

**Multiple Choice:** Select the letter of the most appropriate answer and shade in the corresponding region on the answer sheet.

1. Suppose  $\sin \theta > 0$  and  $\tan \theta > 0$ . What quadrant must angle  $\theta$  lie in?

- A) I.                      B) II.                      C) III.                      D) IV.                      E) none

2. Which of the trigonometric functions below has period  $\frac{2}{3}$ ? ( $x$  is in radians)

- A)  $\sin(2\pi x - 1)$       B)  $\sin(2x - 3)$       C)  $\sin(3\pi x - 3)$       D)  $\sin(3x + 1)$       E) none

3. Suppose  $\cos \theta = \frac{2}{3}$ ,  $\sin \theta = -\frac{3}{5}$ . Find  $\tan \theta$ .

- A)  $-\frac{9}{10}$                       B)  $-\frac{10}{9}$                       C)  $-\frac{2}{5}$                       D)  $-\frac{5}{2}$                       E) none

4. How many solutions are there to the equation  $\sin 4x = 3$  for  $0 \leq x \leq 2\pi$ ? ( $x$  is in radians)

- A) 2                      B) 4                      C) 6                      D) 8                      E) none

5. If  $\cos \theta = \frac{1}{5}$ , then what must  $\cos(2\theta)$  be?

- A)  $-\frac{23}{25}$                       B)  $\frac{2}{5}$                       C)  $-\frac{2}{5}$                       D)  $\frac{23}{25}$                       E) none

6. Evaluate  $\cos^2 15^\circ - \sin^2 15^\circ$ .

- A)  $\frac{\sqrt{2}}{2}$                       B)  $\frac{\sqrt{3}}{2}$                       C)  $-\frac{\sqrt{2}}{2}$                       D) 1                      E) none

7. Which of the following is an equivalent expression for  $\tan x$ ? (here  $x$  is an angle measured in radians)

- A)  $\tan(\pi - x)$                       B)  $\tan(\pi + x)$                       C)  $\tan\left(\frac{\pi}{2} + x\right)$                       D)  $\tan\left(\frac{\pi}{2} - x\right)$                       E) none

8. Suppose  $\cot \theta = \sqrt{8}$ . Find  $\csc \theta$ , given that  $\theta$  is a third quadrant angle.

- A)  $-9$                       B) 9                      C) 3                      D)  $-3$                       E) none

No calculators allowed

Pittsburg State University

Trigonometry - Team Event

Team Member #2

2019 Math Relays

**Multiple Choice:** Select the letter of the most appropriate answer and shade in the corresponding region on the answer sheet.

9. Which of the trigonometric functions below has period  $\frac{\pi}{4}$ ? ( $x$  is in radians)

- A)  $\cos(4\pi x - 1)$       B)  $\cos(8\pi x - 3)$       C)  $\cos(4x - 3)$       D)  $\cos(8x + 1)$       E) none

10. Suppose  $\cos \theta = -\frac{3}{5}$ ,  $\sin \theta = -\frac{2}{5}$ . Find  $\cot \theta$ .

- A)  $-\frac{3}{2}$       B)  $\frac{3}{2}$       C)  $\frac{2}{3}$       D)  $-\frac{2}{3}$       E) none

11. How many solutions are there to the equation  $\cos 4x = -\frac{1}{7}$ ? for  $0 \leq x \leq 2\pi$  ( $x$  is in radians)

- A) 2      B) 4      C) 6      D) 8      E) none

12. Evaluate  $2 \sin \frac{\pi}{8} \cos \frac{\pi}{8}$ .

- A)  $\frac{\sqrt{2}}{2}$       B)  $-\frac{\sqrt{2}}{2}$       C)  $\sqrt{2}$       D)  $-\sqrt{2}$       E) none

13. Suppose  $\sec \theta = -5$ . Find  $\tan \theta$ , given that  $\theta$  is a third quadrant angle.

- A)  $-2\sqrt{6}$       B)  $2\sqrt{6}$       C)  $2\sqrt{3}$       D)  $-2\sqrt{3}$       E) none

14. Evaluate  $\tan 15^\circ$

- A)  $\frac{\sqrt{2} - \sqrt{6}}{4}$       B)  $\frac{\sqrt{2} + \sqrt{6}}{4}$       C)  $2 - \sqrt{3}$       D)  $2 + \sqrt{3}$       E) none

15. Which of the following is an equivalent expression for  $\tan x$ ? (here  $x$  is an angle measured in radians)

- A)  $\cot\left(\frac{\pi}{2} - x\right)$       B)  $\cot\left(\frac{\pi}{2} + x\right)$       C)  $\cot(\pi + x)$       D)  $\cot(\pi - x)$       E) none

16. Suppose  $\cos \theta > 0$  and  $\tan \theta < 0$ . What quadrant must angle  $\theta$  lie in?

- A) I.      B) II.      C) III.      D) IV.      E) none

No calculators allowed

Pittsburg State University

Trigonometry - Team Event

Team Member #3

2019 Math Relays

**Multiple Choice:** Select the letter of the most appropriate answer and shade in the corresponding region on the answer sheet.

17. Suppose  $\cos \theta = -\frac{1}{3}$ . Find  $\sin \theta$ , given that  $\theta$  is a second quadrant angle.

- A)  $-\frac{2\sqrt{2}}{3}$       B)  $\frac{2\sqrt{2}}{3}$       C)  $\frac{\sqrt{3}}{2}$       D)  $-\frac{\sqrt{3}}{2}$       E) none

18. Which of the following is an equivalent expression for  $\cos x$ ? (here  $x$  is an angle measured in radians)

- A)  $\sin(\pi + x)$       B)  $\sin(\pi - x)$       C)  $\cos(4\pi + x)$       D)  $\cos(3\pi - x)$       E) none

19. Which of the trigonometric functions below has period  $2\pi$ ? ( $x$  is in radians)

- A)  $\tan x$       B)  $\tan 2x$       C)  $\tan \frac{x}{2}$       D)  $\tan 2\pi x$       E) none

20. How many solutions are there to the equation  $\tan 2x = 5$  for  $0 \leq x \leq 2\pi$ ? ( $x$  is in radians)

- A) 2      B) 4      C) 6      D) 8      E) none

21. Suppose  $\csc \theta > 0$  and  $\sec \theta < 0$ . What quadrant must angle  $\theta$  lie in?

- A) I.      B) II.      C) III.      D) IV.      E) none

22. Suppose  $\tan \theta = 3$ ,  $\cos \theta = -\frac{1}{6}$ . Find  $\sin \theta$ .

- A)  $-\frac{1}{2}$       B)  $\frac{1}{2}$       C) 2      D) -2      E) none

23. Evaluate  $\cos 105^\circ$

- A)  $\frac{\sqrt{2} - \sqrt{6}}{4}$       B)  $\frac{\sqrt{2} + \sqrt{6}}{4}$       C)  $\frac{2 + \sqrt{3}}{4}$       D)  $\frac{2 - \sqrt{3}}{4}$       E) none

24. Evaluate  $\sin 101^\circ \cos 11^\circ - \cos 101^\circ \sin 11^\circ$

- A) 1      B) 0      C) -1      D)  $\frac{1}{2}$       E) none

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Trigonometry - Team Event

Team Member #4

2019 Math Relays

**Multiple Choice:** Select the letter of the most appropriate answer and shade in the corresponding region on the answer sheet.

25. Suppose  $\cot \theta = -3$ ,  $\cos \theta = -\frac{1}{9}$ . Find  $\sin \theta$ .

- A) 27                      B)  $-27$                       C)  $\frac{1}{6}$                       D)  $\frac{1}{3}$                       E) none

26. Which of the following is an equivalent expression for  $\sin x$ ? (here  $x$  is an angle measured in radians)

- A)  $\cos\left(\frac{\pi}{2} + x\right)$                       B)  $\cos\left(\frac{\pi}{2} - x\right)$                       C)  $\sin(\pi + x)$                       D)  $\sin(\pi - x)$                       E) none

27. Suppose  $\tan \theta > 0$  and  $\cos \theta < 0$ . What quadrant must angle  $\theta$  lie in?

- A) I.                      B) II.                      C) III.                      D) IV.                      E) none

28. Suppose  $\sin \theta = \frac{1}{2}$ . Find  $\cos \theta$ , given that  $\theta$  is a first quadrant angle.

- A)  $\frac{\sqrt{3}}{2}$                       B)  $-\frac{\sqrt{3}}{2}$                       C)  $\frac{1}{2}$                       D)  $-\frac{1}{2}$                       E) none

29. Which of the trigonometric functions below has period 3? ( $x$  is in radians)

- A)  $\cot 3x$                       B)  $\cot \frac{x}{3}$                       C)  $\cot \frac{3x}{\pi}$                       D)  $\cot \frac{\pi x}{3}$                       E) none

30. How many solutions are there to the equation  $\sec 2x = \frac{\sqrt{3}}{2}$  for  $0 \leq x \leq 2\pi$ ? ( $x$  is in radians)

- A) 2                      B) 4                      C) 6                      D) 8                      E) none

31. Evaluate  $\sin 75^\circ$

- A)  $\frac{\sqrt{2} - \sqrt{6}}{4}$                       B)  $\frac{\sqrt{2} + \sqrt{6}}{4}$                       C)  $\frac{2 + \sqrt{3}}{4}$                       D)  $\frac{2 - \sqrt{3}}{4}$                       E) none

32. Evaluate  $\frac{\tan 20^\circ - \tan 65^\circ}{1 + \tan 20^\circ \tan 65^\circ}$

- A) 1                      B) 0                      C)  $-1$                       D)  $\frac{1}{2}$                       E) none

Thank you for participating in the Pittsburg State Math Relays!