OU Math Day 2023

# Trigonometry test

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1. A triangle has side lengths 3, 4, 5. What is the sine of the angle opposite the side of length 4?

   (A) $3/4$ (B) $3/5$ (C) $4/5$ (D) $1$ (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) $2\sin x$ (B) $1-\cos 2x$ (C) $\sin^2 x$ (D) $\cos^2 x - \sin^2 x$ (E) None of the above

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3. Convert $75°$ into radians (arc length):

   (A) $\pi/3$ (B) $5$ (C) $5\pi/12$ (D) $15$ (E) None of the above

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4. If $\sin x = 1/2$ and $0 \le x \le \pi/2$, what is $\cos x$?

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

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5. An observer standing 100 ft from a building and at the level of its base measures an angle of $30°$ to the top of the building. How tall is the building?

   (A) 10 ft (B) 30 ft (C) 45 ft (D) $100/\sqrt{3}$ ft (E) None of the above

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6. On a circle of radius 3, what is the length of the arc intercepted by a central angle of $120°$?

   (A) $\pi$ (B) $2\pi$ (C) $3\pi$ (D) $4\pi$ (E) None of the above

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7. $\sin x \cos x \tan x \cot x$ is equal to:

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

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8. How many solutions does the equation $\cos x = \cot x$ have in the interval $0 < x < \pi$?

   (A) 0 (B) 1 (C) 2 (D) 3 (E) None of the above

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9. The hypotenuse of a right triangle has length 4 and one of the legs has length 2. What is the sine of the angle between these two sides?

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

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10. What is the value of $\sin^2 0° + \sin^2 1° + \ldots + \sin^2 90°$?

    (A) 30 (B) 44 (C) 45 (D) 45.5 (E) None of the above

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11. Let $S = \sin 2023°$, $C = \cos 2023°$. Which of the following is true?

    (A) $S, C > 0$ (B) $S > 0, C < 0$ (C) $S < 0, C > 0$ (D) $S, C < 0$ (E) None of the above

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12. The percentage of a slope is defined as rise/run, that is, the height gained per horizontal distance covered, with this ratio given as a percentage. What is the angle at the base of a 50% slope?

(A) $30^\circ$ (B) $45^\circ$ (C) $50^\circ$ (D) $60^\circ$ (E) None of the above

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13. If $\cos x = 1/3$, then $\cos 2x$ equals

(A) $1/2$ (B) $2/3$ (C) $-2/3$ (D) $-7/9$ (E) None of the above

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14. Find all solutions of $\sin^2 x - \sin x - 2 = 0$ with $0 \le x \le 2\pi$.

(A) $3\pi/2$ (B) $0, \pi, 2\pi$ (C) $\pi/2, 3\pi/2$ (D) There are no solutions; (E) None of the above

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15. A triangle has angles $\alpha = 45^\circ$, $\beta = 60^\circ$. The ratio $a/b$ of the sides opposite these angles equals

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

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16. How many solutions of $\tan x = 2$ are there in $0 \le x \le 2\pi$?

(A) 0 (B) 1 (C) 2 (D) 4 (E) None of the above

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17. What is the (smaller) angle at the intersection of the lines $y = x$, $y = 3 + (\sqrt{3} - 2)x$?

(A) $15^\circ$ (B) $45^\circ$ (C) $60^\circ$ (D) $90^\circ$ (E) None of the above

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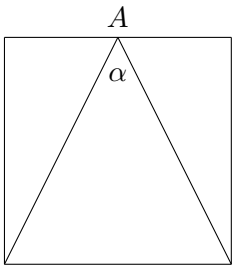
18. Let $A$ be the midpoint of side of the square and $\alpha$ the angle shown. What is $\sin(\alpha)$?




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

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19. If $\tan x = 1/2$, $0 < x < \pi/2$, what is $\cos x$?

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

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20. How many solutions does the equation $x = \cos x$ have?

(A) 0 (B) 1 (C) 2 (D) 3 (E) None of the above

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Answers for the 2023 Trigonometry Test:

1–5: CECCD

6–10: BBBAD

11–15: DEDAA

16–20: CCDBB