

1. Find the exact solution using natural logarithms.

$$3^{2-3x} = 4^{2x+1}$$

A.  $x = \frac{2 \ln 3 - \ln 4}{3 \ln 3 + 2 \ln 4}$

B.  $x = \frac{2 \ln 3 + \ln 4}{3 \ln 3 - 2 \ln 4}$

C.  $x = \frac{3 \ln 3 - \ln 4}{2 \ln 3 + 2 \ln 4}$

D.  $x = \frac{2 \ln 3 - 2 \ln 4}{3 \ln 3 + \ln 4}$

E.  $x = \frac{3 \ln 3 + 2 \ln 4}{2 \ln 3 - \ln 4}$

2. A drug is eliminated from the body at a given rate. For a dose of 10 milligrams, the amount  $A(t)$  remaining in the body after  $t$  hours is given by  $A(t) = 10(0.8)^t$  and that in order for the drug to be effective at least 2 milligrams must be in the body. Determine when 2 milligrams is left in the body.

A. 7.2 hours

B. 1.4 hours

C. 4.3 hours

D. 8.3 hours

E. 10.2 hours

3. Express  $\theta = 2$  in degrees, minutes, and seconds to the nearest second.

A.  $114^\circ 59' 16''$

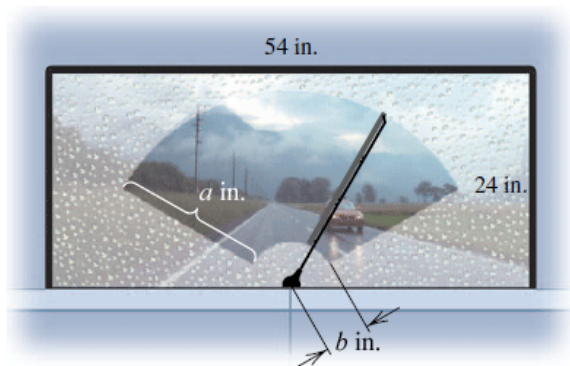
B.  $114^\circ 35' 29''$

C.  $114^\circ 14' 31''$

D.  $114^\circ 45' 27''$

E.  $114^\circ 27' 14''$

4. A rectangular window measures 54 inches by 24 inches. There is a 15 inch wiper blade attached by a 4 inch arm at the center of the base of the window. If the arm rotates  $130^\circ$ , find the area wiped out by the blade to the nearest square inch.

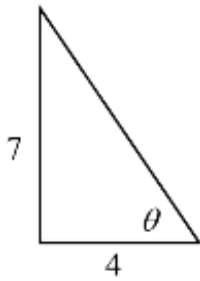


- A.  $225 \text{ in}^2$   
B.  $410 \text{ in}^2$   
C.  $237 \text{ in}^2$   
D.  $391 \text{ in}^2$   
E.  $279 \text{ in}^2$
5. Stonehenge in Salisbury Plains, England, was constructed using solid stone blocks weight over 99,000 pounds each. Lifting a single stone required 550 people, who pulled the stone up a ramp inclined at an angle of  $9^\circ$ . Approximate the distance that a stone was moved in order to raise it to a height of 30 feet.
- A. 31 feet  
B. 189 feet  
C. 75 feet  
D. 192 feet  
E. 101 feet
6. Find the exact value of  $\cos \theta$  if  $\tan \theta = -\frac{3}{4}$  and  $\sin \theta < 0$ .
- A.  $-\frac{4}{5}$   
B.  $\frac{4}{5}$   
C.  $-\frac{3}{5}$   
D.  $\frac{3}{5}$   
E.  $-\frac{4}{3}$

7. Find the exact value of  $\csc \theta$  if  $\theta$  is in standard position and point  $P(-2, 3)$  is on the terminal side.

- A.  $-\frac{3}{\sqrt{13}}$   
B.  $-\frac{\sqrt{13}}{3}$   
C.  $\frac{3}{\sqrt{13}}$   
D.  $\frac{\sqrt{13}}{3}$   
E. None of the above

8. Find the exact value of  $\sec \theta$ .



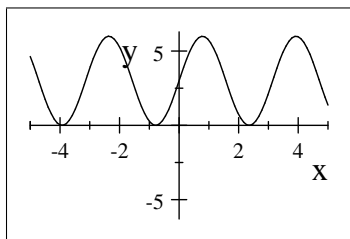
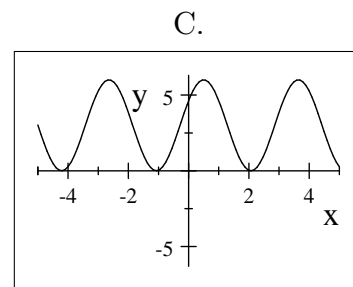
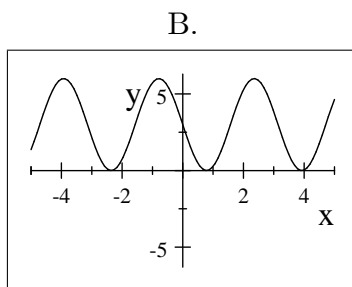
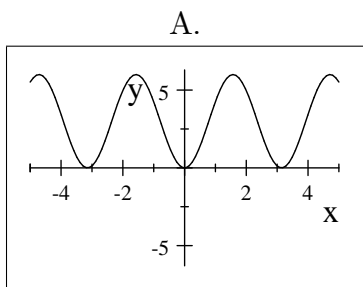
- A.  $\frac{\sqrt{65}}{4}$   
B.  $\frac{4}{\sqrt{65}}$   
C.  $\frac{\sqrt{65}}{7}$   
D.  $\frac{7}{\sqrt{65}}$   
E.  $\frac{7}{4}$

9. Find all values of  $x$  in  $[0, 2\pi]$  where  $\sin x = \frac{1}{2}$ .

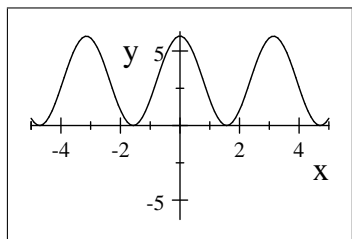
- A.  $\frac{\pi}{6}, \frac{5\pi}{6}$   
B.  $\frac{\pi}{6}, \frac{7\pi}{6}$   
C.  $\frac{\pi}{6}, \frac{11\pi}{6}$   
D.  $\frac{5\pi}{6}, \frac{11\pi}{6}$   
E.  $\frac{5\pi}{6}, \frac{7\pi}{6}$

10. Approximate, to the nearest 0.0001 radian all angles  $\theta$  in  $[0, 2\pi)$  that satisfy the equation  $\tan \theta = 1.543$ .
- A. 0.9958, 4.1374
  - B. 0.9958, 5.2874
  - C. 2.1458, 4.1374
  - D. 2.1458, 5.2874
  - E. 4.1374, 5.2874

11. Which of the following graphs could represent the graph of  $y = 3 \cos(2x) + 3$ ?



D.



E.

12. A builder wishes to construct a ramp 24 feet long that rises to a height of 5 feet above level ground. Approximate to 1 decimal places the angle that the ramp should make with the horizontal.
- A.  $78.0^\circ$
  - B.  $11.8^\circ$
  - C.  $78.2^\circ$
  - D.  $24.3^\circ$
  - E.  $12.0^\circ$

13. Which of the following are true for  $y = -2 \sin \left( 2x - \frac{\pi}{3} \right)$

I. The minimum value of the function is  $-2$

II. The phase shift is  $\frac{\pi}{3}$

III. The period is  $\pi$

A. I and II

B. I and III

C. II and III

D. I, II, and III

E. None of them are true

14. Find the general solution of the equation  $2 \cos^2 x + 3 \cos x + 1 = 0$ .

A.  $(2n + 1) \pi, \frac{\pi}{3} + 2\pi n, \frac{5\pi}{3} + 2\pi n$

B.  $(2n + 1) \pi, \frac{2\pi}{3} + 2\pi n, \frac{4\pi}{3} + 2\pi n$

C.  $(2n + 1) \pi, \frac{\pi}{6} + 2\pi n, \frac{11\pi}{6} + 2\pi n$

D.  $(2n + 1) \pi, \frac{5\pi}{6} + 2\pi n, \frac{7\pi}{6} + 2\pi n$

E.  $(2n + 1) \pi, \frac{\pi}{6} + 2\pi n, \frac{5\pi}{6} + 2\pi n$

15. Simplify the expression  $\frac{\sec^2 x}{\sec^2 x - 1}$ .

A.  $\cos^2 x$

B.  $\sin^2 x$

C.  $\tan^2 x$

D.  $\cot^2 x$

E.  $\csc^2 x$

Answers:

1. A
2. A
3. B
4. C
5. D
6. B
7. D
8. A
9. A
10. A
11. E
12. E
13. B
14. B
15. E