

**2002 MU ALPHA THETA NATIONAL CONVENTION
ALPHA DIVISION--- TRIGONOMETRY TOPIC TEST**

Each question in this test has five available answer choices. Choice (e) for all questions is NOTA, which indicates "None of These Answers."

1. Convert from polar to rectangular coordinates: $(4, \frac{2\pi}{5})$
 - (a) (4.19, 0.30)
 - (b) (4, 120)
 - (c) (-0.5, 0.87)
 - (d) (1.24, 3.80)
 - (e) NOTA

2. Determine $\sin \frac{8\pi}{9}$.
 - (a) 0.3420
 - (b) 0.0487
 - (c) -0.9397
 - (d) -0.3639
 - (e) NOTA

3. If $\tan \theta = -\frac{8}{15}$ where θ lies in QII, then determine $\sec \theta$.
 - (a) $\frac{17}{15}$
 - (b) $\frac{15}{17}$
 - (c) $-\frac{17}{15}$
 - (d) $-\frac{15}{17}$
 - (e) NOTA

4. A student attending the national Mu Alpha Theta convention determined that the cafeteria, boys' dormitory and girls' dormitory are noncollinear and form a triangle. The girls' dormitory is 900 feet from the cafeteria and the boys' dormitory is slightly farther at 1200 feet. If the distance between the dormitories is 2002 feet, then determine the measure of the angle (to the nearest degree) formed at the cafeteria.
 - (a) 125°
 - (b) 140°
 - (c) 144°
 - (d) 158°
 - (e) NOTA

5. Find the exact value of $\cot(\arcsin \frac{5}{13})$

(a) $\frac{12}{5}$

(b) $\frac{5}{12}$

(c) $\frac{12}{13}$

(d) $\frac{13}{12}$

(e) NOTA

6. State the range for the function $y = \arccos(x)$.

(a) $(0, 2\pi)$

(b) $(-\frac{\pi}{2}, \frac{\pi}{2})$

(c) $[0, \pi]$

(d) $[-\frac{\pi}{2}, \frac{\pi}{2}]$

(e) NOTA

7. The graph of the function $y = -2\sin(4x + \frac{\pi}{2}) - 1$ appears as:

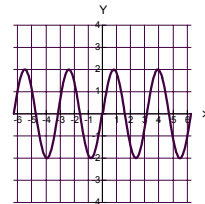
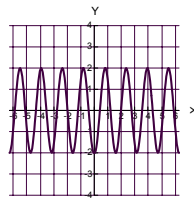
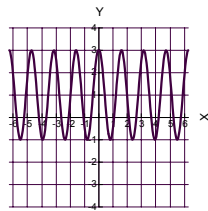
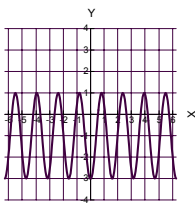
(a)

(b)

(c)

(d)

(e) NOTA



8. State the amplitude of the function in #7.

(a) 4

(b) 2

(c) 1

(d) 0.5

(e) NOTA

9. Determine the exact value of $\cos \frac{5\pi}{12}$

(a) $\frac{-\sqrt{2} - \sqrt{6}}{4}$

(b) $\frac{\sqrt{2} + \sqrt{6}}{4}$

(c) $\frac{\sqrt{2} - \sqrt{6}}{4}$

(d) $\frac{\sqrt{6} - \sqrt{2}}{4}$

(e) NOTA

10. Ship A is 72 miles from a lighthouse on the shore. Its bearing from the lighthouse is N 15° E. Ship B is 81 miles from the same lighthouse. Its bearing from the lighthouse is N 52° E. Find the distance between the two ships to the nearest mile.
 (a) 9 miles (b) 67 miles (c) 54 miles (d) 49 miles (e) NOTA
11. Find all solutions over the interval $[0, 2\pi)$: $\cos x + \sin 2x = 0$.
 (a) $\frac{\pi}{2}, \frac{3\pi}{2}, \frac{\pi}{6}, \frac{5\pi}{6}$ (b) $0, \pi, \frac{4\pi}{3}, \frac{5\pi}{3}$ (c) $\frac{\pi}{2}, \frac{3\pi}{2}, \frac{7\pi}{6}, \frac{11\pi}{6}$ (d) $0, \pi, \frac{\pi}{3}, \frac{2\pi}{3}$ (e) NOTA
12. Determine the number of solutions in $\triangle ABC$ if $a = 20, b = 25, \alpha = 126^\circ$
 (a) 0 (b) 1 (c) 2 (d) 3 (e) NOTA
13. Determine the length of \overline{AB} in $\triangle ABC$ if $\alpha = 65^\circ, \beta = 50^\circ, b = 12$ meters
 (a) 10 meters (b) 14 meters (c) 2 meters (d) 8 meters (e) NOTA
14. A triangular lot has sides of length 400 feet, 175 feet, and 325 feet. Find the EXACT area of the lot.
 (a) $3750\sqrt{55}$ sq.ft. (b) $625\sqrt{110}$ sq.ft. (c) $250\sqrt{165}$ sq.ft. (d) $25\sqrt{6}$ sq.ft. (e) NOTA
15. Find the area (to the nearest tenth) of triangle ABC using the given information.
 $\beta = 65^\circ, a = 8.4m, c = 12.6m$
 (a) 105 m^2 (b) 52.9 m^2 (c) 22.3 m^2 (d) 47.9 m^2 (e) NOTA
16. Convert $(-\sqrt{3}, 1)$ to EXACT polar coordinates. Express θ in radian measure.
 (a) $(2, \frac{4\pi}{6})$ (b) $(2, \frac{5\pi}{6})$ (c) $(2, \frac{\pi}{3})$ (d) $(2, \frac{2\pi}{3})$ (e) NOTA
17. Solve for all values of x such that $\cos 2x + 5\cos x = 6$ (k is an integer in answer choices)
 (a) $0 + k\pi$ (b) $\frac{\pi}{2} + (2k + 1)\pi$ (c) $0 + 2k\pi$ (d) $0 + \frac{k\pi}{2}$ (e) NOTA
18. Find the EXACT value for $\sin 2x$ if $\cos x = -\frac{9}{41}$ and x lies in QIII.
 (a) $-\frac{720}{1681}$ (b) $\frac{360}{1681}$ (c) $\frac{720}{1681}$ (d) $-\frac{360}{1681}$ (e) NOTA

19. Find the EXACT value for $\tan 165^\circ$.

- (a) $2\sqrt{3}$ (b) $\sqrt{3} - 2$ (c) $2 - \sqrt{3}$ (d) $\frac{2\sqrt{3}}{3}$ (e) NOTA

20. Find the EXACT value for $\sin\left[\arccos\frac{1}{2} + \arcsin(-1)\right]$

- (a) -2 (b) -1 (c) -0.5 (d) 0 (e) NOTA

21. A person is standing at an observation deck at the Atlanta Hartsfield airport. He sees an airplane begin the final approach for landing. If the plane's horizontal distance from the observation deck at the time of the sighting is 3.75 km and the line-of-sight distance is 4.25 km, then determine the angle of elevation from the observation deck to the plane to the nearest degree.

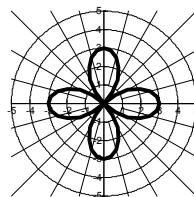
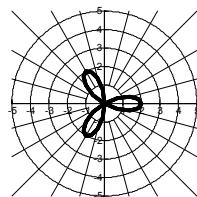
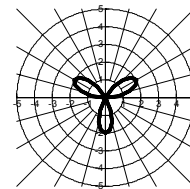
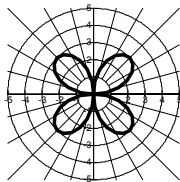
- (a) 41° (b) 28° (c) 62° (d) 49° (e) NOTA

22. Solve for the radian measure of x in $6\cos^2 x = -7\sin x - 14$ over the interval $0 \leq x \leq 2\pi$

- (a) $0.41^R, 2.73^R$ (b) $1.16^R, 5.12^R$ (c) $2.42^R, 3.86^R$ (d) $5.43^R, 3.99^R$ (e) NOTA

23. The sketch of $r = 2\cos 3\theta$ is:

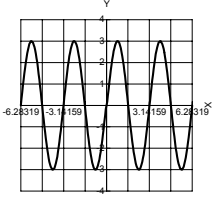
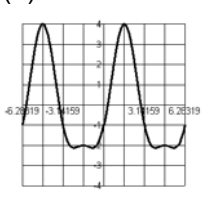
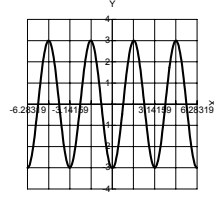
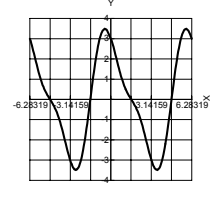
- (a) (b) (c) (d)



(e) NOTA

24. Simplify $\frac{\sin^2 x}{\cos^2 x} + \sin x \csc x$

- (a) $\tan^2 x$ (b) $\cot^2 x$ (c) $\sec^2 x$ (d) $\csc^2 x$ (e) NOTA

25. Simplify completely: $\frac{(\sec y - \tan y)^2 + 1}{\sec y \csc y - \tan y \csc y}$
- (a) $2 \tan y$ (b) $2 \cot y$ (c) $2 \sec y$ (d) $2 \csc y$ (e) NOTA
26. The sketch of $y = 3 \sin x - \cos 2x, -2\pi \leq x \leq 2\pi$ is
- (a)  (b)  (c)  (d) 
- (e) NOTA
27. Find the EXACT value for $\cos(x + y)$ if $\sin x = \frac{13}{85}$ and $\cos y = -\frac{7}{25}$. (x lies in QII and y lies in QIII)
- (a) $\frac{276}{2125}$ (b) $\frac{399}{425}$ (c) $\frac{2016}{2125}$ (d) $\frac{36}{85}$ (e) NOTA
28. A company safety committee has recommended that a floodlight be mounted in a parking lot so as to illuminate the employee exit for nighttime usage. Find the angle of depression, to the nearest degree, of the light if it is mounted 40 feet above the ground and 54 feet from the exit.
- (a) $36^\circ 32'$ (b) $53^\circ 28'$ (c) $36^\circ 53'$ (d) $53^\circ 47'$ (e) NOTA
29. A circle with its center at the origin in a rectangular coordinate system passes through the point (4,5). What is the length of the arc on the circle in the first quadrant between the positive horizontal axis and the point (4,5)? Compute your answer to the nearest unit.
- (a) 3 units (b) 8 units (c) 2,052 units (d) 6 units (e) NOTA
30. Find the EXACT value of $\tan 2x$, given $\cos x = \frac{9}{41}, \frac{3\pi}{2} \leq x \leq 2\pi$
- (a) $-\frac{720}{1681}$ (b) $\frac{3280}{81}$ (c) $\frac{720}{1519}$ (d) $\frac{369}{800}$ (e) NOTA

TIE BREAKER: (Show all work)

A plot of land has been surveyed with the resulting information as shown in the diagram. Find the length of \overline{CD} to the nearest meter.