

Math Relays 2023

Trigonometry

Select the most appropriate letter from (a) to (e) and shade in the corresponding region on the answer sheet. Choice “none” represents “none of these”.

1. $\sin 2024^\circ =$

- (a) $-.4067$ (b) $.4067$ (c) $\sin 134^\circ$ (d) $\cos 134^\circ$ (e) none

2. $(\cot 2^{2023} - \csc 2^{2023})(\cot 2^{2023} + \csc 2^{2023}) + 1 =$

- (a) 0 (b) 1 (c) $.2315$ (d) $-.2315$ (e) none

3. $(\frac{18}{\pi})' = ?$ radians

- (a) $\frac{1}{600}$ (b) $\frac{1}{360}$ (c) $\frac{1}{600\pi}$ (d) $\frac{\pi}{600}$ (e) none

4. If $\sin x = \frac{3}{5}$ and x is a II-quadrant angle, then $\cos 2x =$

- (a) $\frac{4}{5}$ (b) $\frac{9}{25}$ (c) $.14$ (d) $.28$ (e) none

5. $\sin^{2023} 1^\circ + \sin^{2023} 359^\circ =$

- (a) 1 (b) -1 (c) 0 (d) 359 (e) none

6. The period of $y = \sin^{20} x$ is

- (a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$ (c) π (d) 2π (e) none

7. The period of $y = \sin^4 x + \cos^4 x + \tan^4 x + \cot^4 x + \sec^4 x + \csc^4 x$ is

- (a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$ (c) π (d) 2π (e) none

8. $\frac{\sqrt{2-\sqrt{3}}}{2} =$

- (a) $\frac{\sqrt{6}-\sqrt{2}}{4}$ (b) $\sin 22.5^\circ$ (c) $\sin 75^\circ$ (d) $\sin 67.5^\circ$ (e) none

9. $\cos^{2023} 2^\circ - \cos^{2023} 358^\circ =$

- (a) 1 (b) -1 (c) 0 (d) 359 (e) none

10. The distance between tips of the hands of lengths 5 and 3 on a clock showing 4 pm is

- (a) 8 (b) 7 (c) 6 (d) $\sqrt{34}$ (e) none

11. $\tan^2 1^\circ \tan^2 2^\circ \cdots \tan^2 89^\circ =$

- (a)
- 89^2
- (b) 89 (c) 0 (d) 1 (e) none

12. Between $-\frac{\pi}{6}$ and $\frac{\pi}{6}$, the equation $\cos^4 x - \sin^4 x = 0$ has

- (a) no solutions (b) 1 solution (c) 2 solutions (d) 3 solutions (e) none

13. If $\sin x = .125$, $0 \leq x \leq \frac{\pi}{2}$, then $\sin 2x =$

- (a) .0625 (b)
- $-.0625$
- (c) .0615 (d)
- $\frac{63}{1024}$
- (e) none

14. Evaluate $1 + \cos x + \cos^2 x + \cdots + \cos^5 x$ for $x = \frac{\pi}{3}$

- (a) .98 (b)
- $\frac{63}{32}$
- (c)
- $(\sqrt{3}/2)^5$
- (d)
- $(\sqrt{3}/2)^6$
- (e) none

15. The equation $-1.1 + 1.2 \sec x = 0$, $-\infty < x < \infty$, has

- (a) 1 solution (b) 2 solutions (c) infinitely many solutions (d) no solutions (e) none

16. The period of $y = \tan(1 + \sin^{2024} x)$ is

- (a)
- $\frac{\pi}{4}$
- (b)
- $\frac{\pi}{2}$
- (c)
- π
- (d)
- 2π
- (e) none

17. The amplitude of $y = (1 + \sin 2x)^2$ is

- (a) 1 (b) 2 (c) 3 (d) 4 (e) none

18. The y -intercept of $y = 4^{\sin x + \cos x}$ is

- (a) 1 (b) 2 (c) 3 (d) 4 (e) none