Directions: E is none of these is correct.
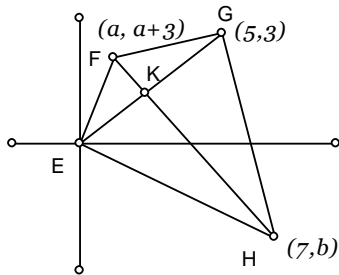
1. If one endpoint of a segment is (-2, 5) and its midpoint is (4, 9), find the length of the segment.

   a) $2\sqrt{5}$ b) $4\sqrt{13}$ c) $4\sqrt{5}$ d) $8\sqrt{2}$

Use the figure at the left to answer questions:# 2 - #5 (not drawn to scale)

Given Kite *EFGH* with diagonals *FH* and *EG*.

2. Find the coordinates of *K*.

   a) $\left(\frac{3}{2},\frac{5}{2}\right)$ b) $\left(\frac{a+7}{2},\frac{b+a+3}{2}\right)$ c) $(4,1)$ d) $\left(\frac{5}{2},\frac{3}{2}\right)$

3. Find the equation of *FH*.

   a) $3x - 5y = 7$ b) $5x + 3y = -8$ c) $5x + 3y = 17$ d) $3x + 5y = 32$

4. Find the sum of *a* + *b*.

   a) -2.75 b) -5 c) -1 d) 3

5. What is the area of the kite.

   a) 25.25 b) 32 c) 34 d) 40.5

6. The regions defined by $|x + 2y| \le 2$ and $|-4x - 2y| \le 8$ intersect to form what shape?

   a) Rhombus   b) Rectangle   c) Kite   d) Square

7. Find the area enclosed by the graph of $r^2 = \dfrac{36}{1+8\sin^2\theta}$.

   a) 6π b) 12π c) 18π d) 24π

8. The points $(3, 7)$, $(6, 2)$, and $(2, k)$ are the vertices of a triangle. For how many real values of k is the triangle a right triangle?

   a) 1   b) 2   c) 3   d) 4

9. Which of the following is a polar representation of the Cartesian coordinate relation $y = x^2$?

   a) $r = \theta^2$ b) $r = \sec\theta\tan\theta$ c) $r = \cos^2\theta$ d) $r = \cos\theta\cot\theta$

10. Which of the following represents the set of points twice the distance from (-1, 2) as from (4, 6).

   a) $3x^2 + 3y^2 - 34x - 44y + 203 = 0$
   c) $3x^2 + 3y^2 + 16x - 4y - 16 = 0$

   b) $3x^2 + 3y^2 + 16x - 4y - 26 = 0$
   d) $3x^2 + 3y^2 - 16x + 4y + 56 = 0$

11. Find the shortest distance between the point (1, 0, 0) and the line defined by $x = t + 1$, $y = 2t - 1$, and $z = 3t - 4$.

   a) 1   b) 1.5   c) $\sqrt{3}$ d) $\sqrt{6}$

The points A(-1, 2), B(3, 4) and C(5, 2) lie on circle O. Use this information to answer the questions # 12 - #14.
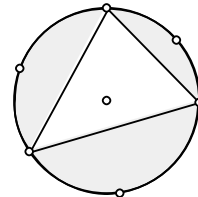
12. What is the area of the circle?

   a) 5π b) 10π c) 12π d) 16π

13. Find the distance the chord with endpoints (-1, 2) and (5, 2) is from the center of the circle.

   a) 1   b) 1.5   c) 2.5   d) 3

14. Find the area of the shaded region. (Given $\triangle ABC$)

   a) $5\pi - 6$

   b) $10\pi - 7$

   c) $12\pi - 6$

   d) $12\pi - 10$

15. The points (3, 0, 1), (2, −2, 1), and (−2, −4, 2) define a plane. Which of the following points is also on the plane?

   a) (5, 1, 1)   b) (1, 3, 2)   c) (2, 4, 2)   d) (−1, −3, 3)

16. A football's path can be described by the parametric equations $x = 4t$ and $y = 40t - 16t^2$. Find a particular equation in x and y that describes the path of the ball.

   a) $y = 2x(5 - 4x)$ b) $y = 2x(5 - 8x)$ c) $y = x(10 - x)$ d) $y = x(5 - 8x)$

17. What is the measure of the acute angle (in radians) of the intersection of the lines $y = 3x + 3$ and $y = 1 - x$?

a) $\dfrac{\pi}{4}$ 　　　　　 b) Arctan(3) $-\dfrac{\pi}{4}$ 　　　　　 c) Arctan(3) $+\dfrac{\pi}{4}$ 　　　　　 d) $\dfrac{3\pi}{4}-$ Arctan(3)

18. What is the eccentricity of the conic section defined by the set of points (x, y) such that the distance between (x, y) and $(-2, 0)$ is twice the distance between (x, y) and $(1, 0)$?

　　a) 0 　　　　　 b) ¼ 　　　　　 c) ½ 　　　　　 d) 1

19. Two distinct lines with slopes m_1 and m_2 with $m_1 < m_2$ pass through the point $(-6, 7)$ such that distance between the lines and the origin is 2. What is the value of $8m_1 + 4m_2$?

　　a) 0 　　　　　 b) -12 　　　　　 c) -14 　　　　　 d) -18

20. Which of the following is closest to the value of the area contained by the graphs of both $(x - 1)^2 + (y - 2)^2 = 16$ and $(x - 3)^2 + (y - 2)^2 = 16$?   Use $\tan^{-1}(\sqrt{15}) \approx 75^\circ$.

　　a) $\dfrac{40\pi}{3} - 4\sqrt{15}$ 　　　 b) $\dfrac{40\pi}{3} - 2\sqrt{15}$ 　　　 c) $18\pi - 4\sqrt{15}$ 　　　 d) $20\pi - 4\sqrt{15}$

21 Given the function $f(x, y) = \dfrac{1}{2x^2 + 3y}$, what is the maximum value of $f(x, y)$ if the chosen coordinate (x, y) must lie on the line segment with endpoints $(3,0)$ and $(0,1)$?

　　a) $\dfrac{1}{5}$ 　　　　　 b) $\dfrac{8}{23}$ 　　　　　 c) $\dfrac{1}{3}$ 　　　　　 d) $\dfrac{2}{5}$

22. The length of the latus rectum of a parabola is 4 and the focus is located at $(2, 3)$. Given that the parabola has standard form $y = ax^2 + bx + c$ where $a < 0$, find the vertex of the parabola.

　　a) $(2, 1)$ 　　　　　 b) $(2, 2)$ 　　　　　 c) $(2, 4)$ 　　　　　 d) $(2, 5)$

23. Consider the point $P(1, 0)$ on the ellipse given by the equation $4x^2 + y^2 = 4$.
There are two points (a, b) and (c, d) on the ellipse whose distance from P is a maximum.
What is the value of $abcd$?

　　a) $-\dfrac{32}{81}$ 　　　　　 b) $-\dfrac{8}{81}$ 　　　　　 c) $-\dfrac{32}{9}$ 　　　　　 d) $-\dfrac{8}{9}$

24. Find the radius of the sphere with equation $x^2 + y^2 + z^2 - 2x - 6y + 8z - 38 = 0$

　　a) 4 　　　　　 b) 8 　　　　　 c) 16 　　　　　 d) 64

25. Find the distance between the polar graph $r = 2\sqrt{3} \cos(\theta)$ and the polar coordinate $(4, 150^\circ)$.

　　a) $4 - \sqrt{3}$ 　　　　　 b) $3\sqrt{31} - \sqrt{3}$ 　　　　　 c) $\sqrt{31} - \sqrt{3}$ 　　　　　 d) $2\sqrt{3}$

26. Find the distance from the center to a focus of the hyperbola $3x^2 - 12x - 8y^2 + 8y - 38 = 0$.

    a) $\sqrt{11}$ b) 4   c) $\sqrt{22}$ d) 5

27. Consider parabola P which has directrix $y = 0$ and contains the point (3, 4). Find the distance between the focus of P and the point (3, 4).

    a) 3   b) 4   c) 5   d) 6

Using the following information to answer questions#28 - #30: Triangle ABC is formed using A(-5, -2), B(3, 5) and C(6, -3) as its vertices.

28. What is the equation of the altitude to side AC?

    a) $x + 11y = 58$ b) $x - 5y = 10$ c) $11x - y = 52$ d) $11x - y = 28$

29. What is the length of the median to side AB?

    a) $\dfrac{\sqrt{277}}{2}$ b)   c)   d)

30. The point of intersection of the altitude to AC and the median to AB is $\left(\dfrac{a}{b}, \dfrac{c}{b}\right)$, find $a + b + c$.

    a) 1063   b) 687   c) 447   d) - 1455

Tie-Breakers:

1. Isosceles triangle ABC is defined by the points A(0, 0), B(2, 5), and C(−2, 5). The coordinates D(0, y_1) and E(0, y_2) on the y-axis have the property that DB + DC = AD and EB + EC = AE. What is $y_1 y_2$? Note: The notation DB denotes the distance from D to B.

2. A pyramid has a square base with edge length 2 and height 4. What is the cosine of the dihedral angle formed by two of the triangular sides?

3. Find the equation of the ellipse with vertices (4, -2) and (4, 8) and minor axis 6.