

**If none of the answers given is correct choose NOTA.**

1. For the parabola  $y^2 = 4px$ , which of the following statements are true?

- i) The focus is at  $(p,0)$ .                      ii) The directrix has equation  $x = -p$ .  
 iii) The latus rectum has a length of  $|4p|$ .

- a) i, iii only                      b) i, ii only                      c) ii, iii only                      d) i, ii, iii                      e) NOTA

2. What is the slope of the line perpendicular to the line containing the points  $(a, b^3)$  and  $(b, a^3)$ ,  $a \neq b$ ?

- a)  $-(a^2 + ab + b^2)$                       b)  $\frac{-1}{a^2 - ab + b^2}$                       c)  $\frac{-1}{a^2 + ab + b^2}$                       d)  $\frac{1}{a^2 + ab + b^2}$                       e) NOTA

3. An ellipse centered at the origin passes through the point  $(0,7)$  and has an area of  $14\pi$ . What is the length of its minor axis?

- a) 2                      b) 4                      c) 14                      d) 49                      e) NOTA

4. The abscissa of a point is  $-6$  and its distance from the point  $(1,3)$  is  $\sqrt{74}$ . Find the sum of the possible ordinates of the point.

- a) 6                      b) 10                      c) 26                      d) 50                      e) NOTA

5. Find  $h \cdot k$  if  $3x + ky + 2 = 0$  and  $5x - y + h = 0$  are equations of the same line.

- a)  $\frac{-7}{3}$                       b)  $-2$                       c)  $\frac{-5}{3}$                       d)  $\frac{-2}{3}$                       e) NOTA

6. A hyperbola has one focus at  $(26,0)$  and as asymptotes the lines  $12y = \pm 5x$ . Which of the following is a vertex of the hyperbola?

- a)  $(-24,0)$                       b)  $(-10,0)$                       c)  $(0,10)$                       d)  $(12,0)$                       e) NOTA

7. Find the maximum area of a right triangle given that the sum of the lengths of its legs is 5.

- a)  $\frac{5}{2}$                       b)  $\frac{7}{2}$                       c)  $\frac{25}{8}$                       d)  $\frac{25}{4}$                       e) NOTA

8. Which of the following is the polar graph of a lemniscate?

- a)  $r = 2\sin(3\theta)$                       b)  $r = 2 - 2\cos(\theta)$                       c)  $r^2 = 16\cos(2\theta)$                       d)  $4 = 2\theta$                       e) NOTA

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9. A parabola has its focus at the pole and its vertex at the polar point  $(4, \pi)$ . Which of the following is an equation of the directrix?

- a)  $r \sin(\theta) = 8$       b)  $r \cos(\theta) = 4$       c)  $r \cos(\theta) = -8$       d)  $r \sin(\theta) = -4$       e) NOTA

10. A radar at  $(0,0)$  in an airport control tower detects all planes within a 50 mile radius. A plane flew on the course  $x + 2y = 110$ . If the plane's speed is 240 mph, to the nearest hundredth of a minute, how long will it appear on the radar screen?

- a) 4.47      b) 5.23      c) 5.78      d) 6.34      e) NOTA

11. Find  $k$  such that the  $y$ -intercept of the line with the equation  $3x + 2ky + 9 = 0$  is  $-6$ .

- a)  $-1.5$       b)  $-0.75$       c)  $\frac{2}{3}$       d)  $\frac{4}{3}$       e) NOTA

12. A parabola was graphed on a chalkboard. A passing student accidentally rubbed off the coefficient of  $xy$  in the equation of the parabola  $-5x^2 + ?xy - 2y^2 + 5x - 3y - 8 = 0$ . The missing coefficient  $?$  could be

- a)  $\sqrt{10}$       b)  $2\sqrt{10}$       c) 10      d) 40      e) NOTA

13. Rectangle ABCD has sides parallel to the axes and a vertex in each quadrant. It is three times as long as it is wide. The longest side is parallel to the  $x$ -axis. The perimeter of the rectangle is 56 and the coordinates of D are  $(9,2)$ . What are the coordinates of B?

- a)  $(-12,-5)$       b)  $(-5,-9)$       c)  $(-7,-4)$       d)  $(-6,-3)$       e) NOTA

14. Which of the following statements is false?

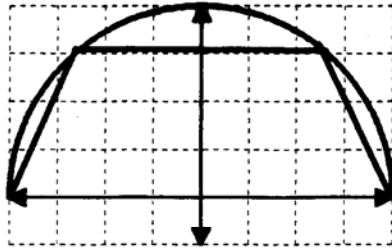
- a) The midpoint of the hypotenuse of a right triangle is equidistant from its three vertices.  
b) A triangle that has two congruent medians is equilateral.  
c) The diagonals of a rhombus are perpendicular.  
d) The line segments joining the midpoints of successive sides of any rectangle form a rhombus.  
e) NOTA

15. The shock wave of a supersonic jet flying parallel to the ground is a cone. Points on the intersection of the cone and the ground receive a sonic boom at the same time. What type of conic is the intersection?

- a) circle      b) parabola      c) ellipse      d) hyperbola      e) NOTA

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16. An isosceles trapezoid, centered at the origin, is inscribed in a semicircle of radius 4 with its base on the x-axis as shown. Write a function  $A(x)$  that represents the area of any such trapezoid where  $x$  is the abscissa of the right endpoint of the upper base.



- a)  $(x + 4)\sqrt{16 - x^2}$     b)  $\frac{(x+2)(x^2 + 16)}{2}$     c)  $\frac{3(2x+8)}{2}$     d)  $\frac{(x+4)(x^2 + 16)}{2}$     e) NOTA

17. If you eliminate the parameter  $t$  in the equations  $x = e^t + 1$  and  $y = \sin(t)$ , then

- a)  $y = \ln(\sin(x) - 1)$     b)  $y = \sin(e^{x-1})$     c)  $x = e^{\sin(y)}$     d)  $y = \sin(\ln(x-1))$     e) NOTA

18. The equivalent rectangular equation of the polar equation  $r \sin(\theta + \frac{\pi}{6}) = 2$  is

- a)  $\sqrt{3}x + y = 2$     b)  $x + \sqrt{3}y = 4$     c)  $x + 2y = 2\sqrt{3}$     d)  $\sqrt{3}x + y = 4$     e) NOTA

19. A hyperbola with a horizontal axis passes through  $(7, -2)$ . The equation of its asymptotes are  $3x - 4y = 17$  and  $3x + 4y = 1$ . Find the x-intercepts of the hyperbola to the nearest thousandth.

- a) -1.807, 7.807    b) 2.302, 9.302    c) 1.807, 9.207    d) -1.302, 6.302    e) NOTA

20. The area common to the circles  $(x - 2)^2 + (y - 2)^2 = 25$  and  $(x - 2)^2 + (y - 6)^2 = 25$  is divided into two equal parts by the line  $14x + 3y = k$ . Find  $k$ .

- a) 32    b)  $16 + 4\sqrt{21}$     c) 40    d)  $42 + \sqrt{21}$     e) NOTA

21. Given that the vector  $\vec{v} = a\mathbf{i} + b\mathbf{j}$  is orthogonal to the vector  $4\mathbf{i} - 7\mathbf{j}$  and that  $a + b = 22$ , find the magnitude of  $\vec{v}$ .

- a)  $\sqrt{247}$     b)  $3\sqrt{13}$     c)  $2\sqrt{65}$     d)  $\sqrt{303}$     e) NOTA

22. Find the distance between the plane  $2x + 3y - 6z - 2 = 0$  and the point  $(4, -6, 1)$ .

- a)  $\frac{18}{7}$     b)  $\frac{14}{5}$     c)  $\frac{16}{7}$     d)  $\frac{7}{9}$     e) NOTA

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23. Find the equation of the circle with polar center at  $(5, 60^\circ)$  and radius 3.

- a)  $r^2 + 10r\cos(\theta - 60^\circ) + 16 = 0$
- b)  $r^2 - 10r\sin(\theta - 60^\circ) - 16 = 0$
- c)  $r^2 - 10r\cos(\theta - 60^\circ) + 16 = 0$
- d)  $r^2 - 10r\sin(\theta - 60^\circ) + 16 = 0$
- e) NOTA

24. The arch of an underpass is a semi-ellipse 60 ft wide and 20 ft high. Find the height clearance at the edge of the lane, if the edge of the lane is 20 ft from the middle?

- a)  $\frac{10\sqrt{5}}{7}$
- b)  $\frac{20\sqrt{5}}{3}$
- c)  $\frac{3\sqrt{10}}{5}$
- d)  $\frac{5\sqrt{10}}{3}$
- e) NOTA

25. Given the equation  $2x^2y - x^3 - 8xy + 8x^2 - 20x + 8y + 14 = 0$ , which of the following are true?

- i)  $x = -2$  is a vertical asymptote.
  - ii)  $y = \frac{1}{2}x - 2$  is a slant asymptote.
  - iii) The y intercept is  $\frac{-7}{4}$ .
  - iv) The graph has one x-intercept.
  - v) The graph always increases.
- a) iii, iv only
  - b) i, ii, iii, v only
  - c) ii, iii, iv only
  - d) All are true.
  - e) NOTA

26. A student did an analytic proof that the diagonals of a rhombus are perpendicular. One vertex was placed at the origin. Vertices adjacent to the origin were placed at  $(a, 0)$  and  $(b, c)$ , where  $b < a$ , and both  $b$  and  $a$  are positive. Which of the following could be part of her proof?

- a)  $\frac{c}{b-a} = \frac{c}{a+b}$ , where  $c = \sqrt{a^2 - b^2}$
- b)  $\frac{c}{b-a} \cdot \frac{a+b}{c} = \frac{a+b}{b-a}$
- c)  $\sqrt{(a+b)^2 + c^2} = \sqrt{(b-a)^2 + c^2}$ , where  $c = \sqrt{a^2 - b^2}$
- d)  $\frac{c}{b-a} \cdot \frac{c}{a+b} = -1$ , where  $c = \sqrt{a^2 - b^2}$
- e) NOTA

27. Which of the following statements is false?

- a) DeMoivre's Theorem is true when  $n = 0$ .
- b)  $e^{i\pi} = -1$
- c) The polar graph of  $\ln r = \theta$  is a spiral.
- d) If  $z_1 = r\text{cis}(\alpha)$  and  $z_2 = r\text{cis}(\beta)$ , then  $z_1 z_2 = r^2 \text{cis}(\alpha\beta)$ .
- e) NOTA

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28. The graph of  $y^2 - 3yx = 0$  is

- a) a parabola
- b) a point
- c) two intersecting lines
- d) two parallel lines
- e) NOTA

29. The angle of inclination of a line  $l$  is  $31.4^\circ$ . To the nearest hundredth what is the slope of the line perpendicular to  $l$ ?

- a) -1.64                  b) -0.61                  c) 0.61                  d) 62.78                  e) NOTA

30. The points  $A(0,0,0)$ ,  $B(a,b,c)$ ,  $C(a + \frac{1}{a}, b + \frac{1}{b}, c - \frac{2}{c})$ ,  $D(\frac{1}{a}, \frac{1}{b}, \frac{-2}{c})$  taken in order are the vertices of a

- a) rhombus
- b) square
- c) non-regular rectangle
- d) non-rectangular parallelogram
- e) NOTA