PROBLEM SET #11 **NAME:**_____
Math 196L Spring 2017

Instructions: Read each problem (1-3). Write a sentence or two about the approach you might take to solve each problem. Draw a picture to illustrate the scenario. Write a formula that might be needed to help set up or solve the problem.
In addition to the above write down the following identities. The last ones are found in section 7.3 of our textbook.

$\sin(s+t)$

$\sin(s-t)$

$\cos(s+t)$

$\cos(s-t)$

$\tan(s+t)$

$\tan(s-t)$

$\sin(2x)$

$\cos(2x)$

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1. A certain drawbridge divides into two equal sections where the sections rotate upward to an angle of 35°. This draw bridge is 150 feet long when stretched across a river. The water level is 15 feet below the closed bridge.
   (A) When the draw bridge is raised to its maximum height, find the distance between the end of one of the sections and the water level.

   (B) When the bridge sections are fully raised approximate how many feet is the gap between the two sections.

2. A mathematically inclined state trooper is hidden 25 feet from the edge of the highway. Due to budget cuts, he does not have a working speed gun. Instead, he has worked out that if he can measure the angle that the right front corner of a vehicle makes with a line parallel to the (straight) road after exactly one second, then he can still figure out when to issue speeding tickets. One second after the front end of a truck passes the state trooper, he measures the angle between the road and the line of observation from himself to the front of the truck. Assume that the right side of the truck is 5 feet from the road's edge. If the speed limit is 55 miles per hour and a speeding ticket is issued for speeds of 5 miles per hour or more over the limit, for what angle(s) should the trooper issue a ticket?

3. You are scouting an enemy fortification and need to the height of a wall that your Special Forces team will need to scale, and how far back it is from the fence that surrounds the base of the fortification. Using your military issue protractor, you measure the angle to the top of the fortification to be 17.7 degrees when you are right up against the fence and 8.2 degrees when you move back 300 meters from the fence. Round your answer to the nearest cm. (Assume that the ground is level.)

4 . Simplify the following: (using identities)

(A) $[a\cos(z) - b\sin(z)]^2 + [a\sin(z) + b\cos(z)]^2$

(B) $\dfrac{1}{\tan(\beta)+\cot(\beta)}$

(C) $\dfrac{\sin(2\theta)}{2\sin(\theta)}$

(D) $\dfrac{\cot(-t)+\tan(-t)}{\cot(t)}$

(E) $\cos(u+v) + \cos(u-v)$

5. Using addition and subtraction of angles to calculate exact values in trig functions.

(A) **Angle $A = 15°$.**

i) Write angle A either as sum or the difference of two angles whose exact evaluation in a trig functions is known. Each angle is a central angle.

ii) Using these two angles calculate the exact values of $\sin(A)$, $\cos(A)$ *and* $\tan(A)$.

(B) **Angle $B = 285°$.**

i) Write angle B either as sum or the difference of two angles whose exact evaluation in a trig functions is known. Find at least 3 different sets of angles. Each angle is a central angle.

ii) Using each set found, calculate the exact values of $\sin(B)$, $\cos(B)$ *and* $\tan(B)$.

(C) **Angle $C = \dfrac{11\pi}{12}$.**

i) Write angle C either as sum or the difference of two angles whose exact evaluation in a trig functions is known. Find at least 3 different sets of angles. Each angle is a central angle.

ii) Using each set found, calculate the exact values of $\sin(C)$, $\cos(C)$ *and* $\tan(C)$.

6. Given: $\cos(\theta_1) = -\frac{2}{3}$ and θ_1 is in Quadrant III
$\sin(\theta_2) = \frac{1}{5}$ and θ_2 is in Quadrant I

(A) Calculate the following without finding the exact values of the angles θ_1 *and* θ_2:

(i) $\sin(\theta_1 + \theta_2)$ (ii) $\cos(\theta_1 - \theta_2)$

(B) In what quadrant does $\theta_1 + \theta_2$ terminate? In what quadrant does $\theta_1 - \theta_2$ terminate?
Your answer should ***not*** *be based on finding exact value of* θ_1 *and* θ_2.

7. Evaluate the following without finding the actual angle value:

(A) $\csc\left(\arctan\left(\frac{x}{\sqrt{x^2+4}}\right)\right)$

(B) $\sin\left(2\arccos\left(-\frac{3}{7}\right)\right)$

(C) $\cos\left(2\ \tan^{-1}\left(\frac{3}{x}\right)\right)$