

# Trigonometry

State Convention  
Greenelefe, FL

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1. Which of the following angles are coterminal?

- I)  $3,960^\circ$
- II)  $-9,000^\circ$
- III)  $30^\circ$
- IV)  $1,530^\circ$

- A) I and III only
- B) I, II, and III only
- C) III and IV only
- D) I and II only
- E) I, II III and IV

2.  $(\sec 60^\circ) \cdot (\tan 300^\circ) \cdot (\cos 300^\circ) \cdot (\sin 30^\circ) =$

- A)  $\frac{\sqrt{3}}{3}$
- B)  $\frac{1}{2}$
- C)  $\frac{\sqrt{3}}{2}$
- D) 2
- E) NOTA

3. Which of the following is not a Pythagorean triplet?

- A) 11, 60, 61
- B) 28, 45, 53
- C) 33, 56, 65
- D) 49, 81, 99
- E) NOTA

4. If  $\sin A = \frac{2x}{3}$ ,  $x > 0$  and  $\tan A < 0$ , what is  $\sec A$  equal to?

- A)  $\frac{3}{2x}$
- B)  $\frac{3}{\sqrt{9-4x^2}}$
- C)  $\frac{-2x}{\sqrt{9-4x^2}}$
- D)  $\frac{-3}{\sqrt{9-4x^2}}$
- E) NOTA

5. If  $\cos 64^\circ 20' = 0.4331$  and  $\cos 64^\circ 30' = 0.4305$ , what is  $\cos 64^\circ 26'$  equal to?

- A) 0.4320
- B) 0.4318
- C) 0.4315
- D) 0.4312
- E) NOTA

6.  $(2r\sin\theta\cos\theta)^2 + r^2(\cos^2\theta - \sin^2\theta)^2 =$

- A)  $5r^2$
- B)  $r^2$
- C)  $r^2\sin\theta$
- D)  $r^2\cos^2 2\theta$
- E) NOTA

7. In  $\triangle ABC$   $a=12$ ,  $b=7$ , and  $\angle C=45^\circ$ . What is the area of  $\triangle ABC$ ?

- A) 21
- B)  $21\sqrt{2}$
- C)  $42\sqrt{2}$
- D)  $21\sqrt{3}$
- E) NOTA

8.  $\text{Arctan } x + \text{Arccot } x =$

- A)  $\pi$
- B)  $x$
- C)  $\frac{\pi}{2}$
- D) Insufficient Information
- E) NOTA

9.  $\sin(\operatorname{Arctan} \frac{4}{3} + \operatorname{Arccot} \frac{3}{4}) =$   
 A) 1 B)  $\frac{24}{25}$  C)  $\frac{7}{25}$  D)  $\frac{12}{13}$  E) NOTA
10. What is the sum of the solutions of  $\sin x + \cos x = 1$  on  $[0, 2\pi)$ ?  
 A)  $\frac{\pi}{2}$  B)  $\pi$  C)  $\frac{3\pi}{4}$  D)  $2\pi$  E) NOTA
11. Solve for  $x$  in the equation  $\operatorname{Arccos} 2x = \operatorname{Arcsin} x$   
 A)  $\frac{\sqrt{3}}{4}$  B)  $\frac{\sqrt{3}}{3}$  C)  $\frac{1}{4}$  D)  $\frac{\sqrt{5}}{5}$  E) NOTA
12.  $(1 - \cos x)(\csc x + \cot x) =$   
 A)  $\sin x$  B)  $\csc x$  C) 1 D)  $\cos x$  E) NOTA
13. Find the sum of the fifth roots of 32. ( $i = \sqrt{-1}$ )  
 A) 0 B)  $(5+5\sqrt{3}) + (5+5\sqrt{3})i$  C)  $32i$  D) 10 E) NOTA
14.  $\sin 55^\circ + \sin 35^\circ =$   
 A)  $\sqrt{2} \cos 10^\circ$  B)  $\sqrt{2} \cos 80^\circ$  C)  $\sin 110^\circ$  D)  $\cos 10^\circ$  E) NOTA
15. What does  $\cos 3\theta$  equal to in terms of  $\cos \theta$ ?  
 A)  $3\cos^2\theta - 2$  B)  $\frac{6\cos^2\theta - 4}{2}$  C)  $3\cos^3\theta + \cos^2\theta + 1$   
 D)  $4\cos^3\theta - 3\cos\theta$  E) NOTA
16. In any triangle,  $a\cos B + b\cos A$  is equivalent to \_\_\_\_\_?  
 A)  $2b\cos A$  B)  $a + b$  C)  $c$  D)  $s - c$  E) NOTA
17. If  $a = 3$ ,  $b = 4$ , and  $\angle C = 60^\circ$ , what is the length of side  $c$ ?  
 A) 13 B)  $\sqrt{25 - 12\sqrt{3}}$  C)  $6\sqrt{3}$  D)  $\frac{2\sqrt{3}}{3}$  E) NOTA

18. Thom Morris is a very busy man (which explains why he is always so sleepy). One day three mathletes come up to him simultaneously and begin to pull him in different directions. One pulls him at a  $60^\circ$  angle with a force of 6N (Newtons), a second pulls him with a force of 9N at a  $180^\circ$  angle and the third mathlete pulls him at a  $300^\circ$  angle with a force of 16N. Thom only wants to go to sleep. What is the magnitude of the force (in Newtons) that he must put up to stay still and go to sleep?

- A)  $\sqrt{373}$  B)  $\sqrt{79}$  C)  $\sqrt{227}$  D) 31 E) NOTA

19.  $\sin(150^\circ + 45^\circ) =$

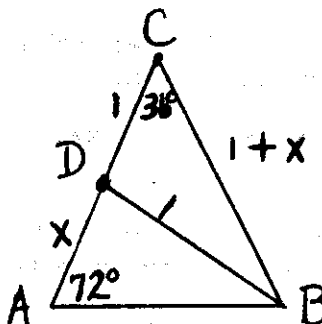
- A)  $\frac{\sqrt{6} + \sqrt{2}}{4}$  B)  $\frac{\sqrt{6} - \sqrt{2}}{4}$  C)  $\frac{-\sqrt{6} + \sqrt{2}}{4}$  D)  $\frac{-\sqrt{6} - \sqrt{2}}{4}$  E) NOTA

20.  $1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \frac{x^8}{8!} - \dots =$

- A)  $\cos x$  B)  $\sin x$  C)  $\sinh x$  D)  $\cosh x$  E) NOTA

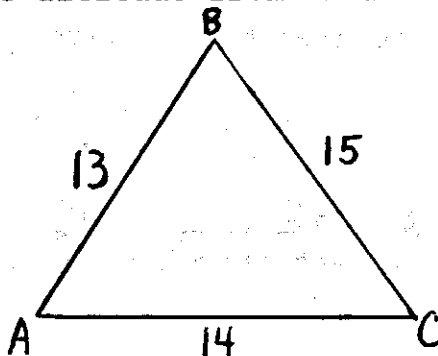
21. From the following diagram find  $\sin 18^\circ$ .

- A) Insufficient Information  
 B)  $\frac{\sqrt{5}+1}{2}$   
 C)  $\frac{\sqrt{5}-1}{4}$   
 D)  $\frac{\sqrt{10+2\sqrt{5}}}{4}$   
 E) NOTA



22. What is the length of the altitude from  $\angle B$  in the diagram?

- A) 12 B) 7  
 C) 15 D) 17  
 E) NOTA



23. As Amy rides a ferris wheel, her distance from the ground varies sinusoidally with time. Amy starts slightly past the bottom and it takes her 4 seconds to reach the top which is 45 feet above the ground. If the diameter of the wheel is 40 feet and she makes a revolution every 10 seconds, which of the following represents an equation of Amy's exact position above the ground,  $h$ , in terms of time (in seconds),  $t$ ?

- A)  $h=40\cos\frac{\pi}{5}t$
- B)  $h=-20\cos\frac{\pi}{5}t+25$
- C)  $h=25\cos\frac{5}{\pi}(t+4)+20$
- D)  $h=20\cos\frac{\pi}{5}(t-4)+25$
- E) NOTA

24. How many leaves does the equation  $r=a^2\cos 9\theta$  have?

- A) 3 B) 4.5 C) 9 D) 18 E) NOTA

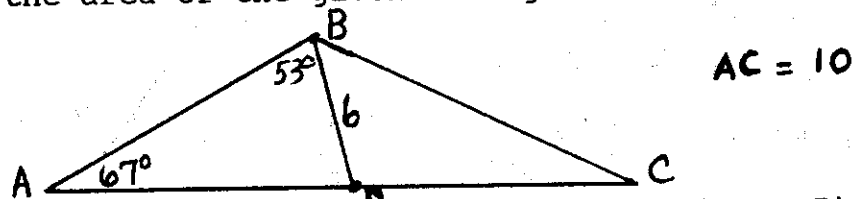
25. What is the linear speed of a point on the outside of a wheel with radius 6 and angular velocity  $3\pi$  radians per second?

- A)  $9\pi$  B)  $18\pi$  C)  $54\pi$  D)  $108\pi$  E) NOTA

26. How many points of intersection are there between the graphs of  $r=4-5\sin\theta$  and  $r=3\sin\theta$ ?

- A) 0 B) 1 C) 2 D) 3 E) NOTA

27. Evaluate the area of the given triangle ABC.



- A) Insufficient information B)  $60 \cdot \sin 67^\circ$  C) 30 D)  $15\sqrt{3}$
- E) NOTA

28. If  $\sin x > \cos x$ , which of the following must be true:

- I)  $\tan x$  is always positive
- II)  $\sin 2x$  is never negative
- III)  $\cos 2x$  is always negative

- A) I only B) III only C) I & III only D) II & III only
- E) NOTA

29. What is the period of the function:

$$y = \sin \frac{2}{3}x + \cos \frac{7}{8}x$$

A)  $2\pi$  B)  $3\pi$  C)  $\frac{16\pi}{7}$  D)  $12\pi$  E) NOTA

30. In a given triangle  $\sin A : \sin B : \sin C = 4 : 5 : 6$  and  $\cos A : \cos B : \cos C = x : y : 2$ . What is the sum of  $x$  and  $y$ ?

A) 18 B) 19 C) 20 D) 21 E) NOTA