1) The medians of a triangle intersect at a point. The distance from the vertex to the point is exactly two-thirds of the distance from the vertex to the midpoint of the opposite side. Find the exact distance of that point from the vertex A(3, 4) of a triangle, given that the other two vertices are at (0, 0) and (8, 0).

A) $\frac{\sqrt{17}}{3}$  C) $\frac{2\sqrt{17}}{3}$  E) None of the Above.
B) $\frac{8}{3}$  D) 2

2) A Ferris wheel has a diameter of 200 feet and the bottom of the Ferris wheel is 5 feet above the ground. Find the equation of the wheel if the origin is placed on the ground directly below the center of the wheel.

A) $x^2 + (y - 105)^2 = 10,000$  C) $x^2 + (y - 205)^2 = 10,000$  E) None of the Above.
B) $x^2 + (y - 105)^2 = 11,025$  D) $x^2 + y^2 = 11,025$

3) A rectangle that is x feet wide is inscribed in a circle of radius 12 feet. Express the area of the rectangle as a function of x.

A) $A(x) = x\sqrt{576 - x^2}$  C) $A(x) = x\sqrt{144 - x^2}$  E) None of the Above.
B) $A(x) = x^2\sqrt{144 - x^2}$  D) $A(x) = x(576 - x^2)$

4) Let $P = (x, y)$ be a point on the graph of $y = \sqrt{x}$. Express the distance d from P to the point (1, 0) as a function of x.

A) $d(x) = x^2 - x + 1$  C) $d(x) = x^2 + 2x + 2$  E) None of the Above.
B) $d(x) = \sqrt{x^2 - x + 1}$  D) $d(x) = \sqrt{x^2 + 2x + 2}$

5) Given $f(x) = \frac{1}{x}$ and $(f')g(x) = \frac{x - 66}{x^2 + 5x}$, find the function g.

A) $g(x) = \frac{x^2 + 55x}{x - 6}$  C) $g(x) = \frac{x + 55}{x - 6}$  E) None of the Above.
B) $g(x) = \frac{x^3 + 55x^2}{x - 6}$  D) $g(x) = \frac{x + 66}{x - 55}$

6) Alan is building a garden shaped like a rectangle with a semicircle attached to one side. If he has 20 feet of fencing to go around it, what width will give him the maximum area in the garden?

A) width $= \frac{20}{\pi - 4}$  C) width $= \frac{80}{\pi + 4}$  E) None of the Above.
B) width $= \frac{40}{\pi + 4}$  D) width $= \frac{40}{\pi - 8}$
7) Use the graph below to find \((f \circ g \circ h)(-3)\) where \(f\) is linear, \(g\) is quadratic, and \(h\) is cubic.

A) 1 
B) 0 
C) -2 
D) -3 
E) None of the Above.

8) If \(7^x = 3\), what does \(7^{-3x}\) equal?

A) \(\frac{1}{27}\) 
B) -27 
C) 343 
D) \(\frac{1}{343}\) 
E) None of the Above.

9) Let \(\log_b(3) = 0.5\) and \(\log_b(2) = 0.1\), evaluate \(\log_b(4.5)\).

A) .15 
B) .9 
C) .55 
D) 2.5 
E) None of the Above.

10) Given \(f(x) = 3^x\) and \(g(x) = 4^{1-x}\), find the point of intersection of the graphs of \(f\) and \(g\).

A) \(\frac{\ln 4}{\ln 3 + \ln 4}\) 
B) \(\frac{\ln 4}{\ln 3 + \ln 4}\) 
C) \(\frac{\ln 24}{\ln 8}\) 
D) \(\ln 3 - \ln 4\) 
E) None of the Above.

11) For what numbers \(x, 0 \leq x \leq 2\pi\), does the graph of \(y = \tan\left(\frac{\pi}{4}x - 2\right)\) have vertical asymptotes?

A) \(2 + \frac{8}{\pi}, 6 + \frac{8}{\pi}\) 
B) \(\frac{8}{\pi}, 4 + \frac{8}{\pi}\) 
C) \(\frac{8}{\pi} - 2, \frac{8}{\pi} - 6\) 
D) \(\frac{2}{\pi}, \frac{3}{2\pi}\) 
E) None of the Above.

12) Solve the equation on the interval \(0 \leq \theta < 2\pi\): \(\cot \theta = 2 \cos \theta\).

A) \(\left\{\frac{\pi}{3}, \frac{\pi}{2}, \frac{2\pi}{3}, \frac{3\pi}{2}\right\}\) 
B) \(\left\{0, \frac{\pi}{3}, \frac{2\pi}{3}, \pi\right\}\) 
C) \(\left\{\frac{\pi}{6}, \frac{\pi}{2}, \frac{5\pi}{6}, \frac{3\pi}{2}\right\}\) 
D) \(\left\{0, \frac{\pi}{6}, \frac{5\pi}{6}, \pi\right\}\) 
E) None of the Above.
13) Find a rectangular equation for the plane curve defined by the parametric equations: \( x = 5 \tan t, \ y = 4 \sec t; \ 0 \leq t \leq 2\pi \).

   A) \( y = 4\sqrt{1 + \frac{x^2}{25}}; \ \text{for} \ x \in -\infty < x < \infty \)
   C) \( \frac{y^2}{16} - \frac{x^2}{25} = 1; \ \text{for} \ x \in -\infty < x < \infty \)

   B) \( y = x^2 - 9; \ \text{for} \ x \in -3 \leq x \leq 3 \)
   D) \( \frac{y^2}{16} + \frac{x^2}{25} = 1; \ \text{for} \ x \in -\infty < x < \infty \)

   E) None of the Above

14) Find all \( \theta \) on \( (0, \frac{\pi}{2}) \) such that the matrix is invertible.

\[
\begin{bmatrix}
\sec \theta & \pi \cot \theta \\
\tan \theta & 0 & \csc \theta \\
-\sin \theta & \pi \tan \theta
\end{bmatrix}
\]

   A) 0
   C) All \( \theta \) on \( (0, \frac{\pi}{2}) \)
   E) None of the Above

   B) All \( \theta \) on \( (0, \frac{\pi}{4}) \)
   D) \( \frac{\pi}{4} \)

Suppose the point (2, 4) is on the graph of \( y = f(x) \). Find a point on the graph of the given function.

15) \( y = -f(x + 5) - 3 \)

   A) (-3, -7)
   C) (7, -7)
   E) None of the Above

   B) (7, -10)
   D) (-3, 0)

Solve the problem.

16) Use the tables to find \( (fg)(-7) \).

<table>
<thead>
<tr>
<th>( x )</th>
<th>-7</th>
<th>2</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f(x) )</td>
<td>9</td>
<td>7</td>
<td>-7</td>
</tr>
</tbody>
</table>

   A) -63
   C) 49
   E) None of the Above

   B) 28
   D) 45

17) Find the center-radius form of the equation of the circle having a diameter with endpoints \((-5, 1)\) and \((3, 7)\).

   A) \( (x - 1)^2 + (y + 4)^2 = 5 \)
   C) \( (x + 1)^2 + (y - 4)^2 = 25 \)
   E) None of the Above

   B) \( (x + 3)^2 + (y - 7)^2 = 10 \)
   D) \( (x - 3)^2 + (y + 7)^2 = 100 \)
Given the equation or other information for a parabola, find the matching description or graph.

18) \( f(x) = ax^2 + bx + c, \quad a > 0; \quad b^2 - 4ac < 0 \)

- **A)** Graph A
- **B)** Graph B
- **C)** Graph C
- **D)** Graph D
- **E)** None of the Above

Find a polynomial of lowest degree with only real coefficients and having the given zeros.

19) \( \sqrt{13} \) and 3 (multiplicity 2)

- **A)** \( f(x) = x^4 - 6x^3 - 4x^2 + 78x - 117 \)
- **B)** \( f(x) = x^3 + 3x^2 - 13x - 39 \)
- **C)** \( f(x) = x^3 - 3x^2 - 13x + 39 \)
- **D)** \( f(x) = x^4 + 6x^3 + 4x^2 - 78x + 117 \)
- **E)** None of the Above

Give the domain and range for the rational function. Use interval notation.

20) \( f(x) = \frac{1}{(x - 8)^2 + 9} \)

- **A)** Domain: \( (-\infty, 8) \cup (8, \infty) \); Range: \( (9, \infty) \)
- **B)** Domain: \( (-\infty, -8) \cup (-8, \infty) \); Range: \( (-\infty, 9) \)
- **C)** Domain: \( (-\infty, 8) \cup (8, \infty) \); Range: \( (-\infty, 0) \)
- **D)** Domain: \( (-\infty, 8) \cup (8, \infty) \); Range: \( (-\infty, 9) \)
- **E)** None of the Above
Find an equation for the rational function graph.

21) 

\[
A) f(x) = \frac{x - 6}{x(x - 7)} \\
B) f(x) = \frac{x - 7}{x(x - 6)} \\
C) f(x) = \frac{x(x - 6)}{x - 7} \\
D) f(x) = \frac{x(x - 7)}{x - 6} \\
E) None of the Above
\]

Solve the equation.

22) \( \log_3 x = \sqrt{\log_3 x} \)

A) \{0, 3\} \\
B) \{3\} \\
C) \{1, 3\} \\
D) \{0, 1\} \\
E) None of the Above

Determine the equation of the graph.

23) The function graphed is of the form \( y = a \tan bx \) or \( y = a \cot bx \), where \( b > 0 \). Determine the equation of the graph.

A) \( y = \tan 4x \) \\
B) \( y = \cot 4x \) \\
C) \( y = 4 \cot x \) \\
D) \( y = 4 \tan x \) \\
E) None of the Above

Solve the problem.

24) The position of a weight attached to a spring is \( s(t) = -7 \cos 20\pi t \) inches after \( t \) seconds. What is the maximum height that the weight reaches above the equilibrium position and when does it first reach the maximum height?

A) The maximum height of 7 inches is first reached after 10 seconds. \\
B) The maximum height of 14 inches is first reached after 5 seconds. \\
C) The maximum height of 14 inches is first reached after 10 seconds. \\
D) The maximum height of 7 inches is first reached after 0.05 seconds. \\
E) None of the Above
Write the following as an algebraic expression in u, u > 0.

25) \( \sin \left( \arccos \frac{\sqrt{u^2 + 4}}{u} \right) \)

A) \( \frac{\sqrt{u^2 + 2}}{u^2 + 2} \)  
B) \( u \sqrt{2} \)  
C) \( \frac{u \sqrt{u^2 + 2}}{u^2 + 2} \)  
D) \( \frac{2 \sqrt{u^2 + 4}}{u^2 + 4} \)  
E) None of the Above

Solve the inequality. Write the solution set in interval notation.

26) \( \left| \frac{4x + 1}{x - 5} \right| \geq 0 \)

A) \( \left[ -\frac{1}{4}, 5 \right) \)  
B) \( (-\infty, 5) \cup (5, \infty) \)  
C) \( (-5, 5) \)  
D) \( \left[ -\frac{1}{4}, 5 \right) \)  
E) None of the Above

Evaluate the expression.

27) \( \cos \left( \arcsin \frac{3}{5} + \arccos \frac{\sqrt{3}}{2} \right) \)

A) \( \frac{2 \sqrt{3} + 2}{5} \)  
B) \( \frac{4 \sqrt{3} + 3}{10} \)  
C) \( \frac{-25 \sqrt{3} - 48}{100} \)  
D) \( \frac{4 \sqrt{3} - 3}{10} \)  
E) None of the Above

Solve the equation for solutions in the interval \([0, 2\pi)\).

28) \( \sec \frac{x}{2} = \cos \frac{x}{2} \)

A) \( \{0\} \)  
B) \( \left\{ \frac{\pi}{4}, \frac{5\pi}{4} \right\} \)  
C) \( \left\{ \frac{\pi}{12}, \frac{5\pi}{6}, \frac{2\pi}{3}, \frac{7\pi}{12}, \frac{7\pi}{6}, \frac{13\pi}{12}, \frac{5\pi}{3} \right\} \)  
D) \( \left\{ 0, \frac{\pi}{4}, \pi, \frac{5\pi}{3} \right\} \)  
E) None of the Above

Solve the equation for x.

29) \[
\begin{bmatrix}
0 & 0 & x \\
-4 & x & -4 \\
1 & 1 & x
\end{bmatrix}
= 4
\]

A) \( \{2\} \)  
B) \( \{-2\} \)  
C) \( \{4\} \)  
D) \( \emptyset \)  
E) None of the Above

30) Use the coding matrix \( A = \begin{bmatrix} 1 & 1 & 1 \\ -1 & 1 & 2 \end{bmatrix} \) and its inverse \( A^{-1} = \begin{bmatrix} -1 & -1 & 1 \\ 5 & 2 & -3 \end{bmatrix} \) to decode the cryptogram \[
\begin{bmatrix}
37 & 16 & 35 \\
38 & 20 & 4 \\
82 & 40 & 60
\end{bmatrix}
\]

Number of letters of the alphabet 1 through 26 in their usual order.

A) GOOD_LUCK  
B) HELP_THEM  
C) LOOK_DOWN  
D) STAY_CALM  
E) None of the Above