

Trigonometry

PSU Math Relays 2016

- For each problem choose the correct answer and shade the corresponding letter completely on the answer sheet. Choose “(E) none” if no correct answer is given as a choice in (A), (B), (C), or (D).
- You may write on the test but only the answer sheet will be graded.
- **No calculator** is allowed on this test.
- All angles are given in radians unless they appear in degrees such as 30° .

1. Convert 510° to radians.

(A) $\frac{8\pi}{3}$ (B) 3π (C) $\frac{17\pi}{6}$ (D) $\frac{19\pi}{6}$ (E) none

2. Simplify $\cos(-x) \tan(-x)$.

(A) $\sin x$ (B) $\sec x$ (C) $-\sin x$ (D) $-\sec x$ (E) none

3. $\cos\left(-\frac{\pi}{4}\right) =$

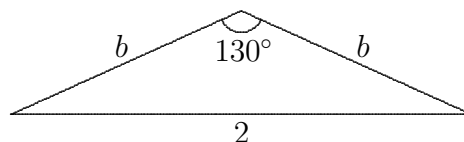
(A) $\frac{\sqrt{3}}{2}$ (B) $\frac{\sqrt{2}}{2}$ (C) $\sqrt{2}$ (D) $-\frac{\sqrt{2}}{2}$ (E) none

4. $\csc^2 x - 1 =$

(A) $\sin^2 x$ (B) $\cos^2 x$ (C) $\tan^2 x$ (D) $\cot^2 x$ (E) none

5. In the isosceles triangle shown in the figure below, find side b .

(A) $\sec 25^\circ$ (B) $\csc 25^\circ$
(C) $\sin 25^\circ$ (D) $\cos 25^\circ$ (E) none



6. $\sin 75^\circ \cos 15^\circ - \cos 75^\circ \sin 15^\circ =$.

(A) $\frac{1}{2}$ (B) $-\frac{1}{2}$ (C) $\frac{\sqrt{3}}{3}$ (D) $-\frac{\sqrt{3}}{3}$ (E) none

7. $\cot(3\pi + x) =$

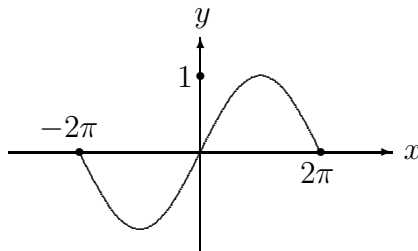
(A) $\tan x$ (B) $\cot x$ (C) $-\tan x$ (D) $-\cot x$ (E) none

8. $\sin\left(x - \frac{3\pi}{2}\right) =$

- (A) $\sin x$ (B) $-\sin x$ (C) $\cos x$ (D) $-\cos x$ (E) none

9. Which function has the graph on $[-2\pi, 2\pi]$ shown in the figure below?

- (A) $\sin(2x)$ (B) $\sin\left(\frac{x}{2}\right)$
 (C) $\cos(2x)$ (D) $\cos\left(\frac{x}{2}\right)$ (E) none



10. $\cos^2 75^\circ - \sin^2 75^\circ =$

- (A) $\frac{1}{2}$ (B) $\frac{\sqrt{3}}{2}$ (C) $-\frac{1}{2}$ (D) $-\frac{\sqrt{3}}{2}$ (E) none

11. Find $\sin\left(\cos^{-1}\left(\frac{2}{3}\right)\right)$.

- (A) $\frac{2}{3}$ (B) $\frac{\sqrt{2}}{3}$ (C) $\frac{\sqrt{3}}{2}$ (D) $\frac{\sqrt{3}}{3}$ (E) none

12. Given $\cos x = -\frac{3}{4}$ and $\tan x = \frac{\sqrt{7}}{3}$, find the exact value of $\sin(2x)$.

- (A) $\frac{3\sqrt{7}}{4}$ (B) $-\frac{3\sqrt{7}}{8}$ (C) $\frac{3\sqrt{7}}{8}$ (D) $\frac{3\sqrt{7}}{16}$ (E) none

13. Simplify $\sin^2\left(\frac{\pi}{18}\right) + \cos^2\left(\frac{\pi}{18}\right)$.

- (A) 1 (B) 2 (C) $\frac{1}{2}$ (D) $\frac{2}{3}$ (E) none

14. Find the exact value of $\cos\left(\frac{\pi}{8}\right)$.

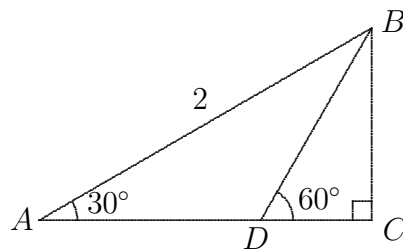
- (A) $\frac{\sqrt{2+\sqrt{2}}}{2}$ (B) $\frac{\sqrt{2-\sqrt{2}}}{2}$ (C) $\sqrt{\frac{2+\sqrt{2}}{2}}$ (D) $\sqrt{\frac{2-\sqrt{2}}{2}}$ (E) none

15. Find the exact value of $\csc\left(\frac{11\pi}{6}\right)$.

- (A) $\frac{1}{2}$ (B) $\frac{\sqrt{3}}{2}$ (C) $-\sqrt{3}$ (D) -2 (E) none

16. In the following figure, $AD =$

- (A) $\frac{\sqrt{5}}{2}$ (B) $\frac{1+\sqrt{2}}{2}$
 (C) $\frac{2\sqrt{3}}{3}$ (D) $\sqrt{2}$ (E) none



17. Convert $\frac{5\pi}{12}$ rad to degrees.

- (A) 60° (B) 75° (C) 85° (D) 115° (E) none

18. Find the exact value of $\cot x$ if $\sin \theta = -\frac{2}{5}$ and $\tan \theta < 0$.

- (A) $\frac{\sqrt{21}}{2}$ (B) $-\frac{5}{2}$ (C) $-\frac{21}{4}$ (D) $-\frac{\sqrt{21}}{5}$ (E) none

19. Find the period of the function $y = -3\sec(4x - \pi)$.

- (A) $\frac{\pi}{4}$ (B) $\frac{\pi}{2}$ (C) π (D) 2π (E) none

20. Simplify $\frac{\sin^2 x \sec x}{\tan x}$.

- (A) $\sin x$ (B) $\cos x$ (C) $\csc x$ (D) $\cot x$ (E) none

21. In the following figure, the point $(-4, -3)$ lies on the terminal side of the angle α . Find $\sec \alpha$.

- (A) $\frac{4}{5}$ (B) $-\frac{4}{5}$
 (C) $\frac{5}{4}$ (D) $\frac{4}{3}$ (E) none

