OU Math Day 2002
TRIGONOMETRY TEST

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1. A right triangle has sides of lengths 3, 4 and 5. What is the cosine of the angle opposite the side with length 4?

   (A) 3/4   (B) 4/5   (C) 3/5   (D) 1/2   (E) None of the above.

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2. Which of the following is equal to $\sin(2x)$ for all values of x?

   (A) $2\sin(x)\cos(x)$ (B) $2\cos^2(x) - 1$ (C) $(1 + \cos(x))/2$ (D) $2\sin(x)$
   (E) None of the above.

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3. Determine the value of $\cos(-u) + sin(-v)\cos(-u) + \sin^2(-u)$ if you are given the information that $\cos(u) = 1/\sqrt{3}$ and $\sin(v) = 2/3$.

   (A) $(6 - \sqrt{3})/9$ (B) $(6 - 5\sqrt{3})/9$ (C) $(6 + 5\sqrt{3})/9$ (D) $(6 + \sqrt{3})/9$ (E) None of the above.

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4. Convert $56°$ into radians.

   (A) $\dfrac{14\pi}{45}$ (B) $\dfrac{10080}{\pi}$ (C) $\dfrac{7\pi}{45}$ (D) $\dfrac{7}{50}$ (E) None of the above.

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5. If $\cos(\theta) = 1/3$ and $0 \le \theta \le \pi/2$ then what is the value of $\sin(\theta)$?

   (A) 1/3   (B) 2/3   (C) −1/3   (D) $2\sqrt{2}/3$ (E) None of the above.

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6. An observer standing at the same level 100 feet from the base of a building measures an angle of $60°$ between the horizontal and the line of sight of the top of the building. How tall is the building?

   (A) 50 ft   (B) 200 ft   (C) 60 ft   (D) 160ft   (E) None of the above.

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7. Which of the following always equals 1?

   (A) $\sin^2(M) + \cos^2(M)$ (B) $2\cos^2(A) - 1$ (C) $\dfrac{2\tan(\theta)}{1 - \tan^2(\theta)}$ (D) $\sec^2(E) - \cot^2(E)$
   (E) None of the above.

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8. Evaluate $\sin(0) - \cos(30°) + \tan(\pi/4) - \sec(60°) + \csc(\pi/2) - \cot(120°)$

(A) $-\dfrac{1}{2} + \dfrac{\sqrt{3}}{3}$ (B) $-\dfrac{9 - \sqrt{3}}{6}$ (C) $2 - \dfrac{3\sqrt{3}}{2}$ (D) $-\dfrac{\sqrt{3}}{6}$ (E) None of the above.

9. On a circle with radius 20 inches, what is the length, in inches, of the arc intercepted by a central angle of $110°$?

(A) 40π in   (B) $110\pi/9$ in   (C) $55\pi/9$ in   (D) 80π in   (E) None of the above.

10. Rewriting the expression $\dfrac{\tan^3(x)\sin(x)\cos^2(x)\csc^2(x)}{\sec^3(x)\cot^2(x)}$ in terms of $\sin(x)$ and $\cos(x)$ results in which of the following?

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

11. If $\tan(x) = -3/5$ then what is $\cot(x)$?

(A) $5/3$ (B) $3/5$ (C) $4/5$ (D) $-5/3$ (E) None of the above.

12. Using the fact that $\cos(\pi/6) = \frac{\sqrt{3}}{2}$, what is the value of $\cos(\pi/12)$?

(A) $\dfrac{\sqrt{2+\sqrt{3}}}{2}$ (B) $\dfrac{1+\sqrt{3}}{2\sqrt{2}}$ (C) $\dfrac{2}{\sqrt{3}}$ (D) $\dfrac{\sqrt{3}}{4}$ (E) None of the above.

13. The three sides of a triangle have length 6, 8, and 10. What is the tangent of the smallest angle in the triangle?

(A) $\sqrt{3}/2$ (B) $1/2$ (C) 1 (D) $3/4$ (E) None of the above.

14. Change $\dfrac{43\pi}{18}$ to degrees.

(A) $\left(\dfrac{43\pi^2}{3240}\right)^\circ$ (B) $430°$ (C) $\left(\dfrac{43\pi^2}{6480}\right)^\circ$ (D) $860°$ (E) None of the above.

15. Simplify $\sin(\theta - 3\pi/2) + \cos(\pi + \theta)$

(A) 0 (B) $2\cos(\theta)$ (C) $\sin(\theta) - \cos(\theta)$ (D) $-2\sin(\theta)$ (E) None of the above.

16. How many solutions does the equation $\sin(\theta) = \tan(\theta)$ have in the interval $-\frac{\pi}{2} < \theta < \frac{\pi}{2}$?

    (A) 0   (B) 1   (C) 2   (D) infinitely many   (E) None of the above.

17. Observers A and B are 2 km apart, and a balloon is directly over the line between them. Observer A measures an angle of $45°$ between the horizontal and the line of sight of the balloon, and B measures an angle of $60°$. What is the height of the balloon?

    (A) $\dfrac{2\sqrt{3}}{2+\sqrt{3}}$ km   (B) $\dfrac{2+\sqrt{3}}{2\sqrt{3}}$ km   (C) 3/2 km   (D) 2 km   (E) None of the above.

18. Evaluate $\sin(\cos(\sqrt{\pi^2/4}))$

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

19. The expression $\dfrac{\tan(x)}{1+\sec(x)} + \dfrac{1+\sec(x)}{\tan(x)}$, when defined, is equivalent to which of the following?

    (A) $2\csc(x)$ (B) $2\tan(x)$ (C) $2\cot(x)$ (D) $2\sin(x)$ (E) None of the above.

20. Describe the behavior of the graph of $y = \sin(x)$ as x increases on the interval from $43\pi/3$ to $31\pi/2$.

    (A) decreases, then increases   (B) strictly increasing   (C) strictly decreasing
    (D) increases, then decreases   (E) None of the above.