

For all questions, answer E: "NOTA" should be chosen only if none of the given answers is correct. Inverse trigonometric functions have the traditional restricted values:

$$-\frac{\pi}{2} \leq \text{Arcsin}(x) \leq \frac{\pi}{2} ; \quad -\frac{\pi}{2} < \text{Arctan}(x) < \frac{\pi}{2} ; \quad 0 < \text{Arccos}(x) < \pi$$

1. Solve for x : $\sin(x) \cos(2x) = \sin(2x)$

A: $\frac{\pi}{2}$

B: $\frac{5\pi}{6} + 2\pi n$

C: $\frac{1+\sqrt{3}}{2}$

D: $\frac{\pi}{4}$

E: NOTA

2. With a starting value of 0, add 2 for each odd function in the list below, subtract 3 for each even function, and add $\frac{1}{2}$ if the function is neither. What is the total sum?

I. $y = \cos(2x)$

II. $y = \sin^2(x) + \cos^2(x)$

III. $y = \sin^2(x + \pi)$

IV. $y = 1/\sin(x)$

V. $y = e^{\sin(x)}$

VI. $y = \tan(x) + \cot(x)$

A: $\frac{1}{2}$

B: $-\frac{9}{2}$

C: $\frac{7}{2}$

D: -3

E: NOTA

3. Racheal is getting a new flatscreen TV mounted on the wall in her living room. For optimal visibility, angle of elevation from the viewer's eyes to the center of the television should be less than 30° from the horizontal. When seated on her couch, Racheal's eyes are 4ft above the floor, and she is 10 ft away from the TV. What is the highest (in feet) that the center of the TV can be mounted on the wall and still be viewed properly?

A: $\frac{10\sqrt{3}}{3}$

B: $\frac{12+\sqrt{3}}{3}$

C: $\frac{12+10\sqrt{3}}{3}$

D: $\frac{8+10\sqrt{2}}{2}$

E: NOTA

4. Two sides of a triangle measure 8 and 12 units long, respectively. The angle between them measures 60° . How long is the third side of the triangle, in units?

A: $8\sqrt{3}$

B: $4\sqrt{7}$

C: $4\sqrt{13}$

D: Not enough information

E: NOTA

5. What is the area of the triangle in the previous question, measured in square units?

A: $24\sqrt{3}$

B: 24

C: $20\sqrt{2}$

D: Not enough information

E: NOTA

6. Maryellen is going on a 20-minute jog. She decides that each minute, including the first, her jogging speed in miles per hour for the next minute will be given by $|5(\sin(\pi t) + \cos(\pi t))|$ where t is the number of minutes she has been jogging. How many miles does Maryellen jog in those 20 minutes, to the nearest tenth of a mile? Assume she begins jogging at time $t = 0$.

A: 2

B: 5

C: 1.7

D: 2.5

E: NOTA

7. If ABCD is a kite, evaluate $\sin A + \sin B + \sin C + \sin D$.
A: 2
C: $2\sqrt{3}$
B: $1 + 2\sin B$
D: $1 + \cos C$
E: NOTA
8. Two points A and B lie on a circle, not diametrically opposed. With a third point C (also on the circle), they form the triangle ABC. How many such points C are there on the circle such that $\sin B = \frac{1}{2}$?
A: 0
C: 2
B: 1
D: Cannot be determined
E: NOTA
9. A triangle has angle measurements of 80° , 70° , and 30° . The longest side of the triangle is 8cm long. If the other sides of the triangle have lengths x and y , in centimeters, with $x < y$, then what is $\frac{x}{y}$?
A: $2\sin 70^\circ$
C: $\frac{1}{2}\cos 70^\circ$
B: $\frac{1}{2}\sin 70^\circ$
D: $\frac{1}{2}\csc 70^\circ$
E: NOTA
10. If a projectile is fired from a cannon at angle θ and initial velocity v , which of the following represents the forward (horizontal) initial velocity of the projectile?
A: $\tan \theta$
C: $v \cos \theta$
B: $v \sin \theta$
D: $\cos v \theta$
E: NOTA
11. An octagon has exterior angles $\alpha_1, \alpha_2, \dots, \alpha_8$. What is $\sin(\alpha_1 + \alpha_2 + \dots + \alpha_8)$?
A: 0
C: 1
B: -1
D: Cannot be determined
E: NOTA
12. What is the period of $f(x) = \sin(x) + \cos(2x)$?
A: π
C: 3π
B: 2π
D: 4π
E: NOTA
13. What is the domain of $f(x) = \sec(2x)$? (\mathbf{R} denotes the set of real numbers)
A: \mathbf{R}
C: $\mathbf{R}, x \neq (2k+1)\pi : k \text{ natural}$
B: $\mathbf{R}, x \neq k\pi : k \text{ natural}$
D: $\mathbf{R}, x \neq (2k+1)\pi : k \text{ integer}$
E: NOTA
14. Which of the following angles is coterminal to 8391° ?
A: 101°
C: 651°
B: 371°
D: 831°
E: NOTA
15. A circus tent has one central pole 25ft tall, and a dozen 20ft poles arranged uniformly in a circle around it, with a diameter 24ft; the tent material is taut between each of these points. Define the central angle of the tent as the angle of the tented material in the plane that cuts through two diametrically opposed tent poles. If the central angle of the tent measures θ , what is $\sin \theta$?
A: $\frac{120}{169}$
C: $\frac{12}{13}$
B: $\frac{5}{13}$
D: $\frac{24}{25}$
E: NOTA

16. Evaluate $\tan 75^\circ$

A: $2 - \sqrt{3}$

B: $2 + \sqrt{3}$

C: $1 + \frac{\sqrt{3}}{2}$

D: $3 - \sqrt{3}$

E: NOTA

17. Find the sum of all solutions to $\sin(x)\cos(2x) = 0$ for $0 < x \leq 2\pi$

A: 7π

B: 5π

C: 3π

D: 2π

E: NOTA

18. How many times does the graph of $y = \sin(x)$ intersect the graph of $y = e^x$?

A: They do not intersect

B: Once

C: Twice

D: Infinitely many times

E: NOTA

19. Find the cotangent of the angle between the vectors $\langle 1, 3 \rangle$ and $\langle 4, 5 \rangle$

A: $\frac{7}{19}$

B: $\frac{19}{\sqrt{410}}$

C: $\frac{19}{7}$

D: $\frac{133}{410}$

E: NOTA

20. Bailey is baking a pie. She knows her brother is going to eat half of it, but the remainder needs to be split among 3 people. If each of those three gets a slice corresponding to a central angle of β (in degrees), what is the cosecant of β ?

A: 2

B: $\frac{\sqrt{3}}{2}$

C: $\sqrt{3}$

D: $\frac{2\sqrt{3}}{3}$

E: NOTA

21. Evaluate: $\text{Arctan}(1) - \text{Arctan}(0)$

A: $\frac{5\pi}{4}$

B: $\frac{\pi}{4}$

C: $-\frac{\pi}{4}$

D: $-\frac{3\pi}{4}$

E: NOTA

22. What is the domain of $f(x) = \text{Arctan}(\sin(x))$?

A: $-1 < x < 1$

B: $0 < x < 1$

C: $0 < x < 2\pi$

D: All real numbers

E: NOTA

23. If $\cos\theta$ is negative and $\tan\theta$ is negative, then which quadrant does the terminal side of θ lie?

A: I

B: II

C: III

D: IV

E: NOTA

24. Which of the following is equal to $\cos^4(x) - \sin^4(x)$?

A: $\cos(2x)$

B: $\cos(x)\sin(x)$

C: 1

D: $\sin(2x)$

E: NOTA

25. If $x = \frac{a}{b}$ where a is the square root of a prime and b is a positive integer, and $\text{Arcsin}(x) = \frac{\pi}{4}$, what is the value of $a + b$, to the nearest tenth?
- A: 4
C: 0
- B: 3.4
D: 0.6
- E: NOTA
26. How many petals does the graph of $r = \sin(2010 \theta)$ have?
- A: 2010
C: 4020
- B: 2009
D: 4019
- E: NOTA
27. A triangle ABC has side lengths of 5, 12 and 13 units respectively for sides a , b , and c . If α is the angle between sides a and c , what is $\sec^2(\alpha)$?
- A: $\frac{144}{169}$
C: $\frac{25}{144}$
- B: $\frac{144}{25}$
D: $\frac{169}{25}$
- E: NOTA
28. Convert 87° into radians
- A: $\frac{29\pi}{60}$
C: $\frac{87}{180\pi}$
- B: $\frac{29}{30}$
D: $\frac{29\pi}{360}$
- E: NOTA
29. A function f is defined by $f(x) = \cos^2(x) + \sin(2x)$. What is $f\left(\frac{\pi}{6}\right)$?
- A: $\frac{3}{4}$
C: $\frac{1+2\sqrt{3}}{4}$
- B: $\frac{3+2\sqrt{3}}{4}$
D: $\frac{5}{4}$
- E: NOTA
30. A triangle has sides a , b and c , and angles A , B and C such that each angle is opposite the side labeled with the same letter. If $a = 10$, $b = 24$, and $A = \text{Arcsin}\left(\frac{5}{13}\right)$ then what is the perimeter of triangle ABC?
- A: 60
C: 30
- B: 46
D: 42
- E: NOTA