Problems PreCal 1508 PLTL Workshop, November 9, 2011
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Please do the problems that you feel will help your group the most first (you don't have to do them in order). All handouts are available at `http://alex.knaust.info/pltlfall2011/`

1. Jimmy is trying to do the second problem and he makes the following argument :

   - The problem tells me $\tan(\theta) = \frac{5}{12}$
   - I also know $\tan(\theta) = \frac{\sin(\theta)}{\cos(\theta)}$
   - So $\frac{5}{12} = \frac{\sin(\theta)}{\cos(\theta)}$
   - Since $\frac{a}{b} = \frac{c}{d}$ means $a = c$, $b = d$
   - Then $\sin(\theta) = 5$, $\cos(\theta) = 12$

   How can he tell from his results that he did something incorrectly?

2. Given the following trigonometric functions, find all others of the given angle. $0 < \theta < \pi$
   (a) $\sin(\theta) = \frac{-3}{5}$ (b) $\tan(\theta) = \frac{5}{12}$ (c) $\sec(\theta) = \frac{-17}{15}$

3. For the following functions, determine their amplitude, period, and phase shift, and use those parameters to sketch a graph of the function. verify with a calculator.

   (a) $y = -\sin\left(\frac{2\pi x}{3}\right)$
   (b) $y = 4\cos\left(x + \frac{\pi}{4}\right)$

4. Determine the domain and range of sin cos and tan. (use $\tan\theta = \frac{\sin\theta}{\cos\theta}$)

5. Find reference angles for the following angles (in radians)

   (a) $135°$
   (b) $-\frac{5\pi}{6}$
   (c) $\frac{\pi}{2}$

6. I want to find out the height of a pole, but unfortunately it is surrounded by a fence and guarded by vicious rabbits. Luckily I have some tools to measure distance and angles. I measure the angle of elevation (angle from ground to top of the pole) from my starting position and discover it is $30°$. Then I walk exactly 12m towards the pole and measure the angle... It is now $45°$. Then I try to climb over the fence to measure the height and am eaten alive by the rabbits. Did I die in vain? If so, how tall is the pole?

7. My friend says he wants to find all the Pythagorean triples (integers a, b, c such that $a^2 + b^2 = c^2$), so he starts with $(1, 1, 1)$ and tries every tuple. I tell him he is a fool, instead he could just pick two integers m, n and say $a = m^2 - n^2$, $b = 2mn$, $c = m^2 + n^2$ and that will be a triple.

   (a) (Regular) He doesn't believe me, please show him I am right
   (b) (Hardened) Will my formula find every Pythagorean triple?
   (c) (Veteran) Fermat conjectured (in 1637) that there are none for $a^3 + b^3 = c^3$ or any power greater than 2. (This was first proven in 1994)