1. Which nondegenerate conic is represented by the following equation?

\[ 3x^2 - 2\sqrt{3} \, xy + y^2 + 2x + 2\sqrt{3} \, y = 0 \]

A. circle  B. parabola  C. hyperbola  D. ellipse  E. none of the above

2. An ellipse whose center is at (-2, 3) has a major axis of length 11 inches and a minor axis of length 4 inches. What is the area (in square inches) enclosed by the ellipse?

A. 44\pi  B. 22\pi  C. 11\pi  D. 4\pi  E. NOTA

3. Find the area of a triangle whose vertices are (-2, 7), (6,8), and (1, -1).

A. 18.9  B. 25.8  C. 40.2  D. 33.5  E. NOTA

4. Find the perimeter (in inches) of a regular hexagon circumscribed about a circle of radius 10 inches.

A. 40\sqrt{3}  B. 60  C. 60\sqrt{3}  D. 150\sqrt{3}  E. NOTA

5. Find the distance between the point (4,1) and the line whose equation is \( y = 2x + 1 \).

A. \( \frac{6\sqrt{5}}{5} \)  B. \( \frac{7\sqrt{5}}{5} \)  C. \( \frac{8}{3} \)  D. 2  E. NOTA

6. Find all vertical asymptotes for the following:

\[ y = \frac{4x^3 + 4x^2 - 3x - 3}{x^2 + 3x + 2} \]

A. \( x = -1 \)  B. \( x = -2 \)  C. \( x = -1, x = -2 \)  D. There are no vertical asymptotes  E. NOTA

7. The graph of which of the following functions does not cross the x-axis.

A. \( y = -x^3 + x^2 + 1 \)  B. \( f(x) = x^6 + x^4 + 2 \)  C. \( h(x) = x^4 - x^3 - 1 \)  D. \( g(x) = x^3 + 3x^2 - 2x - 1 \)  E. NOTA

8. Points A, B, C, and D lie on the graph of \( y^2 + 2xy + x^2 + 3x + 4y + 2 = 0 \), and each has abscissa (x-coordinate) of 1 or -1. Of these points, let A and C be the farthest apart. If \( AC = \sqrt{p + q\sqrt{3}} \), where p and q are integers, find p-q.

A. 22  B. 10  C. 2  D. 7  E. NOTA
9. If the sides of a right triangle are \(a, a-d, a+d\), where \(a\) and \(d\) are positive real numbers, then \(\left(\frac{a}{d}\right)^2 = \) ____.

A. 9  
B. 16  
C. \(\frac{1}{9}\)  
D. \(\frac{1}{16}\)  
E. NOTA

10. Triangle ABC has sides of lengths 20, 21, and 29 units. The diameter of the circle inscribed in the triangle is _____.

A. 12  
B. 7  
C. 11  
D. 6  
E. NOTA

11. The length of a rectangle is increased by 15% and the width is decreased by 20%. The percentage change in the area of the rectangle is _____.

A. 3  
B. 2  
C. 5  
D. 35  
E. NOTA

12. Find the area enclosed by the system of inequalities:

\[
\begin{cases}
2x + y \leq 4 \\
x - y \geq 5 \\
x \geq 0 \\
y \geq -10
\end{cases}
\]

A. 35.5  
B. \(\frac{33}{8}\)  
C. \(\frac{34}{8}\)  
D. 31.75  
E. NOTA

13. A sphere has an area in square units equal to the number of cubic units in its volume. Find the ratio of the circumference of a great circle of the sphere to the area of a great circle of the sphere.

A. \(\frac{3}{4}\)  
B. \(\frac{2}{3}\)  
C. \(\frac{3}{5}\)  
D. \(\frac{1}{\pi}\)  
E. NOTA

14. Find the length of the latus rectum of the parabola \(x^2 - 4x - 12y - 32 = 0\).

A. 3  
B. 6  
C. 9  
D. 12  
E. NOTA

15. What are the coordinates of the focus of the parabola whose equation is \(y^2 - 6y + 8x + 25 = 0\)?

A. (-2, 3)  
B. (-2, 5)  
C. (-2, 0)  
D. (-2, 3)  
E. NOTA
16. An arch is in the form of a semi-ellipse. The arch is 52 meters wide at the base and has a height of 20 meters at its highest point. How wide, in meters, is the arch at a height of 10 meters above the base?

A. 40  B. $26\sqrt{3}$  C. 26  D. $13\sqrt{3}$  E. NOTA

17. What is the volume, in cubic units, of a tetrahedron whose vertices are:
(3, 1, 0)  (1, 4, 0)  (5, 5, 0)  (3, 1, 6)

A. 14  B. 24  C. 42  D. 84  E. NOTA

18. In triangle ABC, angle C has measure 120 degrees, side BC has length 10 units, side AC has length 12. Find the length of side AB.

A. $2\sqrt{91}$  B. $\sqrt{244 - 120\sqrt{3}}$  C. $2\sqrt{41}$  D. $\sqrt{244 + 120\sqrt{3}}$  E. NOTA

19. The graph of $r = \sin \theta$ is a:
A. circle  B. parabola  C. limacon  D. cardioid  E. NOTA

20. What is the tangent of the acute angles formed when the two lines whose equations are $3x - 4y = 7$ and $2x + 3y = 8$ intersect?

A. $-17/6$  B. $17/6$  C. $1/6$  D. $17/18$  E. NOTA

21. What is the area, in square units, of the region enclosed by the graph of the parametric equations $x = 8 \cos \theta$ and $y = 6 \sin \theta$?

A. $96\pi$  B. $48\pi$  C. $12\pi$  D. 48  E. NOTA

22. What is the equation of the line tangent to the circle $x^2 + y^2 + 2x - 4y - 5 = 0$ at the point P(2,1)?

A. $3x + y = 7$  B. $x - 3y = -1$  C. $3x - y = 5$  D. $x + 3y = 5$  E. NOTA

23. Suppose the equation for an ellipse is given by $\frac{(x-3)^2}{16} + \frac{(y+2)^2}{b^2} = 1$.
Find b so that the eccentricity is 0.75.

A. 3  B. 6  C. $\sqrt{7}$  D. 5  E. NOTA
24. Which of the following is an asymptote to the hyperbola \( \frac{(y+2)^2}{9} - \frac{(x-3)^2}{16} = 1 \)

A. \( y = \frac{3}{4}x - 3 \)  
B. \( y = \frac{-3}{4}x - \frac{17}{4} \)  
C. \( y = \frac{3}{4}x - \frac{17}{4} \)  
D. \( y = \frac{-3}{4}x - \frac{1}{4} \)  
E. NOTA

25. Determine an angle of rotation necessary to eliminate the \( xy \) term:
\[ x^2 + xy + 2y^2 + 5x - 3y - 56 = 0 \]

A. \( \frac{3}{8} \pi \)  
B. \( \frac{3}{4} \pi \)  
C. \( \frac{\pi}{8} \)  
D. \( \frac{\pi}{4} \)  
E. NOTA

26. Calculate the area inside the cardioid \( r = 1 + \cos \theta \)

A. \( 3 \pi \)  
B. \( \frac{3}{4} \pi \)  
C. \( \frac{3}{2} \pi \)  
D. \( \frac{\pi}{2} \)  
E. NOTA

27. Find an equation for the hyperbola with eccentricity \( \frac{3}{2} \) and directrix \( x = 2 \).

A. \( r = \frac{6}{2 + 3 \cos \theta} \)  
B. \( r = \frac{2}{2 + 3 \cos \theta} \)  
C. \( r = \frac{6}{1 + 2 \cos \theta} \)  
D. \( r = \frac{3}{1 + 3 \cos \theta} \)  
E. NOTA

28. Find the length of the arc of the curve \( x = \frac{8}{3} t^3, \ y = 2t - t^2 \) between \( t = 1 \) and \( t = 3 \).

A. 4  
B. 16  
C. 12  
D. 8  
E. NOTA

29. Find the area of a parallelogram having \( v_1 = -i + 2j + 2k \) and \( v_2 = 3i - 2j + k \) as adjacent sides.

A. 3  
B. 10  
C. \( \sqrt{101} \)  
D. \( \sqrt{69} \)  
E. NOTA

30. The region in the first quadrant bounded by \( y = \sin x^2 \), the coordinate axes, and the line \( x = b \), \( b > 0 \), is revolved about the y-axis. Find \( b \) such that the volume of the solid generated is \( \frac{\pi}{2} \) cubic units.

A. \( \frac{\pi}{2} \)  
B. \( \sqrt[3]{\frac{1}{3}} \)  
C. \( -\sqrt[3]{\frac{\pi}{3}} \)  
D. \( \sqrt[3]{\frac{\pi}{3}} \)  
E. NOTA
Mu Division—ANALYTIC GEOMETRY TOPIC TEST
Answer Key

1. B
2. C
3. D
4. A
5. E
6. B
7. B
8. B
9. B
10. A
11. E
12. A
13. B
14. D
15. E
16. B
17. A
18. A
19. A
20. B
21. B
22. C
23. C
24. C
25. A
26. C
27. A
28. C
29. C
30. D