1. In any parabola, what is the sum of the length of the latus rectum and distance between the focus and directrix, divided by the focal length?

A. 6   B. 4   C. 3   D. 2   E. NOTA

2. What is the volume of the solid formed when the first quadrant portion of the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ is revolved about the x −axis?

A. $\frac{22\pi}{3}$ B. 8π C. $\frac{128\pi}{9}$ D. 12π E. NOTA

3. Write the equation of the hyperbola with asymptotes $2x - 3y = 5$ and $2x + 3y = -1$, and one vertex is at $(-2, -1)$?

A. $\frac{(x-1)^2}{9} - \frac{(y+1)^2}{4} = 1$ B. $\frac{(x+2)^2}{9} - \frac{(y+1)^2}{4} = 1$ C. $\frac{x^2}{9} - \frac{y^2}{4} = 1$

D. $\frac{(x+1)^2}{9} - \frac{(y-1)^2}{4} = 1$ E. NOTA

4. What is the minimum value of the function $f(x) = x - 3\sqrt{x} + 9$ on its domain?

A. 1.5   B. 2.25   C. 4.5   D. 6.75   E. NOTA

5. If $x^2 - 5x + 6 < 0$, then the value of $y = x^2 + 5x + 6$ takes on all values in the interval:

A. (20,30)   B. (2,72)   C. $(-\infty, 0)$ D. $(0, \infty)$ E. NOTA

6. How many pairs (x, y) of positive integer solutions are there to the equation

$x^2 - y^2 = 11$?

A. 0   B. 1   C. 2   D. Infinite   E. NOTA

7. What is the largest integer value of k for which $kx^2 + 4\sqrt{3}x + k = 1$ has at least one real root?

A. -3 B. 0   C. 3   D. 4   E. NOTA

8. Find the distance between the 2 points of intersection of the circle given by $(x - 3)^2 + (y + 5)^2 = 9$ and the line $x + y = 1$.

A. $3\sqrt{2}$ B. $4\sqrt{2}$ C. $3\sqrt{6}$ D. 6   E. NOTA

9. The parabola with equation $y = ax^2 + bx + c$ with vertex (h, k) is reflected about the line $y = k$. This results in a parabola with equation $y = dx^2 + ex + f$. Which of the following is equal to $a + b + c + d + e + f$?

A. $2b$ B. $2k$ C. $2h$ D. $2a$ E. NOTA

10. Let $f(x) = x^2 + 6x + 5$ and $g(x) = x^2 - 2x + 3$. Then the relationship between $f(x)$ and $g(x)$ can be described as

A. $g(x) = f(x + 1) + 2$ B. $g(x) = f(x + 4) - 6$ C. $g(x) = f(x - 1) + 2$

D. $g(x) = f(x - 4) + 6$ E. NOTA

11. If a and b are the zeros of the parabola $y = x^2 + 4x + 1$, find $\frac{a}{b} + \frac{b}{a}$.

A. $- 10$ B. $- 4$ C. 8   D. 14   E. NOTA

12. Find the length of the minor axis of an ellipse when the foci are $(-1,0)$ and $(1,0)$ and the eccentricity is $\frac{1}{3}$.

A. 4   B. $2\sqrt{2}$ C. 8   D. 16   E. NOTA

13. Identify the conic: $x^2 + 3xy - 4y^2 + 2x + 18y - 8 = 0$.

A. ellipse   B. parabola   C. hyperbola   D. circle   E. NOTA

14. A parabola has vertex $V(-1,3)$ which lies on a circle. The parabola's focus is $F(-1,5)$ and F is also the center of the circle. Which statement must be true?

A. The parabola's latus rectum is a diameter of the circle.

B. An equation of the parabola is $y - 3 = 8(x + 1)^2$.

C. The point $(0, 5 + \sqrt{3})$ lies on the circle.

D. The circle has two x −intercepts and no y −intercept/

E. NOTA

15. Find the center of the hyperbola given by the equation $y = \frac{4x-3}{x-1}$.

A. (1,4)   B. (4,1)   C. (1,2)   D. (1,3)   E. NOTA

16. A rectangle is formed by connecting the endpoints of the latera recta of the conic section with the equation $\frac{x^2}{13} + \frac{y^2}{9} = 1$. Find the area of this rectangle.

A. $\frac{16\sqrt{5}}{9}$ B. $\frac{72\sqrt{13}}{13}$ C. $\frac{16\sqrt{13}}{3}$ D. $\frac{8\sqrt{13}}{3}$ E. NOTA

17. If the difference in area between two circle is 10π and the sum of the radii of the two circles is 5, find the radius of the larger of the two circles.

A. 4   B. $\frac{11}{4}$ C. $\frac{7}{2}$ D. $\frac{9}{\pi}$ E. NOTA

18. Let $\mathcal{L}$ be the locus of points on the Cartesian plane satisfying $x^2 + 4y^2 - 8y + k^2 = 0$. For what value of k is $\mathcal{L}$ empty?

A. ± 2 B. $-2 < k < 2$ C. $k > 2$ D. $k < -2$ or $k > 2$ E. NOTA

19. A triangle has sides $7, 8,$ and 9 is inscribed in a circle J. Find the radius of the circle.

A. $\sqrt{5}$ B. $\frac{2\sqrt{5}}{21}$ C. $\frac{21\sqrt{5}}{5}$ D. $\frac{21\sqrt{5}}{10}$ E. NOTA

20. If the eccentricity of a conic is 3, find the number of distinguishable permutations of the letters in the name of the conic.

A. 360   B. 6720   C. 1260   D. 362880   E. NOTA

21. A parabola contains the points $(-5,0), (0,1),$ and $(7,2)$ and its axis of symmetry is perpendicular to the $y-$axis. Find the $y-$coordinate of the vertex?

A. -9 B. -5 C. -2 D. 0 E. NOTA

22. Points J and W are on circle D with radius r. If sector JDW has perimeter of 10 and area of 4, find the sum of all possible values of r.

A. $\frac{4}{5}$ B. 1   C. 4   D. 5   E. NOTA

23. The points of intersection of $6xy + 2y^2 - 5y - 13 = 0$ and $4xy + 2y^2 - 3y - 12 = 0$ are (A, B) and (C, D). What is $AC + BD$?

A. 5   B. 2   C. -4 D. 6   E. NOTA

24. PQ is a focal chord of the parabola $y = x^2$. The coordinates of P are $(-3,9)$. If the sum of the x and y coordinate of Q is expressed as $\frac{A}{B}$, where A and B are relatively prime, find $|A + B|$.

A. 157   B. 155   C. 153   D. 151   E. NOTA

25. Which of the following is the equation of a line tangent to the circle $x^2 + y^2 - 6x - 4y - 12 = 0$ through the point $(0,6)$?

A. $x - 7y - 6 = 0$ B. $7x - y + 31 = 0$ C. $4x + 3y - 7 = 0$

D. $3x - 4y + 24 = 0$ E. NOTA

26. An arch in the shape of a semi-ellipse is 48 feet wide at the base and has height of 20 feet. How far apart (in feet) are the two points of the ellipse at a height of 10 feet above the base?

A. 12   B. $12\sqrt{3}$ C. 24   D. $24\sqrt{3}$ E. NOTA

27. If $25x^2 + 16y^2 + 150x - 128y - 1119 = 0$ is an equation of a conic which has a directrix of $y = a$ where $a > 0$, find the value of a.

A. 16   B. $\frac{38}{3}$ C. $\frac{62}{3}$ D. 18   E. NOTA

28. Identify $x^2 - y^2 - 10x - 14y - 24 = 0$.

A. parabola   B. hyperbola   C. ellipse   D. circle   E. NOTA

29. Find all values of k so that it's impossible to draw a circle passing through points $(1,2k), (3k, 4),$ and $(5,6k)$.

A. $2, -\frac{2}{3}$ B. $\frac{1}{3}, \frac{3}{5}$ C. $1, -\frac{4}{3}$ D. $\frac{2}{3}, \frac{6}{5}$ E. NOTA

30. An ellipse has an eccentricity of 0.7 and a latus rectum with length 51. Find the area of the ellipse.

A. $200\pi\sqrt{51}$ B. $225\pi\sqrt{51}$ C. $250\pi\sqrt{51}$ D. $275\pi\sqrt{51}$ E. NOTA