# Math 119 Exam 1

**Joseph McGuire**

**Student Name (print):** ______________________________

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This exam contains 5 pages (including this cover page) and 7 questions. The total number of possible points is 35. Enter your answers in the space provided. Draw a box around your final answer.

- **Mysterious or unsupported answers will not receive full credit**. A correct answer, unsupported by calculations, explanation, or algebraic work will receive no credit; an incorrect answer supported by substantially correct calculations and explanations may still receive partial credit.
- **Clearly identify your answer for each problem.**
- **No calculators or outside help allowed, unless it is with your instructor.**

Do not write in the table to the right.

| Question | Points | Score |
|---|---|---|
| 1 | 5 | |
| 2 | 5 | |
| 3 | 5 | |
| 4 | 5 | |
| 5 | 5 | |
| 6 | 5 | |
| 7 | 5 | |
| Total: | 35 | |

1. (5 points) The point $P(x,y) = \left(x, -\frac{14}{15}\right)$ lies on the unit circle and is in the IV Quadrant. Find the values of sin, cos, sec, csc, cot, tan at this point, if they exist. (Leave in fraction form)

**Solution:** The value of $x$ is $+\frac{\sqrt{29}}{15}$. So that means $\sin(t) = -\frac{14}{15}, \cos(t) = \frac{\sqrt{29}}{15}, \sec(t) = \frac{15}{\sqrt{29}}, \csc(t) = -\frac{15}{14}, \tan(t) = \frac{-14}{\sqrt{29}}, \cot(t) = \frac{\sqrt{29}}{-14}$

2. (5 points) You're given a triangle with sides $a = 4, b = 3$ and angle $B = 30^o$. Solve this using only the law of sines and the fact that the angles add up to $180^o$. Show your work. You can use a calculator here.

**Solution:** Solve this for $\sin(A) = \frac{a\sin(B)}{b} \iff A = 41.81^o$ or $A = 180^o - 41.81^o = 138.19^o$. Both of these work as angles so we need to solve two triangles. Solving for the last angles will give us $C = 180^o - 41.81^o - 30^o = 108.19^o$ and the other $C = 180^o - 138.19^o - 30^o = 11.81^o$. Solving for $c = \frac{b\sin(C)}{\sin(B)} = 5.7$ and $1.228$.



**Points earned:** ______ **out of 10 points**

3. (5 points) You're given a triangle with sides $a = 5, b = 7, c = 6$. Solve this triangle using only the law of cosines **and find the area of the triangle**, don't switch to law of sines, and the fact that the angles $A, B, C$ add up to $180^o$. Show your work. You can use a calculator here.

**Solution:** Law of cosines will give us that $\cos(A) = \frac{5}{7}$, $\cos(B) = \frac{1}{5}, \cos(C) = \frac{19}{35}$ using cosine inverse will give us $A = 44.41^o, B = 78.46^o, C = 57.12^o$. Area is 6

4. (5 points) You're given a triangle with a side $a = 7$, $B = 50^o, C = 35^o$. Solve this triangle only using the law of sines and the fact that the angles add up to $180^o$. Show your work. You can use a calculator here.

**Solution:** Solving for the last angle we see that $A = 95^o$. Using the law of sines to solve for $b = \frac{a\sin(B)}{\sin(A)} = 5.383$ and $c = \frac{a\sin(C)}{\sin(A)} = 4.03$.

 **Points earned:** ______ **out of 10 points**

5. (5 points) Evaluate the following:

$$\tan\left(\tan^{-1}\frac{417\pi}{4}\right) \qquad \text{and} \qquad \tan^{-1}\left(\tan\frac{417\pi}{4}\right).$$

Is it true $\tan^{-1}(\tan(x)) = \tan(\tan^{-1}(x))$ for all $x$?

**Solution:** The first can be solved using the cancellation property, the second however can be solved using the fact that $\tan(x+\pi) = \tan(x)$ for all $x$, is $\tan\frac{\pi}{4} = 1$ and then $\tan^{-1}(1) = \frac{\pi}{4}$. Clearly the two are not equal to each other.

6. (5 points) Using your table of trig functions evaluate the following:

$$\tan^{-1}(2\sin\frac{\pi}{6}) \qquad \text{and} \qquad \cot^{-1}(3\cos\frac{\pi}{2})$$

**Solution:** Using the trig table we have $\sin\pi/6 = 1/2$ so $2\sin\pi/6 = 1$ and $\tan^{-1}(1) = \frac{\pi}{4}$, for the second problem $\cos(\pi/2) = 0$ and $\cot^{-1}(0) = \pi/2$.



**Points earned:** ______ **out of 10 points**

7. (5 points) I compress a spring with stiffness $k$ (constant) and mass $m$ (also constant) a total distance of $a$ (constant) from it's rest position. It's displacement is the function:

$$y(t) = a\sin\left(\sqrt{\frac{k}{m}}t\right)$$

Find the amplitude (don't overthink this), period, and frequency of this function. When is the first time, not at $t = 0$, does the spring come back to it's rest position? (That is, when does $y(t) = 0$? Hint: Solve for $t$ in terms of $k, m$ and $\pi$.)

**Solution:** The amplitude is just $|a|$, period is $\frac{2\pi\sqrt{m}}{\sqrt{k}}$ and the frequency is $\frac{\sqrt{k}}{2\pi\sqrt{m}}$. We know $\sin(x) = 0 \iff x = n\pi$ where $n$ is any whole number, then $n = 1$ is the first time this happens when $\sqrt{\frac{k}{m}}t = \pi$.

 **Points earned:** ______ **out of 5 points**