OU Math Day 2009

Trigonometry Test

1. What is the value of $\tan(0^\circ)$?
   (A) $-1$  (B) $-1/2$  (C) 0  (D) 1  (E) None of the above.

2. What is the value of $\cot(0^\circ)$?
   (A) $-1$  (B) $-1/2$  (C) 0  (D) 1  (E) None of the above.

3. Which of the following equals $\tan^2(\theta) - \sec^2(\theta)$?
   (A) $-1$  (B) $\cot^2(\theta)$  (C) $\sin^2(\theta)$  (D) 1  (E) None of the above.

4. A surveyor is positioned at the same horizontal level as the base of a building and 300 meters away from it. If the angle between the horizontal and the line of sight of the top of the building is $60^\circ$, how many meters tall is the building?
   (A) 150  (B) $100\sqrt{3}$  (C) $150\sqrt{3}$  (D) $300\sqrt{3}$  (E) None of the above.

5. In radian measure $210^\circ$ converts into
   (A) $7\pi/6$  (B) $37800/\pi$  (C) $7\pi/3$  (D) $7/25$  (E) None of the above.
6. Let \( \cos(\theta) = \frac{3}{5} \) and \( \sin(\theta) = -\frac{4}{5} \). In which of the four quadrants does \( \theta \) lie?

(A) I  (B) II  (C) III  (D) IV  (E) None of the above.

7. Let \( \cos(\theta) = \frac{3}{5} \) and \( \sin(\theta) = -\frac{4}{5} \). What is the value of \( \sin^2(\theta) + \cos^2(\theta) \)?

(A) -1  (B) 1  (C) -1/5  (D) 7/5  (E) None of the above.

8. Let \( \cos(\theta) = \frac{3}{5} \) and \( \sin(\theta) = -\frac{4}{5} \). What is the value of \( \sin(-\theta) + \cos(-\theta) + \tan(\theta) + \sec(\theta) \)?

(A) 2/15  (B) 79/60  (C) 26/15  (D) 22/5  (E) None of the above.

9. Let \( \cos(\theta) = \frac{3}{5} \) and \( \sin(\theta) = -\frac{4}{5} \). What is the value of \( \sin(2\theta) \)?

(A) -24/25  (B) -7/25  (C) 7/25  (D) 24/25  (E) None of the above.

10. Let \( \cos(\theta) = \frac{3}{5} \) and \( \sin(\theta) = -\frac{4}{5} \). What is the value of \( \tan(2\theta) \)?

(A) -24/7  (B) -7/24  (C) 7/24  (D) 24/7  (E) None of the above.
11. \( \cos(60^\circ) + \sec(60^\circ) \) equals

(A) 1  (B) 5/2  (C) \( 7\sqrt{3}/6 \)  (D) \( (1 + \sqrt{3})/2 \)  (E) None of the above.

12. The addition formula for sine asserts that \( \sin(A + B) \) equals

(A) \( \sin(A) \sin(B) - \cos(A) \cos(B) \)
(B) \( \cos(A) \cos(B) + \sin(A) \sin(B) \)
(C) \( \cos(A) \cos(B) - \sin(A) \sin(B) \)
(D) \( \sin(A) \cos(B) + \cos(A) \sin(B) \)
(E) None of the above.

13. \( \sin \left( \frac{3\pi}{2} + A \right) \) =

(A) \( \cos(A) \)  (B) \( \sin(A) \)  (C) \( -\cos(A) \)  (D) \( -\sin(A) \)  (E) None of the above.

14. \( \cos(0) + \cos(\pi/4) + \cos(\pi/2) + \cos(3\pi/4) + \cos(\pi) = \)

(A) \(-1\)  (B) \(-1/\sqrt{2}\)  (C) 0  (D) \(1/\sqrt{2}\)  (E) None of the above.

15. Two sides of a triangle have lengths 5 and 6. If the cosine of the angle between them is \( 1/5 \) then what is the length of the third side of the triangle?

(A) 11  (B) \( 3\sqrt{2} \)  (C) 7  (D) \( 5\sqrt{6} \)  (E) None of the above.
16. On a circle whose radius is 45 inches what is the length in inches of the arc subtended by a central angle of 100°?

(A) \( \frac{5\pi}{9} \)  (B) \( \frac{5\pi}{18} \)  (C) \( 25\pi \)  (D) \( 50\pi \)  (E) None of the above.

17. How many angles with radian measure between \(-\pi\) and \(\pi\) have their tangent equal to \(\sqrt{3}\)?

(A) 0  (B) 2  (C) 3  (D) 4  (E) None of the above.

18. One side of a right triangle has length 5 and the hypotenuse has length 11. What is the tangent of the angle opposite the side of length 5?

(A) \( \frac{4\sqrt{6}}{11} \)  (B) \( \frac{5}{11} \)  (C) \( \frac{11}{96} \)  (D) \( \frac{5}{4\sqrt{6}} \)  (E) None of the above.

19. How many solutions does the equation \( \sin(2x) - \cos(x) = 0 \) have with \(0 \leq x \leq 2\pi\)?

(A) 2  (B) 3  (C) 4  (D) 5  (E) None of the above.

20. The expression

\[
\frac{\tan^3(x)\sin(x)\cos^2(x)\csc^2(x)}{\sec^3(x)\cot^4(x)}
\]

simplifies to

(A) \( \cos x/\sin x \)  (B) \( \sin^2 x \)  (C) \( \cos^3 x \)  (D) \( \sin^4 x \)  (E) None of the above.

21. Two sides of a triangle have length 5 and 6. Let \(\alpha\) be the angle opposite the side of length 5 and let \(\beta\) be the angle opposite the side of length 6. If \(\sin \alpha = \frac{2\sqrt{6}}{7}\) then what is \(\sin \beta\)?

(A) \( 2\sqrt{5}/7 \)  (B) \( 12\sqrt{6}/35 \)  (C) \( 5/7 \)  (D) \( 6/7 \)  (E) None of the above.