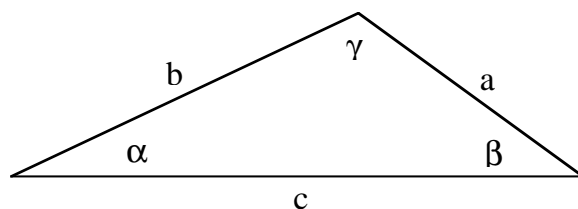


For problems 1-12, write your answer in the blank provided. Include units if appropriate. For multiple choice problems, write the letter corresponding to your answer. No partial credit will be awarded for these problems. Each problem is worth 5 points.

1. If  $\sin x = \frac{\sqrt{3}}{2}$  and  $\cot x < 0$ , find the exact value of  $\tan(x)$ . 1. \_\_\_\_\_

2. Find the radian measure of a central angle  $\theta$  opposite an arc  $s = 27$  meters in a circle of radius  $r = 18$  meters. 2. \_\_\_\_\_

3. Given that  $a = 22$ ,  $b = 35$ , and  $c = 27$ , find the measure of angle  $\alpha$  to the nearest degree. 3. \_\_\_\_\_



4. At a certain time of day, the Washington Monument casts a shadow 790 feet long. From the tip of the shadow, the angle from the horizontal to the top of the monument is  $35^\circ$ . Use this information to find the height of the monument to the nearest foot. 4. \_\_\_\_\_

5. The function  $y = 3 \sin(4x) + 2 \cos(6x)$  is  
(a) a periodic function of period  $\frac{\pi}{3}$ .  
(b) a periodic function of period  $\frac{\pi}{2}$ .  
(c) a periodic function of period  $\pi$ .  
(d) a periodic function of period  $2\pi$ .  
(e) not a periodic function. 5. \_\_\_\_\_

6. Suppose  $\sec x = -\frac{5}{3}$  with  $\pi < x < \frac{3\pi}{2}$ . Find the exact value of  $\sin(\frac{x}{2})$ . You do not have to simplify your answer. 6. \_\_\_\_\_

7.  $\tan x(\csc x \cos x - \sin x \cos x) =$   
(a)  $\sin^2 x$             (b)  $\cos^2 x$             (c)  $\tan^2 x$   
(d)  $\cot^2 x$             (e)  $\sec^2 x$             (f)  $\csc^2 x$  7. \_\_\_\_\_

8. Find all solutions of the equation  $\tan \theta = 2.79$  on the interval  $[0, 2\pi]$ , accurate to two decimal places.

8. \_\_\_\_\_

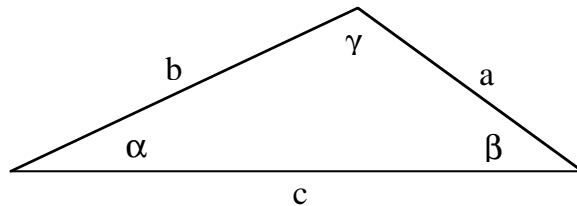
9. An object hangs from a spring attached to the ceiling. If the object is pulled down to the starting position and released, it moves according to the law  $y(t) = A \cos(Bt)$ , where  $y$  is the vertical position of the object and  $t$  is time in seconds. The position of the object at rest is  $y = 0$ . Suppose at time 0 the object is pulled down 4 cm ( $y = -4$ ) and released. After 1.5 seconds the object returns to the starting position. Find  $A$  and  $B$ .

9. \_\_\_\_\_

10. Given that the point  $(-3, 4)$  is a point on the terminal side of an angle  $\theta$ , find the exact value of  $\sin \theta$ .

10. \_\_\_\_\_

11. Given that  $\alpha = 35^\circ$ ,  $a = 60$ , and  $b = 70$ , how many triangles can be constructed?



- (a) none      (b) one      (c) two      (d) three

11. \_\_\_\_\_

12. Find all exact solutions of the equation  $1 + 2 \cos x = 0$  on the interval  $[0, 2\pi]$ .

12. \_\_\_\_\_

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For problems 13-16 below, you must show all of your work in the space provided. Partial credit is possible on these problems. Each problem is worth 10 points.

13. Suppose  $\tan x = \frac{5}{12}$  with  $\pi < x < \frac{3\pi}{2}$ , and  $\sin y = -\frac{3}{5}$  with  $\frac{3\pi}{2} < y < 2\pi$ . Find the exact value of  $\cos(x - y)$ . Be sure to show all of your work. Simplify and circle your answer.

14. Verify the identity given below. Be sure to show all steps of your solution.

$$\sec 2x = \frac{\sec x \csc x}{2 \cot x - \sec x \csc x}$$

15. In order to measure the height of a tree, two measurements are made. At one spot, the angle from the horizontal to the top of the tree is  $25^\circ$ . 80 feet closer to the tree, the angle from the horizontal to the top of the tree is  $45^\circ$ . How tall is the tree (to the nearest foot)? Circle your answer.

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

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

Circle your answer.