NOTA means "None of the Above." For this test, assume that ellipses are non-circular.

1. Find the distance between the points (1, 3) and (18, 3).

A) 3 B) 17 C) 0 D) $\sqrt{17}$ E) NOTA

2. Let the slope of the line $3x+4y=5$ equal A, and let the y-intercept be (0, B). A + B =

A) 0.5 B) 0.75 C) $1.\overline{3}$ D) 2.3 E) NOTA

3. Give the equation of the line that passes through the points (260, 221) and (400, 81).

A) $2x+3y=600$ B) $3x-y=962$ C) $x+y=481$
D) $x-2y=50$ E) NOTA

4. Find the distance between the x- and y-intercepts of $Ax+By+C=0$, for $A\neq B\neq 0$.

A) $\left|\frac{C}{AB}\right|\sqrt{A^2+B^2}$ B) C^2 C) 1 D) A^2+B^2 E) NOTA

The next three questions concern points $A(-5,10)$ and $B(1,4)$, and the line l that passes through them.

5. Give the equation of the line perpendicular to l that passes through the midpoint of $\overline{AB}$.

A) $y=x+5$ B) $y=2x+5$ C) $y=x$ D) $y=x+9$ E) NOTA

6. What is the acute angle that l makes with the x-axis?

A) $\frac{\pi}{3}$ B) $\frac{\pi}{4}$ C) $\frac{\pi}{6}$ D) $\frac{\pi}{7}$ E) NOTA

7. Choose the point on line segment AB three-quarters of the way from A to B.

A) $\left(-\frac{3}{4},\frac{23}{4}\right)$ B) $\left(-\frac{3}{5},\frac{28}{5}\right)$ C) $\left(-\frac{1}{2},\frac{11}{2}\right)$ D) $\left(-\frac{1}{4},\frac{21}{4}\right)$ E) NOTA

The next four questions concern the parabola $x^2+6x-4y+13=0$ and the circle $x^2+y^2-6x+12y+29=0$.

8. What are the coordinates of the focus of the parabola?

A) (-3, 5) B) (3, 5) C) (3, 3) D) (-3, 2) E) NOTA

9. What is the radius of the circle?

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

10. Give the equation of the directrix of the parabola.

A) y = 0 B) y = 1 C) y = 2 D) y = 3 E) NOTA

11. A line segment is drawn starting at the vertex of the parabola and ending tangent to the circle. What is its length?

A) $\sqrt{61}$ B) $\sqrt{67}$ C) $\sqrt{69}$ D) $\sqrt{71}$ E) NOTA

12. What is the equation of the graph $x^2+y^2+18x-18y+162=0$?

A) line B) circle C) point D) plane E) NOTA

13. $\int_{-10}^{13} \big||x-1|-9\big|\,dx =$

A) $\frac{175}{2}$ B) 81 C) 86 D) $\frac{171}{2}$ E) NOTA

14. For $a,b,c>0$, given that (0, 0), $(a,0)$, and (c,b) are the coordinates of a parallelogram, which of the following could be the fourth vertex?

I. $(a+c,b)$ II. $(a+c,a+b)$ III. $(a,b+c)$ IV. $(a,-b)$ V. $(a-c,-b)$

A) IV B) II, IV C) I, V D) IV, V E) NOTA

15. Give the cross product of the vectors $3\vec{i}+7\vec{j}+5\vec{k}$ and $4\vec{i}+3\vec{j}-2\vec{k}$.

A) $\vec{i}+14\vec{j}+37\vec{k}$ B) $28\vec{i}+\vec{j}+3\vec{k}$ C) $-29\vec{i}+26\vec{j}-19\vec{k}$
D) $22\vec{i}+20\vec{j}-20\vec{k}$ E) NOTA

16. Consider the polygon formed when the points (-5, 3), (7, 11), (11, 4), and (-1, -4) are connected in order. Which of the following terms is the *most specific* name of the given polygon?

A) Quadrilateral B) Trapezoid C) Rhombus D) Parallelogram E) NOTA

17. The plane $-29x+26y-19z-34=0$ intersects another plane with equation $x+z=0$ in a line. Give the direction vector of this line. (The cross product of the normal vectors of the planes give the direction vector of the line).

A) $26\vec{i}-48\vec{j}+26\vec{k}$ B) $26\vec{i}+10\vec{j}-26\vec{k}$ C) $19\vec{i}+26\vec{j}+4\vec{k}$
D) $\vec{i}+\vec{k}$ E) NOTA

18. Give the distance between the polar points $\left(1,\frac{\pi}{4}\right)$ and $(1,\pi)$.

A) $\sqrt{2+\sqrt{2}}$ B) $\sqrt{2}$ C) $\sqrt{5}$ D) $\frac{3\pi}{4}$ E) NOTA

19. Give the area of the region given by the intersection of the interiors of the polar graphs $r=a\cos\theta$ and $r=a\sin\theta$.

A) $\frac{a^2}{64}(\pi-8)$ B) $\frac{a^2}{4}(\pi-8)$ C) $a^2(\pi-8)$ D) $\frac{a^2}{8}(\pi-2)$ E) NOTA

20. Give the coordinates of the point of intersection of the asymptotes of the hyperbola: $13x^2-7y^2+26x+14y-85=0$.

A) (-1, 1) B) (1, 1) C) (1, -1) D) (-1, -1) E) NOTA

21. Give the equation that contains the locus of points twice as far from (-1, 1) as from (4, 5) in the xy-plane.

A) $x^2+y^2-34x-18y+80=0$
B) $x^2+y^2+12x+6y-37=0$
C) $3x^2+3y^2-34x-38y+162=0$
D) $3x^2+3y^2+18x+2y-25=0$
E) NOTA

22. Give the area of the region between the graph of $|x|+|y|=4$ and the circle inscribed within $|x|+|y|=4$.

A) $32-8\pi$ B) $16-8\pi$ C) $16-4\pi$ D) $32-4\pi$ E) NOTA

23. An equilateral triangle and a circle are drawn that don't overlap. They have a combined area of $\sqrt{3}+\pi$. If the side of the triangle and radius of the circle are natural numbers, what is the combined perimeter of the triangle and the circle?

A) $3+2\pi$ B) $6+2\pi$ C) $12+\pi$ D) $12+2\pi$ E) NOTA

24. Give the cosecant of the angle between the vectors $\langle 1,1,1\rangle$ and $\langle -1,1,1\rangle$.

A) $\frac{3\sqrt{2}}{2}$ B) $\frac{\sqrt{2}}{3}$ C) $\frac{3\sqrt{2}}{4}$ D) $\frac{3\sqrt{2}}{8}$ E) NOTA

25. What is the graph of the equation $r=\frac{2}{1-\sin\theta}$ in the polar coordinate system?

A) Circle
B) Ellipse
C) Parabola
D) Hyperbola
E) NOTA

26. A trapezoid has vertices with coordinates $\left(4\sqrt{3},0\right)$, (0, 4), (-10, 4), $\left(-10-4\sqrt{3},0\right)$.

A line segment with one endpoint (0, 4) and length 2 is rotated 360 degrees. What is the area swept by the line segment outside of the trapezoid?

A) $\frac{7\pi}{3}$ B) $\frac{7\pi}{6}$ C) $\frac{7\pi}{9}$ D) $\frac{7\pi}{12}$ E) NOTA

27. For $0<\theta<\frac{\pi}{2}$, what is the area of the triangle with vertices $(\cos\theta,0)$, $(0,\sin\theta)$, and (0, 0)?

A) $\sin 2\theta$ B) $2\sin 2\theta$ C) $\frac{1}{2}\sin 2\theta$ D) $\frac{1}{4}\sin 2\theta$ E) NOTA

28. Consider the equation $\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1$ where $a>b$. What are coordinates of the foci of this graph?

A) $\left(h\pm\sqrt{a^2-b^2},k\right)$ B) $\left(h\pm\sqrt{a^2+b^2},k\right)$ C) $\left(h,k\pm\sqrt{a^2-b^2}\right)$

D) $\left(h,k\pm\sqrt{a^2+b^2}\right)$ E) NOTA

29. Consider the convex polygonal region formed when the points (-1, 8), (3, 10), (5, 4), (1, 1), and (-4, 3) are connected in order. Give the area of the region.

A) 42.5 B) 43 C) 46.5 D) 49.5 E) NOTA

30. Pappus' Theorem states that the volume of a region in the xy-plane when rotated around a line is $2\pi Ad$, where A is the area of the region and d is the distance between the centroid of the region and the line of rotation. Give the volume of the solid formed when the region bounded by the graph of $16x^2+4y^2+32x+8y-44=0$ is rotated around the line $5x+5y=98$.

A) $\frac{864\pi^2\sqrt{2}}{5}$ B) $\frac{1,728\pi^2\sqrt{2}}{5}$ C) $\frac{1061\pi\sqrt{2}}{2}$

D) $\frac{4543\pi\sqrt{2}}{2}$ E) NOTA