

OU Math Day 2018

# Trigonometry Test

(edited with answers on the last page)

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1. Find the numerical value of  $\cos(60^\circ) + \cot(30^\circ)$ :

- (A)  $1/2$       (B)  $\frac{3\sqrt{3}}{2}$       (C)  $\frac{1}{2} + \sqrt{3}$       (D)  $\frac{5}{2\sqrt{3}}$       (E) None of the above.

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2. The period of the function  $y = |\sin x|$  equals

- (A)  $\frac{\pi}{2}$       (B)  $\pi$       (C)  $2\pi$       (D)  $3\pi$       (E) None of the above.

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3. If  $\csc(\gamma) = 13/5$  and  $\cot(\gamma) = 12/5$  then  $\cos(\gamma)$  is equal to

- (A)  $12/13$       (B)  $13/5$       (C)  $5/12$       (D)  $5/13$       (E) None of the above.

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4. Which of the following equals  $\cos(2A)$  for all angles  $A$ ?

- (A)  $2 \sin(A) \cos(A)$       (B)  $\sin(A) + \cos(A)$       (C)  $\cos^2(A) - \sin^2(A)$   
(D)  $\sin^2(A) - \cos^2(A)$       (E) None of the above.

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5. Find the exact value of  $\sin(2018\pi) + \cos(2018\pi)$  (where radian measure is used)

- (A) 0      (B) 1      (C) -1      (D) 2      (E) None of the above.

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6. If  $\sec(\theta) = 1/2$  then the value of  $\theta$  is

- (A)  $\pi/3$       (B)  $\pi/6$       (C) there is no solution      (D)  $5\pi/3$       (E) None of the above.
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7. Consider the three points in the plane with coordinates  $O = (0, 0)$ ,  $P = (5, 0)$  and  $Q = (5, b)$  and let  $\theta$  be the angle from  $OP$  to  $OQ$ . If  $\tan(\theta) = 3$  what does  $b$  equal?

- (A)  $25\sqrt{10}$     (B)  $25\sqrt{10}$     (C) 15    (D)  $5/3$     (E) None of the above.
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8. Which of the following equals  $(\sin(x) - \cos(x))^2$  for all possible  $x$ ?

- (A) 1    (B)  $1 + \cos(2x)$     (C)  $1 - \sin(2x)$     (D)  $1 - 2\cos^2(x)$     (E) None of the above.
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9. The shortest side of a triangle with angles measuring  $50^\circ$ ,  $60^\circ$ , and  $70^\circ$  has length 9 inches. Which of the following is the length of the longest side of the triangle in inches?

- (A)  $\frac{9 \sin(60^\circ)}{\sin(50^\circ)}$     (B)  $\frac{9 \sin(60^\circ)}{\sin(50^\circ)}$     (C)  $\frac{9 \sin(50^\circ)}{\sin(70^\circ)}$     (D)  $\frac{9 \sin(70^\circ)}{\sin(50^\circ)}$     (E) none of the above
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10. If angle  $A$  is not in quadrant II and  $\cos(A) = -3/5$ , what is  $\sin(A)$ ?

- (A)  $-4/5$     (B)  $4/5$     (C)  $3/5$     (D)  $-3/5$     (E) None of the above.
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11. A helicopter is simultaneously viewed by two observers who are 2 miles apart on the ground and in line with the helicopter. If both observers are more than two miles away from the helicopter and the angles of elevation they record are  $30^\circ$  and  $45^\circ$  then how many miles above the ground is the helicopter?

- (A)  $\frac{2}{\sqrt{3}-1}$     (B)  $1/3$     (C)  $1/4$     (D)  $\frac{1}{\sqrt{3}}$     (E) None of the above.
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12. Using radian measure, the value of the sum

$$\cos\left(\frac{\pi}{6}\right) + \cos\left(\frac{2\pi}{6}\right) + \cos\left(\frac{3\pi}{6}\right) + \cdots + \cos\left(\frac{2018\pi}{6}\right)$$

equals

- (A) 0    (B) 1009    (C)  $-1009\sqrt{3}$     (D)  $-\frac{2+\sqrt{3}}{2}$     (E) None of the above.
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13. The expression

$$\sec^6(x) - 3\sec^4(x)\tan^2(x) + 3\sec^2(x)\tan^4(x) - \tan^6(x)$$

simplifies to

- (A) 1    (B)  $\sec^4(x)$     (C)  $\sec^3(x) - \tan^3(x)$     (D)  $\tan^2(x)$     (E) None of the above.
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14. If  $\tan \theta$  is positive and  $\sec \theta$  is negative, which quadrant does  $\theta$  lie in?

- (A) quadrant I                      (B) quadrant II                      (C) quadrant III  
(D) quadrant IV                      (E) None of the above.
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15. The number of solutions to the equation  $\cos(\sin(x)) = 0$  is

- (A) 0    (B) 1    (C) 2    (D) infinitely many    (E) None of the above.
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16. Rewrite the expression  $\sin(\sin^{-1}(x) + \cos^{-1}(x))$  as an algebraic expression in  $x$ .

- (A)  $\sqrt{1-x^2}$     (B)  $2x^2 - 1$     (C) 0    (D) 1    (E) None of the above.
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17. Find  $\sin(2\theta)$  if  $\sin(\theta)\cos(\theta) = 5/4$

- (A)  $5/2$  (B)  $\sqrt{5}/4$  (C)  $2/5$  (D) there is no such angle  $\theta$  (E) None of the above.
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18. If  $\sin(\theta) = 3\cos(\theta)$  then  $\sin(2\theta) =$

- (A)  $9/50$  (B)  $3/\sqrt{10}$  (C)  $-4/5$  (D)  $3/5$  (E) None of the above.
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19. The value of  $\arcsin\left(\frac{-\sqrt{2}}{2}\right)$  is

- (A)  $\frac{-\pi}{4}$  (B)  $\frac{\pi}{4}$  (C)  $\frac{-3\pi}{4}$  (D)  $\frac{5\pi}{4}$  (E) None of the above.
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20. How many solutions does the equation  $\cos(x) + \cos(-x) = 0$  have if  $0 \leq x \leq 2\pi$ ? (Radian measure is assumed for  $x$ .)

- (A) infinitely many (B) 1 (C) 2 (D) 3 (E) None of the above.
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21. Consider the three points in the plane with coordinates  $O = (0, 0)$ ,  $P = (5, 2)$  and  $Q = (1, 3)$  and let  $\gamma$  be the angle from  $OP$  to  $OQ$ . What does  $\cos^2(\gamma)$  equal?

- (A)  $1/290$  (B)  $121/290$  (C)  $289/290$  (D)  $169/290$  (E) None of the above.
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22. Which of the following equals  $\tan(\arccos(x/4))$ ?

- (A)  $\frac{\sqrt{16-x^2}}{x}$  (B)  $\frac{x}{\sqrt{16+x^2}}$  (C)  $\frac{x}{4}$  (D)  $\frac{16+x^2}{x}$  (E) None of the above.
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Answers for the 2018 Trigonometry Test:

1-6:       CBACBC

7-11:      CCDAA

12-16:     EACAD

17-22:     DDACBA