Name ____________________________

You will return this exam page with your bluebook upon completion of the exam but only work done in your bluebook will be graded.

APPM 1235 Exam 3
November 19, 2014

• Textbooks, class notes, drones and electronic devices of any kind are NOT permitted.
• If you leave the exam room, you will not be allowed back in and your exam will be concluded.

Box your final answers for each question.

• Begin each numbered problem on a blank, right-side page of your bluebook. All problems should be clearly numbered and in order.

For problems #1 - #5, show your work. Fully simplify all solutions. Unless otherwise indicated, leave your answers in terms of $\pi$ as necessary.

1. [18 points] Find the exact value of the following. If the value is not defined, state "undefined."

   (a) $\sin^{-1}\left(\frac{-\sqrt{2}}{2}\right)$
   (b) $\tan^{-1}\left(\tan\frac{2\pi}{3}\right)$
   (c) $\cos^{-1}\left(\cos\frac{7\pi}{6}\right)$

   (d) $\sin^2\left(\sin^{-1}\left(\frac{-\sqrt{2}}{2}\right)\right)$
   (e) $\cot\left(\cos^{-1}\pi\right)$
   (f) $\tan\left(\cos^{-1}\frac{5}{13}\right)$

2. [10 points] A CU student gets around campus in a human hamster wheel. The wheel has a diameter of 2 meters. The student travels at a rate of 3 revolutions every 12 seconds.

   (a) How fast does the hamster wheel travel in meters per second?

   (b) The student lives in Baker Hall and has a class in Fleming. If the distance from Baker Hall to Fleming is $240\pi$ meters, how many minutes does it take for the student to get from his dorm to his class?

3. [25 points] Consider the graph shown below. It shows the hours of daylight $s$ as function of time $t$ in months for 4 different cities. (Note that the equinox and solstice events are spaced exactly 3 months apart.)

   (a) Let Sept 23 (the first Fall equinox) correspond to $t = 0$. What is $s$ at $t = 0$ for each city?

   (b) What is the period for each city?

   (c) What is the amplitude for Juneau?

   (d) Find a sine function that describes the graph for Juneau. Call this function $s(t)$.

   (e) What is the height of the Juneau wave (that is, the difference between the crest and the trough of the wave)?

Extra credit (2 points): Which city has the most average hours of daylight?
4. [15 points] Find angles A, B, C and D and side x in the figure shown below. This figure is not to scale; do not assume any angle values that are not given.

Figure for problem #4

5. [20 points] In order to construct a new highway sign, you are tasked with inscribing a hexagon within a circular sign. The area on the sign outside of the hexagon will be painted black. A concept of the sign is shown above. The sign is to have a radius of 5 inches. Answer the following questions to determine how much black paint will be needed per sign.

(a) Find $\theta$.

(b) Find the area of one of the triangles.

(c) Find the area of the hexagon.

(d) Find the area of the black paint.

6. [12 points] Match the correct equations to each graph. There are two correct equations for each graph. Two equations are not used.

Graph #1

A. $y = -\cot(x + \pi)$

B. $y = -\cos\left(\frac{1}{2} x\right)$

C. $y = -\sin\left(2x - \frac{\pi}{2}\right)$

D. $y = \tan\left(x + \frac{\pi}{2}\right)$

E. $y = -\cos(2x + \pi)$

F. $y = \sin\left(\frac{1}{2} x - \frac{\pi}{2}\right)$

G. $y = \cot(-x + \pi)$

H. $y = -\sin\left(2x - \frac{\pi}{4}\right)$

END OF EXAM

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