Chapter 7 – Right Triangles and Trigonometry

***In order to get full credit for your assignments they must me done on time and you must SHOW ALL WORK. ***

1. ____ (7-1) Geometric Mean - Page 346-347 #13 – 37 odd

2. ____ (7-2) The Pythagorean Theorem and Its Converse – Day 1– Page 354  #12 – 17, 22 – 29

3. ____ (7-2) The Pythagorean Theorem and Its Converse – Day 2– 7-2 Practice Worksheet or Page 353 #1 – 6, 8 – 11

4. _____(7-3) Special Right Triangles – Day 1– Page 360 #12 – 25

5. _____ (7-3) Special Right Triangles – Day 2– 7-3 Practice Worksheet or Page 360 #1 – 8, 10

6. _____ (7-4) Trigonometry – Day 1- 7-4 A WS (in packet)

7. _____ (7-4) Trigonometry – Day 2- Page 368 # 19 – 51 odd

8. _____ (7-4) Trigonometry – Day 3- 7-4 Practice Worksheet or Page 367 #1 – 14, 17

9. _____ (7-5) Angles of Elevation and Depression- Day 1- 7-5 A WS (in packet)

10. _____ (7-5) Angles of Elevation and Depression- Day 2- Page 374 # 9 – 25 odd

11. _____ (7-5) Angles of Elevation and Depression- Day 3- 7-5 Practice Worksheet

12. _____ Chapter 7 Review

SOH-CAH-TOA
SECTION 7-1 A - Geometry- Geometric Mean

1. \( \frac{7}{x} = \frac{x}{28} \)

2. \( \frac{3}{x} = \frac{x}{9} \)

3. \( \frac{9}{x} = \frac{x}{12} \)

4. \( \frac{2}{5x} = \frac{5x}{10} \)

5. \( \frac{5}{3x} = \frac{3x}{8} \)

6. \( \frac{9}{x} = \frac{x}{14} \)

7. \( \frac{8}{x} = \frac{x}{16} \)

8. \( \frac{3}{9} = \frac{9}{x} \)

9. \( \frac{2}{6} = \frac{6}{x} \)

10. \( \frac{6}{10} = \frac{10}{x} \)
Section 7 – 1: Geometric Mean
Notes

Key Concept: Geometric Mean – the positive ___________ _________ of the ___________ of two numbers

Ex –

- Can also be written as a proportion:

Example #1: Find the geometric mean between each pair of numbers.

a.) 4 and 9           b.) 6 and 15
The ALTITUDE of a right triangle is the geometric mean between the measures of the two segments of the hypotenuse it creates.
The LEG of a right triangle is the geometric mean between the measures of the hypotenuse and the segment (formed by the altitude) of the hypotenuse adjacent to the leg.
Example #2: In $\triangle PQR$, $RS = 3$ and $QS = 14$. Find $PS$.

Example #3: Find $x$ and $y$ in $\triangle PQR$. 
CRITICAL THINKING

1. \[ \text{ is the geometric mean between } a \text{ and } b. \text{ Find } a \text{ if } b = \frac{1}{2}. \]

2. Find the exact value of DE, given AD = 12 and BD = 4.
Fun Activity!!!

You will need:
- This packet
- A pencil
- A baggie containing squares of paper

Directions:
- Draw a right angle on the blank page facing this one. It should take up most of the page
- Label one side of the angle “A” and the other side “B”
- Take several squares of graph paper (SHARE!)
- Line one up on one side of the right angle
- Line another up on the other side of the right angle
- Find another square that matches EXACTLY so that the space between the squares forms a triangle, and the corners (vertices) of the squares touch, but do not overlap (This is side “C”)
- Fill in the table below
- Repeat

<table>
<thead>
<tr>
<th>Length of side A</th>
<th>Length of side B</th>
<th>Length of side C</th>
<th>Area of square A</th>
<th>Area of square B</th>
<th>Area of square A+Area of square B</th>
<th>Area of square C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Make a conjecture about the last two columns?

Make a prediction for a different set of 3 squares not used above.
Section 7 – 2: The Pythagorean Theorem

**Theorem 7.4:** Pythagorean Theorem – In a __________ ____________, the sum of the ______________ of the measures of the legs equals the square of the measure of the ________________.

**Symbols:**

**Example #1:** Find the length of the hypotenuse.

![Diagram of a right triangle with sides 7 in., 12 in., and unknown x in.]

**Example #2:** Find the length of the missing leg.

![Diagram of a right triangle with sides 3 cm, 6 cm, and unknown d cm]
Theorem 7.5: Converse of the Pythagorean Theorem – If the sum of the squares of the measures of two sides of a ___________ __________ equals the square of the measure of the ________________ __________, then the triangle is a ______________ triangle.

Symbols:

Example #3: Verify the triangle is a right triangle.

[Diagram of a triangle with sides labeled 8, 15, and 17]

Pythagorean Triple – three __________ ____________ that satisfy the equation ________________, where \( c \) is the __________ number

Example #4: Pythagorean Triples – Determine whether each set of measures are the sides of a right triangle. Then state whether they form a Pythagorean triple.

a.) 9, 12, and 15

b.) 21, 42, and 54

c.) \( 4\sqrt{3}, 4, \) and 8
1. Determine whether the given vertices form a right triangle:
   Q(-9, -2), R (-4, -4), S (-6, -9)

2. The figure are the right is a rectangular prism with AB = 8, BC = 6, and BF = 8, and M is the midpoint of BD. Find BD and HM. How are EM, FM, and GM related to HM?
Properties of 45°-45°-90° Triangles

Use the Pythagorean Theorem to complete the chart. Use the right triangle below as reference.

<table>
<thead>
<tr>
<th>a</th>
<th>$a^2$</th>
<th>b</th>
<th>$b^2$</th>
<th>c</th>
<th>$c^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>25</td>
<td>5</td>
<td>25</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>121</td>
<td></td>
<td>11</td>
<td></td>
<td>11</td>
<td>121</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td>$7\sqrt{2}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$2\sqrt{3}$</td>
<td></td>
<td>$2\sqrt{3}$</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$4\sqrt{2}$</td>
<td></td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>81</td>
<td></td>
<td>9</td>
<td></td>
<td>$\frac{11}{2}$</td>
<td>$\sqrt{11}$</td>
</tr>
<tr>
<td>$\frac{11}{2}$</td>
<td></td>
<td>$\sqrt{11}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>2</td>
<td>4</td>
<td>$8\sqrt{2}$</td>
<td></td>
</tr>
</tbody>
</table>

What type of triangle do you see in the table above? ________________

Write a conjecture about the relationship between the legs and hypotenuse of this type of triangle.

__________________________________________________________________________________________________________________________________

In the special right triangle (_______- _______ - _______), we find the
   Hypotenuse by multiplying the leg by __________
   Leg by dividing the hypotenuse by __________
Example #1: Find the lengths of the missing sides.

a.)

b.)

\[ 5\sqrt{2} \]

c.)

\[ 4\sqrt{3} \]

d.)

\[ 9\sqrt{2} \]

e.)

f.)
CRITICAL THINKING

1. \( \Delta PAB \) is a 45°-45°-90° triangle with right angle B. Find the coordinates of P in Quadrant I for A (-3, 1) and B (4, 1)

2. The diagram at the right shows some dimensions of Cominskey Park in Chicago, Illinois. \( \overline{BD} \) is a segment from home plate to dead center field, and \( \overline{AE} \) is a segment from the left field foul-ball pole to the right field foul-ball pole. If the center fielder is standing at C, how far is he from home plate?
Properties of $30^\circ$-$60^\circ$-$90^\circ$ Triangles

Use the Pythagorean Theorem to complete the chart. Use the right triangle below as reference.

![Right Triangle Diagram]

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>a²</td>
<td>b</td>
<td>b²</td>
<td>c</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>6</td>
<td>$6\sqrt{3}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$5\sqrt{5}$</td>
<td>$5\sqrt{15}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>192</td>
<td></td>
<td></td>
<td>$16\sqrt{3}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>147</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>121</td>
<td>$11\sqrt{3}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td></td>
<td>$3a^2$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Write a conjecture about the relationship between the legs and hypotenuse of this type of triangle.

__________________________________________________________________________________________

__________________________________________________________________________________________

In the special right triangle (_______ - _______ - _______), we find the Hypotenuse by multiplying the short leg by ________

Long Leg by multiplying the short leg by ______
Short Leg by dividing the hypotenuse by ________
Short leg by dividing the long leg by ________
Example #1: Find the lengths of the missing sides.

a.) 

\[
\begin{array}{c}
5 \\
60
\end{array}
\]

b.) 

\[
\begin{array}{c}
7 \\
60
\end{array}
\]

c.) 

\[
\begin{array}{c}
5\sqrt{3} \\
30
\end{array}
\]

d.) 

\[
\begin{array}{c}
8\sqrt{2} \\
60
\end{array}
\]

e.) 

\[
\begin{array}{c}
9 \\
30
\end{array}
\]

f.) 

\[
\begin{array}{c}
4\sqrt{3} \\
30
\end{array}
\]
1. ΔPCD is a 30°-60°-90° triangle with right angle C, and CD the longer leg. Find the coordinates of P in Quadrant III for C (-3, -6) and D (-3, 7).

2. Find x, y, z, and the perimeter of ABCD
Section 7 – 4-A: Trigonometry

Notes

Trigonometry – from the ____________

• trigon – meaning ______________
• metron – meaning _______________

Trigonometric Ratio: a ratio of the ____________ of the sides of a _________ triangle

Three most common trig ratios:

• ____________________
• ____________________
• ____________________
• ____________________

\[
\begin{align*}
\sin A &= \quad \sin B = \\
\cos A &= \quad \cos B = \\
\tan A &=
\end{align*}
\]
1.) Find the sine, cosine, and tangent of $\angle A$ and $\angle B$.

\[
\begin{align*}
\text{sin (A)} = & \quad \text{sin (B)} = \\
\text{cos (A)} = & \quad \text{cos (B)} = \\
\text{tan (A)} = & \quad \text{tan (B)} =
\end{align*}
\]

2.) Find the sine, cosine, and tangent of $\angle D$ and $\angle E$.

\[
\begin{align*}
\text{sin (D)} = & \quad \text{sin (E)} = \\
\text{cos (D)} = & \quad \text{cos (E)} = \\
\text{tan (D)} = & \quad \text{tan (E)} =
\end{align*}
\]

3.) Find the sine, cosine, and tangent of $\angle A$ and $\angle B$. (HINT: You need to use the Pythagorean Theorem first!)

\[
\begin{align*}
\text{sin (A)} = & \quad \text{sin (B)} = \\
\text{cos (A)} = & \quad \text{cos (B)} = \\
\text{tan (A)} = & \quad \text{tan (B)} =
\end{align*}
\]
4.) Use your trig table to find \( \sin(A) \), \( \cos(A) \), and \( \tan(A) \) for the given measures of angle \( A \).

a.) 15°  
b.) 27°  
c.) 81°

d.) 66°  
e.) 8°  
f.) 59°

5.) Use your trig table to find the measure of angle \( A \) to the nearest degree.

a.) \( \tan(A) = 0.4663 \)  
b.) \( \sin(A) = 0.5000 \)

c.) \( \sin(A) = 0.8746 \)  
d.) \( \cos(A) = 0.7880 \)

e.) \( \sin(A) = 0.1114 \)  
f.) \( \sin(A) = 0.9998 \)

g.) \( \tan(A) = 1.4281 \)  
h.) \( \cos(A) = 0.5656 \)
CRITICAL THINKING

Find sine, cosine, and tangent of angles A and B if \( \triangle ABC \) is a right triangle (hint: Figure out which angle is the right angle first!). A (6, 0), B (-4, 2), C (0, 6).
7-4-A: Trigonometry
Homework

Use your trig table to find \( \sin(A) \), \( \cos(A) \), and \( \tan(A) \) for the given measures of angle \( A \).

1.) 12° 
2.) 42° 
3.) 75° 
4.) 24° 
5.) 35° 
6.) 66° 
7.) 16° 
8.) 79° 
9.) 31° 
10.) 52° 
11.) 8° 
12.) 58° 
13.) 70° 
14.) 48° 
15.) 30° 

Use your trig table to find the measure of angle \( A \) to the nearest degree.

16.) \( \sin(A) = 0.9903 \) 
17.) \( \cos(A) = 0.9063 \) 
18.) \( \cos(A) = 0.6428 \) 
19.) \( \tan(A) = 1.7321 \) 
20.) \( \tan(A) = 0.4456 \) 
21.) \( \sin(A) = 0.6558 \) 
22.) \( \tan(A) = 1.2851 \) 
23.) \( \cos(A) = 0.9607 \) 
24.) \( \tan(A) = 3.2608 \) 
25.) \( \sin(A) = 0.9560 \) 
26.) \( \sin(A) = 0.7777 \) 
27.) \( \cos(A) = 0.6683 \) 
28.) \( \sin(A) = 0.8330 \) 
29.) \( \sin(A) = 0.6440 \) 
30.) \( \tan(A) = 5.6708 \) 
31.) \( \cos(A) = 0.0860 \)
Section 7-4-B: Sine, Cosine, and Tangent Ratios

Notes

Example #1: Express \( \sin (P) \), \( \cos (P) \), \( \sin (Q) \), \( \cos (Q) \), \( \tan (P) \) and \( \tan (Q) \) as ratios.

![Diagram](image1)

Example #2: Find \( n \) to the nearest degree.

![Diagram](image2)

Example #3: Find the value of \( x \) and \( y \) to the nearest tenth.

![Diagram](image3)

![Diagram](image4)
CRITICAL THINKING

Find the perimeter of $\triangle ABC$ if $m\angle A = 35$, $m\angle C = 90$ and $AB = 20$ inches.
Section 7 – 5: Angles of Elevation and Depression

Notes

Angles of Elevation: An _____________ ___ ________________ is the angle between the line of sight and the _________________ when an observer looks upward.

Angles of Depression: An _____________ ___ ________________ is the angle between the line of sight when an observer looks ________________, and the _________________.

Example #1: A wheelchair ramp is 3 meters long and inclines at 6°. Find the height of the ramp.
Example #2: A building 200 feet tall casts a 155 foot shadow. Find the angle of elevation of the sun.

Example #3: Dontaya is at the top of a lighthouse which is 250 feet above sea level. From the top, the measure of the angle of depression to Brace’s boat on the water is 48°. How far is Brace’s boat from the bottom of the lighthouse?

Example #4: Junior, flying a plane over level ground at an altitude of 2,400 feet sights Ciana standing on the street. The angle at which Junior looks down is 6°. Find the ground distance between Ciana and point directly below Junior’s plane.
Kwan-Yong uses a theodolite to measure the angle of elevation from the ground to the top of Ayers Rock to be 15.85. He walks half a kilometer closer and measures the angle of elevation to be 25.6. How high is Ayers Rock to the nearest meter?
7-5 A-Angles of Elevation and Depression Homework

1.) A ladder leaning against a building makes an angle of 78° with the ground. The foot of the ladder is 5 feet from the building. How long is the ladder?

2.) The angle of depression from the top of a cliff to an ant on the ground is 35°. If the ant is 280 feet from the base of the cliff, how tall is the cliff?

3.) A ski run is 1000 yards long with a vertical drop of 208 yards. Find the angle of depression from the top of the ski run to the bottom.

4.) A person whose eyes are 5 feet above the ground is standing on the runway of an airport 100 feet from the control tower. That person observes an air traffic controller at the window of the 132-foot tower. What is the angle of elevation?
<table>
<thead>
<tr>
<th>$m^\circ \angle A$</th>
<th>$\sin A$</th>
<th>$\cos A$</th>
<th>$\tan A$</th>
<th>$m^\circ \angle A$</th>
<th>$\sin A$</th>
<th>$\cos A$</th>
<th>$\tan A$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>0.9998</td>
<td>0.0175</td>
<td>46</td>
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<td>2</td>
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<td>47</td>
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<td>0.9986</td>
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<td>48</td>
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<td>0.0875</td>
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<td>6</td>
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<td>51</td>
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<td>53</td>
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<td>1.3270</td>
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<td>0.9816</td>
<td>0.1944</td>
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<td>0.2250</td>
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<td>0.2309</td>
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<td>0.8480</td>
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<td>0.2419</td>
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</tr>
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<td>15</td>
<td>0.2588</td>
<td>0.9659</td>
<td>0.2679</td>
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<td>0.8660</td>
<td>0.5000</td>
<td>1.7321</td>
</tr>
<tr>
<td>16</td>
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<td>0.9613</td>
<td>0.2867</td>
<td>61</td>
<td>0.8746</td>
<td>0.4848</td>
<td>1.8040</td>
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<tr>
<td>17</td>
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<td>1.9626</td>
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<td>0.9455</td>
<td>0.3434</td>
<td>64</td>
<td>0.8988</td>
<td>0.4384</td>
<td>2.0503</td>
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<tr>
<td>20</td>
<td>0.3420</td>
<td>0.9397</td>
<td>0.3640</td>
<td>65</td>
<td>0.9063</td>
<td>0.4226</td>
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<td>0.3584</td>
<td>0.9336</td>
<td>0.3839</td>
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<td>0.4067</td>
<td>2.2460</td>
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