( \arccos (-2) \right) \)

h) \[ \tan \left( \tan^{-1} (-2) \right) \], also known as \( \tan \left( \arctan (-2) \right) \)

i) \[ \sin^{-1} \left( \sin \left( \frac{\pi}{5} \right) \right) \], also known as \( \arcsin \left( \sin \left( \frac{\pi}{5} \right) \right) \)

j) \[ \cos^{-1} \left( \cos \left( \frac{7\pi}{6} \right) \right) \], also known as \( \arccos \left( \cos \left( \frac{7\pi}{6} \right) \right) \)

k) \[ \tan^{-1} \left( \tan \left( \frac{2\pi}{3} \right) \right) \], also known as \( \arctan \left( \tan \left( \frac{2\pi}{3} \right) \right) \)

6) Rewrite the following as algebraic expressions in \( x \). Assume \( x > 0 \) and that the expressions are defined. (H)

a) \[ \tan \left( \sin^{-1} \left( \frac{x}{5} \right) \right) \], also known as \( \tan \left( \arcsin \left( \frac{x}{5} \right) \right) \)

b) \[ \cos \left( \tan^{-1} (x) \right) \], also known as \( \cos \left( \arctan (x) \right) \)

7) Use a calculator to find two solutions of each of the following equations. Give your answers in degrees \( 0^\circ \leq \theta < 360^\circ \) and in radians \( 0 \leq \theta < 2\pi \) rounded off to four significant digits. (Calculator) (Chapter 4: Various Sections)

a) \( \sin(\theta) = 0.3 \)

b) \( \sin(\theta) = -0.3 \)

c) \( \cos(\theta) = 0.3 \)

d) \( \cos(\theta) = -0.3 \)

e) \( \tan(\theta) = 10 \)

f) \( \tan(\theta) = -10 \)
SECTION 4.8: APPLICATIONS

1) Find \(a\) and \(c\) below. Round off your answer to the nearest hundredth of an inch (i.e., to two decimal places). (Calculator)

\[
\begin{align*}
\angle & \quad 39^\circ \\
2.74 \text{ in} & \quad a \\
\end{align*}
\]

2) A straight 10-foot plastic tube is leaning against a wall that is standing upright and perpendicular from the flat ground. The angle of elevation of the tube from the ground is \(67^\circ\). How far is the bottom of the tube from the bottom of the wall? Round off your answer in decimal form to three significant digits. (Calculator)

3) A balloon in the air is tied by a straight 23-meter wire to a small spike on the ground, which is flat. (Calculator)
   a) At a particular time, the angle of elevation to the balloon is \(18^\circ\). What is the height of the balloon from the ground at that time? Round off your answer to the nearest hundredth of a meter.
   b) An hour later, the wind changes, and the balloon is now 10 meters high above the ground. What is the angle of elevation to the balloon at that time? Round off your answer to the nearest tenth of a degree.

4) A bird is flying at an altitude of 1500 feet over a flat desert. It is flying on a line that takes it directly over an observer who is lying on the ground. (Calculator)
   a) If the angle of elevation from the observer to the bird is \(51^\circ\), what is the distance from the observer to the bird? Round off your answer to the nearest foot.
   b) Later in the day, the bird is 1700 feet away from the observer. The angle of elevation from the observer to the bird is no longer \(51^\circ\), as it was in part a). Find the new angle of elevation. Round off your answer to the nearest tenth of a degree.
   c) At noon, the bird’s shadow is directly beneath the bird. The distance of the bird’s shadow from the observer’s eyes is 250 feet. Find the new angle of elevation. Round off your answer to the nearest tenth of a degree.