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NOTA means "none of these answers."

1. A circle,  $O$ , with a radius of 20 cm has two radii,  $\overline{OX}$  and  $\overline{OY}$  drawn such that they form an angle of  $120^\circ$ . How long is the chord  $\overline{XY}$ ?

- A.  $20\sqrt{2}$  cm                      B.  $20\sqrt{3}$  cm                      C.  $20\sqrt{5}$  cm  
 D.  $20\sqrt{6}$  cm                      E. NOTA

~~X~~ Find the sixth roots of unity.

- A.  $\left\{ 1, -1, \frac{1}{2} + \frac{\sqrt{3}}{2}i, \frac{1}{2} - \frac{\sqrt{3}}{2}i, \frac{1}{3} + \frac{\sqrt{3}}{2}i, -\frac{1}{3} - \frac{\sqrt{3}}{2}i \right\}$   
 B.  $\left\{ \frac{1}{2}, -\frac{1}{2}, 1 + i, 1 - i, \frac{1}{2} + i, -\frac{1}{2} + i \right\}$   
 C.  $\left\{ 1, -\frac{1}{2}, 1 + \frac{\sqrt{3}}{2}i, \frac{1}{2} - \frac{\sqrt{3}}{2}i, \frac{1}{3} + \frac{\sqrt{3}}{2}i, -\frac{1}{3} - \frac{\sqrt{3}}{2}i \right\}$   
 D.  $\left\{ 1, -1, \frac{1}{2} + \frac{\sqrt{3}}{2}i, -\frac{1}{2} + \frac{\sqrt{3}}{2}i, \frac{1}{2} - \frac{\sqrt{3}}{2}i, -\frac{1}{2} - \frac{\sqrt{3}}{2}i \right\}$   
 E. NOTA

3. Through what angle should the equation  $2x^2 + \sqrt{3}xy + y^2 = 10$  be rotated in order to eliminate the  $xy$ -term?

- A.  $\frac{\pi}{2}$                       B.  $\frac{\pi}{3}$                       C.  $\frac{\pi}{4}$                       D.  $\frac{\pi}{6}$                       E. NOTA

4. Which of the following equals  $\cos^2 \theta - \sin^2 \theta$ ?

- A.  $\sin(2\theta)$                       B.  $\frac{1 - \tan^2 \theta}{1 + \tan^2 \theta}$                       C.  $\frac{1 + \tan(2\theta)}{\csc \theta}$   
 D.  $\cot(2\theta) + 3 \cot \theta \csc^2 \theta$                       E. NOTA

5. What is the graph of the equation  $x^2 - xy + y^2 - 3\sqrt{2}x = 0$ ?

- A. a line and a point      B. ellipse      C. hyperbola  
D. parabola      E. NOTA

6. Given that  $\sin \theta = \frac{2}{3}$  and  $\frac{\pi}{2} \leq \theta \leq \pi$ , what is  $\cos \theta$ ?

- A.  $-\frac{\sqrt{3}}{2}$       B.  $-\frac{\sqrt{3}}{6}$       C.  $-\frac{\sqrt{5}}{3}$       D.  $-\frac{\sqrt{5}}{6}$       E. NOTA

7. If  $0 \leq x \leq 2\pi$ , then solve:  $\sin 2x = 4 \sin x$ .

- A.  $\left\{ \frac{\pi}{2}, \frac{3\pi}{2} \right\}$       B.  $(0, \pi)$       C.  $\left( \frac{5\pi}{6}, \frac{7\pi}{8} \right)$   
D.  $\left( \frac{\pi}{6}, \frac{5\pi}{6} \right)$       E. NOTA

8. Change the point  $\left( \frac{3}{2}, \frac{3\sqrt{3}}{2} \right)$  to polar coordinates.

- A.  $(3, +300^\circ)$       B.  $(3\sqrt{3}, +60^\circ)$       C.  $(3, -30^\circ)$   
D.  $(3, -300^\circ)$       E. NOTA

9. What is the length of a side of a regular octagon if the longest diagonal is 15 cm?

- A.  $\frac{15\sqrt{2 - \sqrt{2}}}{2}$  cm      B.  $6\sqrt{2}$  cm      C.  $\frac{15\sqrt{2 - \sqrt{3}}}{3}$   
D. 6 cm      E. NOTA

10. Which of the following equals  $\frac{\sin^3 \theta + \cos^3 \theta}{\sin \theta + \cos \theta}$ ?

A.  $\frac{\sin \theta}{1 + \cos \theta}$

B.  $\tan \theta \cot(2\theta) - 1$

C.  $1 - \sin \theta \cos \theta$

D.  $1 + \sin \theta \cos \theta$

E. NOTA

11. What is  $(-1 + i)^{12}$ ?

A. 32

B.  $i^{64}$

C.  $32\sqrt{3}$

D. -64

E. NOTA

12. Find the area of  $\Delta ABC$  with  $a = 13$  m,  $b = 14$  m, and  $c = 15$  m.

A.  $84 \text{ m}^2$

B.  $83 \text{ m}^2$

C.  $82 \text{ m}^2$

D.  $81 \text{ m}^2$

E. NOTA

13. Identify the graph of:  $r = \frac{3}{\frac{1}{2} - \cos \theta}$ .

A. circle

B. parabola

C. hyperbola

D. ellipse

E. NOTA

14. Solve:  $2 \sin^2 x - \cos x - 1 = 0$ , where  $0 \leq x \leq 2\pi$ .

A.  $\left\{ \frac{\pi}{8}, \frac{3\pi}{8}, \frac{5\pi}{8} \right\}$

B.  $\left\{ \frac{\pi}{2}, \frac{3\pi}{2} \right\}$

C.  $\left\{ \frac{\pi}{3}, \pi, \frac{5\pi}{3} \right\}$

D.  $\left\{ \frac{3\pi}{4} \right\}$

E. NOTA

15. Identify the graph of  $r = \tan \theta \sec \theta$ .

A. A circle with a radius of 1.

B. An ellipse with a major axis of 5.

C. A parabola.

D. A line.

E. NOTA

16. Which of the following equals:  $\frac{\tan^2 \theta - \sin^2 \theta - \sin^2 \theta \tan^2 \theta + 1}{-\cos^2 \theta \cot^2 \theta + 1 + \cot^2 \theta - \cos^2 \theta}$
- A.  $\frac{\tan^2 \theta + \cos \theta}{2 \csc \theta + \cot 2\theta}$       B.  $\tan \theta$       C.  $\frac{1}{\cos 2\theta}$
- D. 1      E. NOTA
17. What is the graph of  $r = 2 \sin \theta$ ?
- A. A circle with a radius of 2.      B. A circle with a radius of 3
- C. A parabola.      D. An ellipse.      E. NOTA
18. If  $\tan \theta = \frac{5}{11}$ , what is  $\sin \theta$ , if  $0 \leq \theta \leq \frac{\pi}{2}$ ?
- A.  $\frac{11\sqrt{146}}{146}$       B.  $\frac{5\sqrt{146}}{146}$       C.  $\frac{11\sqrt{145}}{145}$
- D.  $\frac{\sqrt{3}}{2}$       E. NOTA
19. Find the area of a regular hexagon inscribed in a circle of radius 7 m.
- A.  $73.5 \text{ m}^2$       B.  $\frac{147\sqrt{3}}{2} \text{ m}^2$       C.  $75 \text{ m}^2$
- D.  $49\pi \text{ m}^2$       E. NOTA
20. In  $\triangle ART$ ,  $m\angle R = 135^\circ$ ,  $m\angle T = 15^\circ$ , and  $\overline{AT} = 6\sqrt{3} \text{ m}$ . Find  $RT$ .
- A. 3 m      B.  $3\sqrt{6} \text{ m}$       C.  $3\sqrt{2} \text{ m}$       D.  $3\sqrt{3} \text{ m}$       E. NOTA

21. Solve  $\frac{1 - \cos x}{\sin x} = 1$ , where  $0 \leq x \leq 2\pi$ .

A.  $\left\{ \frac{2\pi}{3}, \frac{3\pi}{4} \right\}$

B.  $\left\{ \frac{5\pi}{6}, \frac{7\pi}{8} \right\}$

C.  $\left\{ 0, \frac{\pi}{2}, \frac{3\pi}{2} \right\}$

D.  $\left\{ \frac{\pi}{2} \right\}$

E. NOTA

22. Which of the following equals:  $\frac{\cos \theta}{1 - \sin \theta}$ ?

A.  $\frac{1 + \sin \theta}{\cos \theta}$

B.  $\cot \theta - 1$

C.  $1 + \tan \theta$

D.  $1 + \sin \theta$

E. NOTA

23. What is the period of  $y = \sqrt{5} \pi \sin\left(\frac{3\pi}{\sqrt{3}}x + \frac{4}{5}\right)$ ?

A.  $\frac{2\pi}{\sqrt{5}}$

B.  $\frac{2}{5\pi}$

C.  $\frac{2\sqrt{3}}{3}$

D.  $\frac{\sqrt{3}}{3}$

E. NOTA

24. Change the point  $(-3, 3)$  to polar coordinates.

A.  $(3\sqrt{2}, 135^\circ)$

B.  $(3\sqrt{2}, 120^\circ)$

C.  $(3, 135^\circ)$

D.  $(3\sqrt{3}, 135^\circ)$

E. NOTA

25. Solve:  $1 + 2 \tan^2 x + \sec x = 0$ , where  $0 \leq x \leq 2\pi$ .

A. 0

B.  $\frac{3\pi}{4}$

C.  $\pi$

D.  $\frac{2\pi}{3}$

E. NOTA

26. Find the polar equation of a circle with a radius of "a" and its center at  $(r_0, \theta_0)$ .

A.  $r = a$

B.  $r^2 + r_0^2 - 2rr_0 \cos(\theta - \theta_0) = a^2$

C.  $r = 2 \sin \theta$

D.  $r = a_0 \sin \theta$

E. NOTA

27. Simplify:  $\frac{\sec \theta + 1}{\sin \theta + \tan \theta}$ .

A.  $\frac{1 + \cos \theta}{\sin^2 \theta + \cos \theta}$

B.  $\frac{1 - \cos \theta}{1 + \cos \theta}$

C.  $\csc \theta$ 

D.  $\tan \theta$

E. NOTA

28. Which of the following is an equivalent expression for  $\cos^4 \theta - \sin^4 \theta$ ?

A.  $\sin(3\theta)$

B.  $\cos(4\theta)$

C.  $\cos(2\theta)$

D.  $\sin\left(\frac{\theta}{2}\right)$

E. NOTA

29. Evaluate:  $(-50\sqrt{2} + 50i\sqrt{2})^{-8}$

A.  $10^{-8}$

B.  $10^{-7}$

C.  $10^{-6}$

D.  $10^{-5}$

E. NOTA

30. Which of the following is the Law of Tangents?

A.  $\frac{a - b}{a + b} = \frac{\tan(A - B)}{\tan(A + B)}$

B.  $\frac{a + b}{a - b} = \frac{\tan(A - B)}{\tan(A + B)}$

C.  $\frac{a - b}{a + b} = \frac{\tan \frac{1}{2}(A + B)}{\tan \frac{1}{2}(A - B)}$

D.  $\frac{a - b}{a + b} = \frac{\tan \frac{1}{2}(A - B)}{\tan \frac{1}{2}(A + B)}$

E. NOTA

## Values of Trigonometric Functions

Degrees	Sin	Cos	Tan	Degrees	Sin	Cos	Tan
0°	0.0000	1.0000	0.0000				
1°	0.0175	0.9998	0.0175	46°	0.7193	0.6947	1.0355
2°	0.0349	0.9994	0.0349	47°	0.7314	0.6820	1.0724
3°	0.0523	0.9986	0.0524	48°	0.7431	0.6691	1.1106
4°	0.0698	0.9976	0.0699	49°	0.7547	0.6561	1.1504
5°	0.0872	0.9962	0.0875	50°	0.7660	0.6428	1.1918
6°	0.1045	0.9945	0.1051	51°	0.7771	0.6293	1.2349
7°	0.1219	0.9925	0.1228	52°	0.7880	0.6157	1.2799
8°	0.1392	0.9903	0.1405	53°	0.7986	0.6018	1.3270
9°	0.1564	0.9877	0.1584	54°	0.8090	0.5878	1.3764
10°	0.1736	0.9848	0.1763	55°	0.8192	0.5736	1.4281
11°	0.1908	0.9816	0.1944	56°	0.8290	0.5592	1.4826
12°	0.2079	0.9781	0.2126	57°	0.8387	0.5446	1.5399
13°	0.2250	0.9744	0.2309	58°	0.8480	0.5299	1.6003
14°	0.2419	0.9703	0.2493	59°	0.8572	0.5150	1.6643
15°	0.2588	0.9659	0.2679	60°	0.8660	0.5000	1.7321
16°	0.2756	0.9613	0.2867	61°	0.8746	0.4848	1.8040
17°	0.2924	0.9563	0.3057	62°	0.8829	0.4695	1.8807
18°	0.3090	0.9511	0.3249	63°	0.8910	0.4540	1.9626
19°	0.3256	0.9455	0.3443	64°	0.8988	0.4384	2.0503
20°	0.3420	0.9397	0.3640	65°	0.9063	0.4226	2.1445
21°	0.3584	0.9336	0.3839	66°	0.9135	0.4067	2.2460
22°	0.3746	0.9272	0.4040	67°	0.9205	0.3907	2.3559
23°	0.3907	0.9205	0.4245	68°	0.9272	0.3746	2.4751
24°	0.4067	0.9135	0.4452	69°	0.9336	0.3584	2.6051
25°	0.4226	0.9063	0.4663	70°	0.9397	0.3420	2.7475
26°	0.4384	0.8988	0.4877	71°	0.9455	0.3256	2.9042
27°	0.4540	0.8910	0.5095	72°	0.9511	0.3090	3.0777
28°	0.4695	0.8829	0.5317	73°	0.9563	0.2924	3.2709
29°	0.4848	0.8746	0.5543	74°	0.9613	0.2756	3.4874
30°	0.5000	0.8660	0.5774	75°	0.9659	0.2588	3.7321
31°	0.5150	0.8572	0.6009	76°	0.9703	0.2419	4.0108
32°	0.5299	0.8480	0.6249	77°	0.9744	0.2250	4.3315
33°	0.5446	0.8387	0.6494	78°	0.9781	0.2079	4.7046
34°	0.5592	0.8290	0.6745	79°	0.9816	0.1908	5.1446
35°	0.5736	0.8192	0.7002	80°	0.9848	0.1736	5.6713
36°	0.5878	0.8090	0.7265	81°	0.9877	0.1564	6.3138
37°	0.6018	0.7986	0.7536	82°	0.9903	0.1392	7.1154
38°	0.6157	0.7880	0.7813	83°	0.9925	0.1219	8.1443
39°	0.6293	0.7771	0.8098	84°	0.9945	0.1045	9.5144
40°	0.6428	0.7660	0.8391	85°	0.9962	0.0872	11.4301
41°	0.6561	0.7547	0.8693	86°	0.9976	0.0698	14.3007
42°	0.6691	0.7431	0.9004	87°	0.9986	0.0523	19.0811
43°	0.6820	0.7314	0.9325	88°	0.9994	0.0349	28.6363
44°	0.6947	0.7193	0.9657	89°	0.9998	0.0175	52.2900
45°	0.7071	0.7071	1.0000	90°	1.0000	0.0000	