1. Find the focal width of the parabola generated by $\frac{1}{8}x+\frac{7}{5}y-\frac{3}{14}y^2=6$.

A. $\frac{7}{3}$ B. $\frac{20}{7}$ C. $\frac{7}{12}$ D. $\frac{14}{3}$ E. NOTA

2. Find the eccentricity of the parabola in problem 1.

A. $\frac{7}{6}$ B. $\frac{7}{3}$ C. 1 D. $\frac{6}{7}$ E. NOTA

3. Find the distance between the y-intercepts of $x^2+y^2-2x+4y=4$.

A. $4\sqrt{2}$ B. 4 C. $2\sqrt{5}$ D. 2 E. NOTA

4. Find the shortest distance between $(x-2)^2+(y-1)^2=9$ and $12x+9y+14=0$.

A. $\frac{2}{15}$ B. $\frac{47}{15}$ C. $\frac{7}{15}$ D. $\frac{1}{3}$ E. NOTA

5. The hyperbola generated by $xy-2y-5x+7=0$ has vertical asymptote $x=a$ and horizontal asymptote $y=b$. Find the value of $b-a$.

A. 7 B. 3 C. 5 D. 4 E. NOTA

6. The area of an ellipse is 18π and the length of a latus rectum is 3. Find the sum of the distances from one point on the ellipse to the two foci.

A. $3\sqrt{3}$ B. 6 C. $6\sqrt{3}$ D. 12 E. NOTA

7. A rectangle is drawn such that two of its vertices are the x-intercepts of $y=2x(x-1)$, and its opposite side (parallel to the x-axis) is tangent to this parabola. Find the area of the rectangle.

A. $\frac{1}{4}$ B. $\frac{2}{3}$ C. $\frac{1}{2}$ D. $\frac{3}{8}$ E. NOTA

8. Find the equation of the line tangent to a circle at (3, 7) if the center of the circle is (–3, 2).

A. $6x+5y-53=0$ B. $6x-5y+17=0$ C. $5x-6y+27=0$ D. $5x+6y-57=0$ E. NOTA

9. A parabola has *x*-intercepts 1 and 2, and *y*-intercept 6. If the parabola has equation $y=ax^2+bx+c$, what is the sum $a+b+c$?

A. –2 B. –1 C. 1 D. 2 E. NOTA

10. A running track of length 1320 feet lies on the perimeter of a rectangular region with a semicircle at each end. What is the maximum possible area, in ft², of the rectangle?

A. $\frac{330^2}{\pi}$ B. $\left(\frac{330}{\pi}\right)^2$ C. $\frac{3}{\pi}(330)^2$ D. $\frac{2}{\pi}(330)^2$ E. NOTA

11. The conjugate axis of $\frac{(x-4)^2}{9}-\frac{(y+3)^2}{16}=1$ is the latus rectum of a parabola. Which of the following could be this parabola?

A. $8x-48=(y+3)^2$ B. $8x+16=(y+3)^2$ C. $8y+48=(x-4)^2$ D. $8y=(x-4)^2$ E. NOTA

12. How many of the following conics share both foci?

$\frac{y^2}{4}-\frac{x^2}{8}=1$ $\frac{x^2}{6}-\frac{y^2}{6}=1$ $\frac{x^2}{20}+\frac{y^2}{8}=1$ $\frac{x^2}{6}+\frac{y^2}{6}=1$ $\frac{x^2}{7}-\frac{y^2}{5}=1$ $\frac{x^2}{997}+\frac{y^2}{985}=1$

A. 3 B. 4 C. 5 D. 6 E. NOTA

13. A comet follows a hyperbolic orbit around the sun, the closest point being at a vertex 42 million miles from the sun. When the line joining the sun and the comet is perpendicular to the transverse axis of the hyperbola, the comet is 112 million miles from the sun. Find the distance (in millions of miles) from the sun to the center of the hyperbola. (The sun is a focus.)

A. 105 B. 126 C. 56 D. 70 E. NOTA

14. Find the smallest possible circumference of a circle in the coordinate plane that passes through (4, 4) and is tangent to both coordinate axes.

A. $16\left(-1+\sqrt{2}\right)\pi$ B. $4\left(1+\sqrt{2}\right)\pi$ C. $\frac{16\pi}{3}$ D. $8\left(2-\sqrt{2}\right)\pi$ E. NOTA

15. If the positive difference between the *x*-intercepts of $y=x^2+kx+3072$ is 244, find the absolute value of the sum of these intercepts.

A. 268 B. 324 C. 244 D. 192 E. NOTA

16. Find the eccentricity of the conic generated by $|z-3|+|z+5|=14$ for complex number z.

A. $\frac{5}{3}$ B. $\frac{4}{7}$ C. $\frac{3}{5}$ D. $\frac{3}{14}$ E. NOTA

17. There is a point L on the lower half of the ellipse $9x^2+4y^2=36$ for which $\angle AOL$ — determined by $A(2, 0)$, $O(0, 0)$, $L(x, y)$ — has a measure of $60°$. Find the value of x^2+y^2.

A. $\frac{9}{2}$ B. $\frac{45}{11}$ C. $\frac{21}{4}$ D. $\frac{48}{7}$ E. NOTA

18. A ball is thrown in a parabolic pathway upward and outward from the top edge of a 50-foot building. It reaches its highest point 20 feet above and 10 feet out from the building. How far from the building is the ball when it hits the ground? All answers are in feet.

A. $10+\frac{10\sqrt{6}}{3}$ B. $10+5\sqrt{14}$ C. $10+\sqrt{140}$ D. $10+2\sqrt{30}$ E. NOTA

19. Let R be a circle that intersects each of the circles $(x+2)^2+y^2=4$, $(x-4)^2+(y-2)^2=4$, and $(x-4)^2+(y+2)^2=4$ in exactly one point, and does not contain any of these circles inside it. If the radius r of R has the form $r=\frac{p}{q}$, where p and q are relatively prime positive integers, what is the value of $p+q$?

A. 5 B. 13 C. 7 11 E. NOTA

20. The equations of the directrices of the hyperbola with asymptotes $3x-4y=13$ and $3x+4y-5=0$ and a focus at (–2, –1) are $x=M$ and $x=N$. Find the product MN.

A. $-\frac{481}{16}$ B. $-\frac{31}{25}$ C. $-\frac{256}{25}$ D. $-\frac{625}{16}$ E. NOTA

21. An ellipse has a horizontal major axis, center at (1, 3), and contains (5, 6) and (7, 5). If its equation is written in the form $\frac{(x+h)^2}{a^2}+\frac{(y+k)^2}{b^2}=1$, find the value of $\frac{a^2}{b^2}+\frac{k}{h}$.

A. 7 B. $\frac{13}{4}$ C. 1 D. 13 E. NOTA

22. Find the area of the figure formed by joining the intersections (in clockwise order) of the hyperbolas $x^2+3xy=28$ and $xy+4y^2=8$.

A. 45 B. 60 C. 90 D. 120 E. NOTA

23. The oblique ellipse $x^2+xy+y^2=20$ and the oblique hyperbola $xy=5$ intersect in four points. Find the shortest distance between any pair of these four points of intersection.

A. $\sqrt{5}$ B. $\sqrt{10}$ C. $\sqrt{15}$ D. $2\sqrt{5}$ E. NOTA

24. Identify the graph of $4x^2-12xy+9y^2+20x-30y+25=0$.

A. parabola B. one line C. parallel lines D. intersecting lines E. NOTA

25. Identify the graph of $x^2+3xy+3y^2-x+1=0$.

A. ellipse B. one line C. parallel lines D. intersecting lines E. NOTA

26. The height s at time t of an object that is moving in a vertical line with constant acceleration a is given by $s=\frac{1}{2}at^2+v_0t+s_0$, where s is measured in feet, t is measured in seconds, and s_0 and v_0 are the initial position and velocity (at time $t=0$). Find the value of $a+v_0+s_0$ if $s=52$ at $t=1$, $s=52$ at $t=2$, and $s=20$ at $t=3$.

A. 36 B. 60 C. 88 D. 100 E. NOTA

27. Find the x-coordinate of the center of the circle that circumscribes triangle ABC with $A(-1,2)$, $B(4,0)$, and $C(1,-3)$.

A. $\frac{4}{3}$ B. 1 C. $\frac{1}{2}$ D. $\frac{7}{6}$ E. NOTA

28. An ellipse with eccentricity $4/7$ and vertices $(\pm 7,0)$ is revolved around its major axis. Find the volume of the resulting figure.

A. 231π B. $\frac{196\sqrt{33}}{3}$ C. $154\sqrt{33}\pi$ D. 308π E. NOTA

29. Find all values of k for which $x^2+y^2-4x+8y=-k-12$ produces no graph.

A. $k \geq 8$ B. $k \geq -8$ C. $k < 8$ D. $k < -8$ E. NOTA

30. Which of the following is/are false? (Assume a represents distance from center to vertex, c represents distance from center to focus, and e represents eccentricity.)

I. The sum of the squares of the distances from a point on a circle to the ends of a diameter is equal to the square of the diameter.

II. If p is the distance from a focus of an ellipse to the corresponding directrix, then $p=\frac{a^2}{c}$.

III. If p is the distance from a focus of an ellipse to the corresponding directrix, then the length of the major axis is $\frac{2ep}{1-e^2}$.

IV. If p is the distance from a focus of a hyperbola to the corresponding directrix, then the length of the transverse axis is $\frac{2ep}{e^2-1}$.

V. The radical axis of two non-concentric circles of equal radius is the perpendicular bisector of the line of centers.

A. I, V only B. II, V only C. II only D. III only E. NOTA