1. A circle has a chord of length 8 that is tangent to a smaller, concentric circle. Find the area between the two circles.

   a) 16π b) 9π c) 24π d) 36π e) NOTA

2. Segment P_1P_2 has length L and endpoints $P_1 = (2,7)$ and $P_2 = (8,3)$.
   Find a point on P_1P_2 that is $\frac{1}{3}L$ away from P_1.

   a) $\left(6,\frac{11}{3}\right)$ b) $(4,5)$ c) $\left(4,\frac{17}{3}\right)$ d) $\left(\frac{11}{3},\frac{17}{3}\right)$ e) NOTA

3. If r_{circum} represents the radius of a circumscribed circle and r_{in} represents the radius of an inscribed circle, find $\frac{r_{circum}}{r_{in}}$ for a triangle with sides of length 5,12, and 13.

   a) $\frac{2}{5}$ b) $\frac{13}{4}$ c) 5 d) 13 e) NOTA

4. Which vector is perpendicular to both $\langle 1,2,3\rangle$ and $\langle 4,5,6\rangle$?

   a) $\langle -1,-2,-1\rangle$ b) $\langle -1,2,1\rangle$ c) $\langle 1,-2,1\rangle$ d) $\langle -1,-2,1\rangle$ e) NOTA

5. Which conic section is represented by the equation $4x^2 - 4xy + y^2 + 4x - 2y + 1 = 0$?

   a) ellipse b) 2 lines c) hyperbola d) 1 line e) NOTA

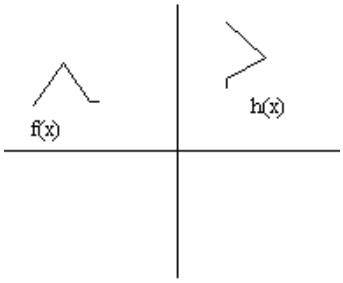
6. Find the shortest distance between the parallel lines with equations $5x - 12y + 33 = 0$ and $5x - 12y - 6 = 0$.

   a) 3 b) 39 c) $\frac{27}{5}$ d) $\frac{27}{13}$ e) NOTA

7. 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

8. If $f(g(x)) = x$, then $h(x)$ is approximately equivalent to which of the following?



a) $-g(x)$ b) $-g(f(x))$ c) $f(-x)$ d) $g(-x)$ e) NOTA

9. The value of the cosine of the angle between the vectors $\langle 3,4 \rangle$ and $\langle -3,4 \rangle$ can be expressed, in reduced form, as $\frac{A}{B}$. Find $A + B$?

a) 28 b) 29 c) 30 d) 31 e) NOTA

10. Find $\det \begin{vmatrix} \sin x & i\sin x & -1 \\ i & \cos x & i \\ -\sin x & i & -\sin x \end{vmatrix}$, when $x = \frac{3\pi}{2}$.

a) i b) 1 c) 0 d) -1 e) NOTA

11. What is the vertex of the parabola with equation $y = x^2 + 8x - 7$?

a) (-8,-7) b) (8,121) c) (4,41) d) (-4,-23) e) NOTA

12. What is the shortest distance between the sphere $x^2 + y^2 + z^2 = 9$ and the point, represented in spherical coordinates, $\left(5, \frac{\pi}{2}, \frac{\pi}{6}\right)$? *(Hint: this sphere is centered about the origin)*

a) $2\sqrt{3}$ b) 2 c) $\sqrt{6}$ d) $5 - 3\sqrt{2}$ e) NOTA

13. Let $c_1, c_2, ..., c_5$ be each of the fifth roots of –2. Find $\sum_{i=1}^{5} |c_i|$.

a) 10 b) $5\sqrt[5]{2}$ c) 2 d) $\sqrt[5]{2}$ e) NOTA

14. A man standing atop a watchtower sees a ship at an angle of depression of 15°. He looks at the ship again minutes later and sees it at an angle of depression of 30°. If the ship traveled 800 feet toward the watchtower in that time, how high above sea level is the man, to the nearest hundredth of a foot?

a) 200.00 b) 519.62 c) 565.69 d) 400.00 e) NOTA

15. If $f(x)=\dfrac{x}{3-x}$ and $g(x)$ is the inverse of $f(x)$, find $g(-2)+g(2)$.

a) 0 b) 2 c) -4 d) 4 e) NOTA

16. Determine the Cartesian coordinates of the foci of the conic section determined by the polar equation: $r=\pm\sqrt{\sec(2\cdot\Theta)}$

a) $(0, \pm\sqrt{2})$ b) $(\pm\sqrt{2}, 0)$ c) $(0, \mp\sqrt{3})$ d) $(\mp\sqrt{3}, 0)$ e) NOTA

17. A regular octagon has sides of length *s*. Calculate the area of the octagon in terms of *s*.

a) $s^2(1+\sqrt{2})$ b) $4s^2(2+\sqrt{2})$ c) $2s^2(1+\sqrt{2})$ d) $s^2(2+\sqrt{2})$ e) NOTA

18. How many 'petals' does the graph of the curve $r=4\cos\theta\sin\theta$ have?

a) 4 b) 2 c) 8 d) 6 e) NOTA

19. Find the volume of the parallelepiped described by the following 3 vectors: $\langle 1,1,0\rangle, \langle 0,1,0\rangle, \langle 0,0,2\rangle$

a) 1 b) 2 c) 1.5 d) 4 e) NOTA

20. The positive difference of the distances from point P to the points $(-2,0)$ and $(4,0)$ is 4. Find the equation for the locus of all such points.

a) $\dfrac{x^2}{16}-\dfrac{y^2}{9}=1$ b) $\dfrac{(x-1)^2}{16}-\dfrac{y^2}{25}=1$

c) $\dfrac{x^2}{16}-\dfrac{(y-1)^2}{25}=1$ d) $\dfrac{(x-1)^2}{4}-\dfrac{y^2}{5}=1$ e) NOTA

21. What is the area of the rectangle found by joining the two latera recta of the ellipse with equation $\dfrac{x^2}{13}+\dfrac{y^2}{9}=1$?

a) $\dfrac{16\sqrt{5}}{3}$ b) $\dfrac{72\sqrt{13}}{13}$ c) $\dfrac{16\sqrt{13}}{3}$ d) $\dfrac{8\sqrt{13}}{3}$ e) NOTA

22. Find the eccentricity, e, of a parabola whose equation is $4y^2 = x$.

a) ½ b) 0 c) 8 d) 1 e) NOTA

23. What are the slopes of the asymptotes of the hyperbola with equation $\frac{x^2}{5} - \frac{y^2}{45} = 1$?

a) $\pm\frac{1}{3}$ b) $\pm\frac{1}{9}$ c) ± 9 d) $\pm\frac{1}{27}$ e)NOTA

24. List all the asymptotes of the function: $f(x) = \frac{2}{x - \log_x 256}$.

a) $x = 2, x = 0, y = 16$ b) $x = 2, y = 0$ c) $x = 0, x = 4, y = 0$ d) $x = 0, y = 0$ e)NOTA

25. Find the area of the triangle formed by connecting the following 3 points: (0,0), (1017,4), and (79,568).

a) 288670 b) 39035.5 c) 78071 d) 577340 e) NOTA

26. Find the polar equation of a line passing through the point $\left(1,-\sqrt{3}\right)$ and having slope $-\sqrt{3}$.

a) $\theta = \frac{\pi}{3}$ b) $r = \frac{-\pi}{6}$ c) $r = \frac{-\pi}{3}$ d) $\theta = \frac{-\pi}{3}$ e) NOTA

27. Find the equation of a circle with radius 5 and centered at (3,-1).

a) $x^2 + y^2 - 9x + 2y - 15 = 0$ b) $x^2 + y^2 - 6x + 2y + 15 = 0$
c) $x^2 + y^2 - 6x + 2y - 15 = 0$ d) $x^2 + y^2 + 6x - 2y + 15 = 0$ e) NOTA

28. A particularly arrogant hyperbola is striving to have his eccentricity be equal to the golden ratio. His semi-major axis (*a*) is equal to 1. What should be the length of the square of his semi-minor axis (*b*) if he is to achieve this?

a) $\frac{\sqrt{5}-1}{2}$ b) $\frac{2}{1-\sqrt{5}}$ c) $\frac{2}{1+\sqrt{5}}$ d) $\frac{1+\sqrt{5}}{2}$ e) NOTA

29. If $x = 2^t$ and $\log y = t \log\sqrt{2}$, find an expression for *y* in terms of *x*.

a) $\sqrt{x} = y, x \neq 0$ b) $y = x^2, x \neq 0$ c) $\frac{x}{2} = y, x \neq 0$ d) $2x = y, x \neq 0$ e) NOTA

30. What is the sum of the number of faces of one each of the five Platonic solids (*Hint: a Platonic solid is a regular polyhedron)*?

a) 24 b) 50 c) 36 d) 48 e) NOTA