Unit 5 Test

1. Use Law of Cosines to solve for angle B. $17.6^2 = 15^2 + 20.9^2 - 2(15)(20.9)\cos B, B = 55.8°$, which means the picture was drawn accurately.

2. $$CD^2 = 32.6^2 + 51.4^2 - 2(32.6)(51.4)\cos 27, CD = 26.8$$
$$\angle C,\ \angle C = 33.5°$$
$$AB^2 = 64.1^2 + 51.4^2 - 2(64.1)(51.4)\cos 33.5, AB = 35.4$$
This means that the artist's drawing is off by 1.1 foot.

3. The area of a trapezoid is $A = \frac{1}{2}h(b_1 + b_2)$. In the problem, we were given both bases, a side and a diagonal. So, we need to find the height. In order to do this, we first need to find the angle between 2200 and 2400(x), use that to find it's complement, then we can take the cosine to find the height.
$$2100^2 = 2400^2 + 2200^2 - 2(2400)(2200)\cos x$$
$$x = 54.1° \rightarrow 90° - 54.1° = 35.9°$$
$$\cos 35.9° = \frac{h}{2200} \rightarrow h = 1782.1$$
$$A = \frac{1}{2}(1782.1)(2400 + 3000) = 4,811,670\ sq.\ ft.$$

4. $AB^2 = 4^2 + 21^2 - 2(4)(21)\cos 120, AB = 23.3$ *minus* 5, new AB is 18.3 new $\angle E$ is $18.3^2 = 4^2 + 21^2 - 2(4)(21)\cos E, \angle E = 42.6°$

5. Answers:
   a. $x^2 = 13.3^2 + 17.6^2 - 2(13.3)(17.6)\cos 132, x = 28.3$
   b. $\cos 52 = \frac{x}{19.3}, x = 11.9$
   c. $\frac{\sin 42}{18.6} = \frac{\sin x}{15.9}, x = 34.9°$
   d. $\frac{\sin 46}{92.7} = \frac{\sin 12}{x}, x = 26.8$

6. Answers:
   a. We will call the distance across the canyon h. $\frac{\sin 32}{12} = \frac{\sin 87}{x}, x = 22.6. \sin 61 = \frac{h}{22.6}$, 19.8 km.
   b. We will call the distance between the two boulders y. $y = a + b$, where a is the distance from boulder 1 to the first stop (that the surveyor took) and b is the distance from that spot to boulder 2.
   - $$\tan 3° = \frac{a}{19.8} \qquad \tan 37° = \frac{b}{19.8}$$
   - So, $a + b = 19.8(\tan 3° + \tan 37°) = 16.0$ km.

7. Company A coverage: $x^2 = 38^2 + 47^2 - 2(38)(47)\cos 72.8, x = 51$ Company B coverage: $\frac{\sin x}{58} = \frac{\sin 12}{59}, x = 11.8° \rightarrow \frac{\sin 12}{59} = \frac{\sin 156.2}{b}, b = 114.52$ Overlap: $\frac{\sin a}{38} = \frac{\sin 72.8}{51}, a = 45.4° \rightarrow \frac{\sin 12}{15} = \frac{\sin 122.6}{o}, o = 60.8$

8. Answers:
   a. magnitude $= \sqrt{48.3^2 + 47.6^2} = 67.8$, direction $= \tan\theta = \frac{47.6}{48.3} \rightarrow 44.6°$
   b. magnitude $= \sqrt{18.6^2 + 17.5^2} = 25.5$, direction $= \tan\theta = \frac{47.6}{48.3} \rightarrow 43.3°$

9. Answers:
   a. magnitude $= \sqrt{(19-1)^2 + (-4-12)^2} = 24.1$, direction $= \tan\theta = \frac{-18}{16} \rightarrow -48.4°$
   b. magnitude $= \sqrt{(-21+11)^2 + (11-21)^2} = 14.1$, direction $= \tan\theta = \frac{-10}{-10} \rightarrow 45°$

10. This is the SSA or ambiguous case. Because $137 > 425\sin 16°$, we will have two solutions or two different lengths that the golfer could have hit the ball. $\frac{\sin 16}{137} = \frac{\sin x}{425}, x = 58.8°$ or 121.2° (this is the angle at the ball) Case 1: Use 58.8°, the angle at the pin is $105.2° \frac{\sin 105.2}{d} = \frac{\sin 16}{137}$, distance is 479.6 yards. Case 2: Use 121.2°, the angle at the pin is $42.8° \frac{\sin 42.8}{d} = \frac{\sin 16}{137}$, distance is 337.7 yards. It is safe to say that the golfer did not hit the ball 479.6 yards, considering that Tiger Woods longest recorded drive is 425 yards. So, we can logically rule out Case 1 and our answer is that the golfer's drive was 337.7 yards.

11. $\cos 36° = \frac{x}{0.5}, x = 0.4$ *miles*
12. The third angle in the triangle is 35°, from the Triangle Sum Theorem.

$$\frac{\sin 35}{127.3} = \frac{\sin 127}{x}, x = 177.2$$

Therefore, the ball was hit 177.2 feet. The distance between second base and the ball can be calculated as follows:

$$\frac{\sin 35}{127.3} = \frac{\sin 18}{x}, x = 68.6$$

13. Therefore, the distance from second base to the ball is 68.6 feet.
14. The distance between the tower and target 2 is: $x^2 = 37^2 + 18^2 - 2(37)(18)\cos 67.2°, 34.3$ *miles*. This means that the second target is out of range by 4.3 miles.
15. Answer:
    - We need to find area, use Heron's Formula. $s = \frac{1}{2}(587 + 247 + 396) = 615$
    - $A = \sqrt{615(615-587)(615-247)(615-396)} = 37,253.1$, times $5.2 \times 10^{13} = 1.9 \times 10^{18}$ bacteria.