

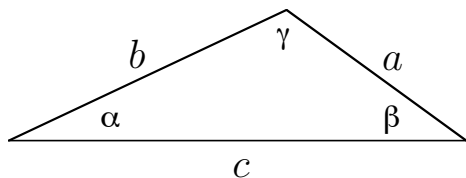
For problems 1-11, show all your work and write your answer in the blank provided. Each problem is worth 5 points. You can earn 0, 3, or 5 points on each problem. **Sufficient work must be shown to receive any credit**, and the problem must be mostly correct to earn 3 points.

1. Suppose $\tan x = -\frac{4}{3}$ with $0 < x < \pi$. Find the exact value of $\tan(x + \pi)$.
1. _____

2. Suppose $\tan x = -\frac{4}{3}$ with $0 < x < \pi$. Find the exact value of $\cot x$.
2. _____

3. Suppose $\tan x = -\frac{4}{3}$ with $0 < x < \pi$. Find the exact value of $\sin x$.
3. _____

4. Given that $\alpha = 25^\circ$, $a = 15$, and $b = 33$, find the measure of angle β to the nearest degree. If there are two answers, give both of them. If there are no possible answers, write "none".
4. _____



5. Suppose $\sin x = \frac{1}{3}$ with $\frac{\pi}{2} < x < \pi$. Find the exact value of $\sin 2x$. You do not have to simplify your answer.

5. _____

6. Find all exact solutions of the equation $\sqrt{2}\sec x + 2 = 0$ on the interval $[0, 2\pi]$.

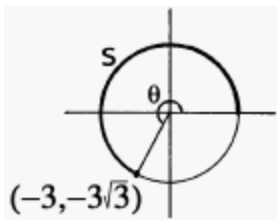
6. _____

7. Suppose that a supporting cable runs from the top of a 25 foot antenna to a point on the ground 20 feet from the base of the antenna. What is the angle between the cable and the ground (to the nearest degree)?

7. _____

8. Referring to the diagram below, find the exact value of $\sin \theta$.

8. _____



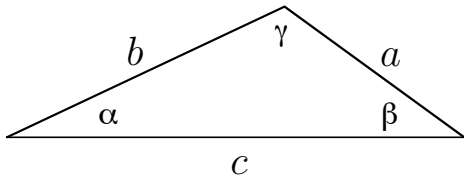
9. Referring to the diagram in problem #8, find the exact length of arc s opposite the angle θ .

9. _____

10. Suppose $\sin x = -\frac{5}{13}$ with $\frac{3\pi}{2} < x < 2\pi$ and $\cos y = -\frac{3}{5}$ with $\pi < y < \frac{3\pi}{2}$. Find the exact value of $\sin(x + y)$. You do not have to simplify your answer.

10. _____

11. Given that $\beta = 110^\circ$, $\gamma = 39^\circ$, and $b = 42$ centimeters, find a to the nearest centimeter. If there are two answers, give both of them. If there are no possible answers, write “none”.



11. _____

For problem 12, write the letter corresponding to the correct answer in the blank provided. 5 points for the correct answer. You do not need to show any work.

12. $\frac{\csc x - \sin x}{\cos x} =$

- (a) $\sin x$ (b) $\cos x$ (c) $\tan x$
(d) $\cot x$ (e) $\sec x$ (f) $\csc x$

12. _____

For problems 13-17, you must show all of your work in the space provided. Partial credit is possible on these problems. Each problem is worth 8 points.

13. Suppose $\tan x = -\frac{4}{3}$ with $\pi < x < 2\pi$. Find the exact value of $\cos \frac{x}{2}$. Be sure to show all of your work. Simplify and circle your answer.

14. To find the length AB of a small lake, a surveyor at point C measures angle ACB to be 115° , length AC to be 500 feet, and length BC to be 325 feet. What is the length of the lake (to the nearest foot)? Circle your answer.

15. Find the amplitude, period, and phase shift of the function $y = \sin(\frac{x}{3} - \frac{\pi}{3})$. Also, graph the function over an interval of at least one period in length. Be sure to provide sufficient labels on your graph.

amplitude: _____

period: _____

phase shift: _____

16. Verify the identity given below, using algebraic manipulation and trigonometric identities. Be sure to show all steps of your solution. Graphical solutions are not allowed for this problem.

$$\frac{\sin x}{1 + \cos x} + \frac{1 + \cos x}{\sin x} = 2 \csc x$$

17. Find all exact solutions θ in degrees, $0^\circ \leq \theta < 360^\circ$, of the equation

$$2 \cos^2 \theta = 1 - \sin \theta$$

Circle your answer.