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°59′16″
B. 114°35′29″
C. 114°14′31″
D. 114°45′27″
E. 114°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°, find the area wiped out by the blade to the nearest square inch.

A. 225 in²
B. 410 in²
C. 237 in²
D. 391 in²
E. 279 in²

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°. 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 \( \sec \theta \).

\[ \text{Diagram: Right triangle with sides 7 and 4.} \]

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 $y = 3 \cos(2x) + 3$?

A. 
B. 
C. 
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°
B. 11.8°
C. 78.2°
D. 24.3°
E. 12.0°
13. Which of the following are true for \( y = -2 \sin(2x - \frac{\pi}{3}) \)
   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