Test 2 - MTH 1400 Online

Dr. Graham-Squire, Summer 2016

Name: _____

I pledge that I have neither given nor received any unauthorized assistance on this exam.

_____

(*signature*)

DIRECTIONS

1. Don't panic.
2. Show all of your work and use correct notation! A correct answer with insufficient work or incorrect notation will lose points.
3. Clearly indicate your answer by putting a box around it.
4. Cell phones and computers are not allowed on this test. Calculators are allowed on the first 7 questions of the test, however you should still show all of your work. No calculators are allowed on the last 2 questions. If you change from the With calculator portion of the test to the No Calculator portion, it is fine to go back to the With Calculator portion again. However, once you turn in the No Calculator portion of the test, you CANNOT return to it.
5. Give all answers in exact form, not decimal form (that is, put π instead of 3.1415, $\sqrt{2}$ instead of 1.414, etc) unless otherwise stated.
6. If you need it, the quadratic formula is $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.
7. If you need it, the law of cosines is $c^2 = a^2 + b^2 - 2ab\cos(C)$.
8. Make sure you sign the pledge.
9. Number of questions = 9. Total Points = 60.

1. (6 points) If a car engine overheats, the resulting cooling process can be modeled by the equation

$$\ln\left(\frac{T-20}{180}\right) = -0.12t,$$

where T is the temperature of the engine t minutes after the car has overheated.

(a) Solve the equation for T. (that is, rewrite the equation in the form $T =$ _____, where _____ is an expression in terms of t). Show your work!

(b) Find the temperature of the engine 13 minutes after the car has overheated. Explain/show how you got your answer. Round answer to nearest 0.1 degrees.

2. (8 points) The current population (in 2016) of the US is 318.9 million. In 1900, the US population was 76.2 million. Assuming that the US population can be modeled by an exponential growth function (and that the population continues to grow at the same rate we have seen for the past 116 years), approximate when the US population will reach 1 billion (that is, 1,000 million) (rounded to the nearest year). Make sure to show/explain your work.

3. (6 points) (a) Use trigonometric relations to write the $\tan\theta$ solely in terms of $\cos\theta$, assuming that θ is in Quadrant III. So your answer should be in the form $\tan\theta =$ _____, where _____ is an expression in terms of $\cos\theta$. Make sure to show your work and/or explain your reasoning!

   (b) Check to see if your answer is correct by evaluating both sides of the equation for $\theta = 4$ (Make sure your calculator is in radians!).

   (c) Explain how you know that $\theta = 4$ is in Quadrant III. (it may help to know that $\pi = 3.14$)

4. (6 points) Julie is standing on top of a hill and looking at a flagpole of height h which is a distance of d feet away. The top of the flagpole is higher than Julie, and the bottom of the flagpole is lower, and d is the horizontal distance between Julie and the pole. Julie measures the angle of elevation to the top of the flagpole to be $18°$, and the angle of depression to the bottom of the pole to be $14°$.

   (a) Draw a diagram of the situation.

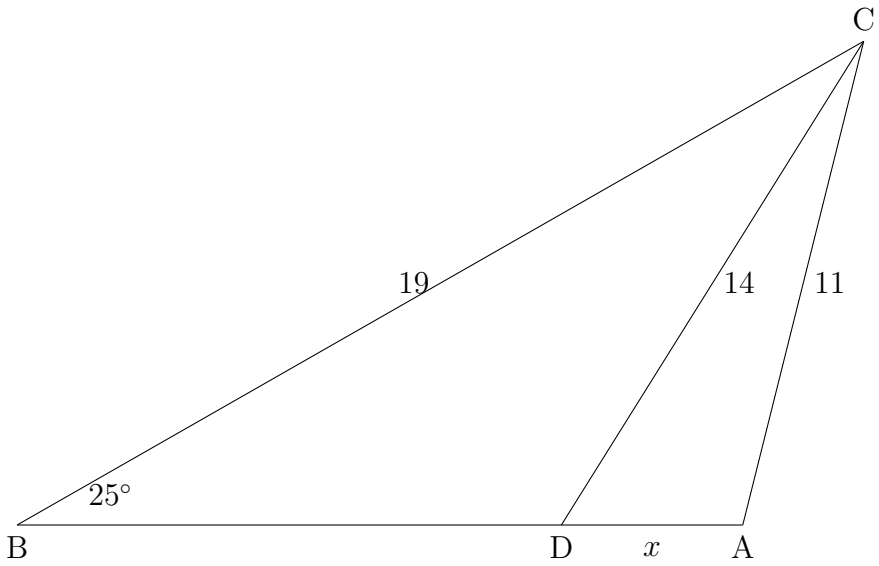
   (b) If Julie's distance d to the flagpole is 100 feet, calculate the height h of the flagpole. Round to nearest 0.01.

5. (4 points) Julie is standing on top of a hill and looking at a flagpole of height h which is a distance of d feet away. The top of the flagpole is higher than Julie, and the bottom of the flagpole is lower, and d is the horizontal distance between Julie and the pole. Julie measures the angle of elevation to the top of the flagpole to be $18°$, and the angle of depression to the bottom of the pole to be $14°$.

   (a) Draw a diagram of the situation (should look same as in previous problem).

   (b) Now suppose Julie does *not* know the distance d to the flagpole, but she *does* know that the flagpole is 60 feet tall. Can she calculate the distance d? If not, explain why not. If so, calculate it (round to nearest 0.01) and explain how you got your answer.

6. (6 points) In the diagram below, $\overline{BC} = 19$, $\overline{DC} = 14$, $\overline{AC} = 11$, angle $B = 25°$. Use laws of trigonometry to calculate the length of $x = \overline{AD}$, rounded to the nearest 0.01. (Note: you can assume that $\overline{AB}$ is a straight line.) If there is more than one possible answer, you should judge from the diagram which answer you think is more correct, and explain your reasoning.



7. (6 points) Grace is a ranger at Yellowstone National Park, and she has to measure the size of a hot spring. Of course, the water in the spring is boiling hot, so she cannot measure length of the spring directly. Instead, she locates a point A at one end of the spring and a point B at the other end of the spring. From a point C that is 20 feet from point A and 24 feet from point B, Grace measures angle C to be $23°$.

   (a) Draw a diagram of this situation.

   (b) Use the given information to calculate the length $\overline{AB}$ of the hot spring. Round to nearest 0.01 feet.

No Calculator Name:_____

•Note that once you finish this portion of the test and turn it in, you CANNOT return to it!

8. (12 points) Without using a calculator, calculate the following. If the expression does not exist or is undefined, say so and explain why. Make sure to show your work, if there is any work to be shown! If it would help you, you can fill out the unit circle on the next page.

   (a) $\sin(60°)$

   (b) $\cos\left(\frac{7\pi}{6}\right)$

   (c) $\tan\left(-\frac{3\pi}{4}\right)$

   (d) $\sec(630°)$

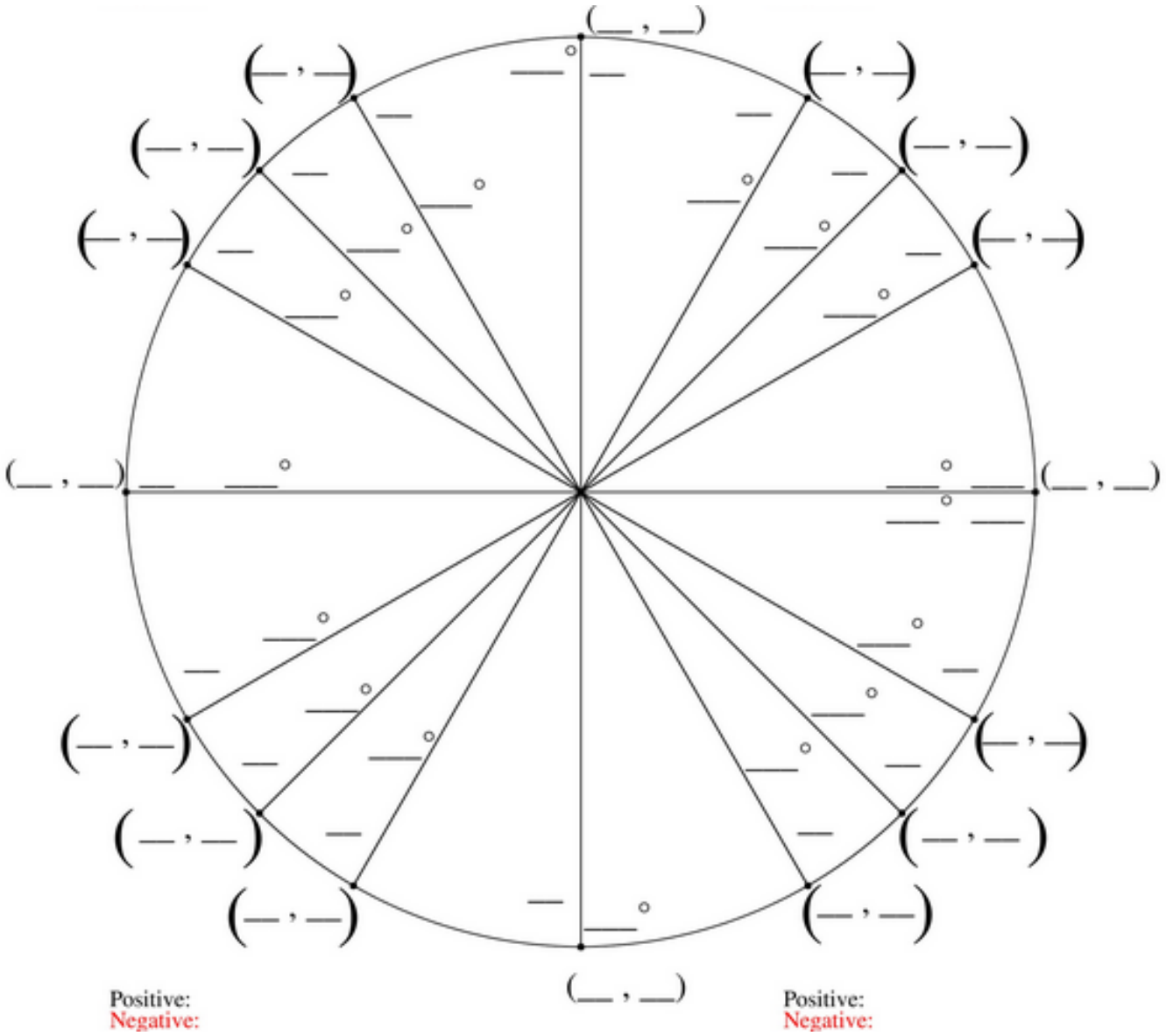
   (e) $\cot\left(\frac{29\pi}{3}\right)$

   (f) $\cos^{-1}\left(-\frac{\sqrt{2}}{2}\right)$

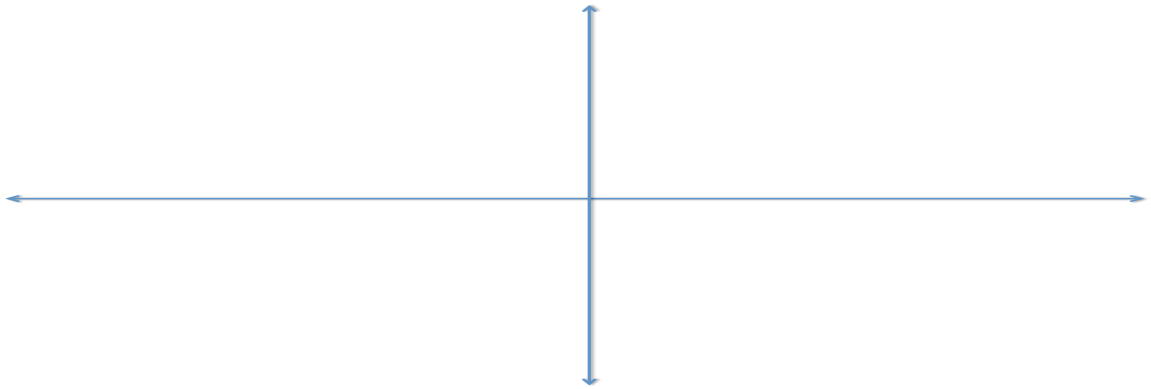
   (g) $\arcsin(\sqrt{3})$

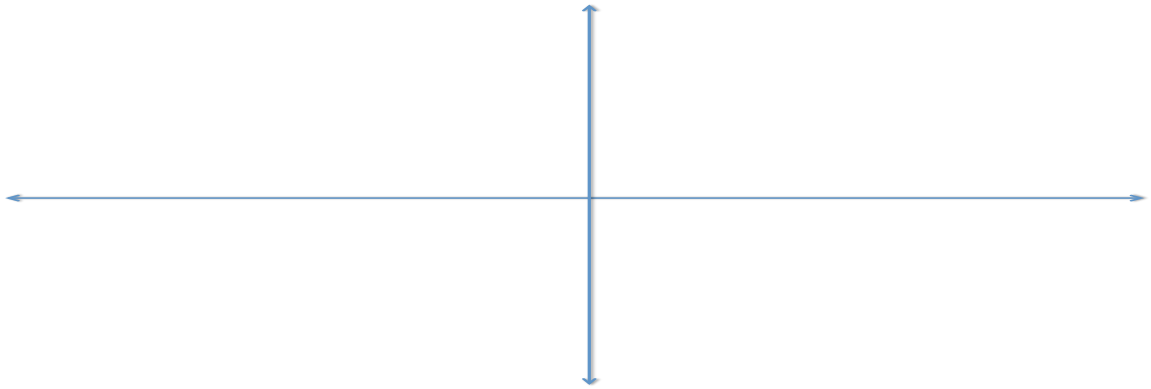
   (h) $\tan^{-1}\left(-\frac{1}{\sqrt{3}}\right)$

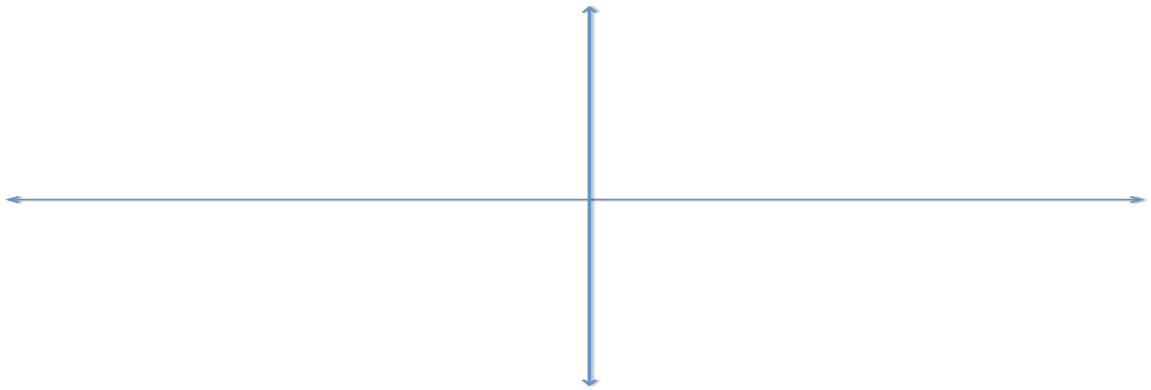
Unit Circle for you to fill in, if you would like to:



9. (6 points) Graph $y = 4\sin(2x)$. Explain how you transform the graph of $\sin x$ to get your result (or show it by doing successive graphs), and label important points on your graph (y-values, x-intercepts, etc).







Extra Credit: (2 points) One of the following equations is true for all values of x in the domain, and the other equation is only true for certain values of x in the domain:

$$\sin(\sin^{-1} x) = x \qquad\qquad \sin^{-1}(\sin x) = x$$

(a) Which equation is true for all values of x in the domain, and which is only true for certain values of x in the domain? Explain how you know which is which.

(b) For each equation, give an example of a value of x that either is undefined or makes the equation false. Explain why your example x-value does not work.