**Do all problems neatly on your own paper and/or graph paper. Give all numerical answers in simplest form. **

Solve each system algebraically.

1. $\begin{aligned} 5y^2 - x^2 &= 4 \\ 2y &= x + 3 \end{aligned}$

2. $\begin{aligned} 2x^2 + 3y^2 &= 24 \\ 3x^2 + 2y^2 &= 21 \end{aligned}$

3. Solve and graph to find the real solutions of the system $\begin{aligned} 4y^2 - 16x^2 &= 16 \\ x^2 + y^2 &= 4 \end{aligned}$.

4. Graph to find the area of intersection for the system $\begin{aligned} x^2 + y^2 &\le 9 \\ x &\ge 2y^2 \end{aligned}$.

5. Determine the eccentricity for each of the following conics.

a) $y = 2x^2 - 3$ b) $(x-1)^2 + y^2 = 7$ c) $8x^2 + 6y^2 = 48$ d) $9x^2 - 16(y+3)^2 = 144$

6. Given points P(-2, 5) and Q(4, -3).
   a) Find R, if Q is the midpoint of $\overline{PR}$.
   b) Write the equation of the perpendicular bisector of $\overline{PQ}$.

7. The distance between the points (x, 7) and (3, -5) is 15. Find all possible values of x.

8. Graph the hyperbola xy = -8. Identify the asymptotes and locate 4 points on each branch.

9. Graph the parabola $x = \frac{-1}{8}y^2 - 2$. Identify and locate vertex, axis of symmetry, focus, directrix, and one other pair of points.

10. Graph the hyperbola $49(x-1)^2 - 4(y-2)^2 = 196$. Identify and locate center, vertices, foci, and asymptotes.

11. Graph the ellipse $8(x-2)^2 + 4(y+3)^2 = 16$. Identify and locate center, vertices, co-vertices, and foci. Which axis is the major axis?

12. Graph the parabola $x^2 - 4x - y + 8 = 0$. Rewrite in vertex form, identify and locate vertex, axis of symmetry, focus, directrix, and one other pair of points.

13. Write the equation of a circle that has center (-2, -5) and passes through (4, -3).

14. Write the equation of an ellipse with foci (9, -2) and (3, -2) and major axis length 18.

15. Write the equation of a hyperbola with vertices (5, 4) and (5, -4) and foci (5, 6) and (5, -6).

16. Write the equation of a line that is tangent to the circle $x^2 + y^2 = 25$ at (-3, -4).

17. Write the equation of a parabola in vertex form that opens to the right, has vertex (4, -3), and passes through (12, -1).

18. Write the equation of a parabola in vertex form with directrix $y = 5$ and focus (-4, -1).

Identify the conic. Rewrite in standard form, graph, and find and locate center, vertices, co-vertices, foci, and radius where appropriate.

19. $4x^2 + 4y^2 - 8x + 16y - 80 = 0$

20. $9x^2 + 25y^2 + 36x - 150y + 36 = 0$

21. $y^2 - 3x^2 - 6x - 4y - 8 = 0$

22. Graph the parabola $3y^2 + 12y - 4x + 24 = 0$. Rewrite in vertex form. Identify and locate vertex, axis of symmetry, focus, and directrix.

23. Determine the eccentricity of each conic.

a) $4x^2 + 4y^2 = 12$ b) $9y^2 - (x-1)^2 = 9$ c) $9x^2 + (y-1)^2 = 9$ d) $y^2 - 9y - x = 0$

24. Simplify, if *n* is an integer > 1: $\dfrac{x^3 y^{4n}}{x^{2n+2} y^{n-1}}$

25. Simplify: $\dfrac{16x^{-4}y}{(2y)^3} \cdot \left(\dfrac{2x^2}{y^{-4}}\right)^{-3}$

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Answers: 1. (-1, 1) , (-29, -13) 2. $\left(\sqrt{3}, \pm\sqrt{6}\right), \left(-\sqrt{3}, \pm\sqrt{6}\right)$ 3. $(0, \pm 2)$ 5a) 1 b) 0 c) $\frac{1}{2}$ d) $\frac{5}{4}$

6a) (10, -11) b) $y = \frac{3}{4}x + \frac{1}{4}$ 7. 12 or -6 9. V(-2, 0), axis of symmetry $y = 0$, F(-4, 0), directrix $x = 0$

10. C(1, 2); vertices (3, 2), (-1, 2); foci $\left(1+\sqrt{53}, 2\right), \left(1-\sqrt{53}, 2\right)$; asymptotes $y = \frac{7}{2}x - \frac{3}{2}$, $y = \frac{-7}{2}x + \frac{11}{2}$

11. center (2, -3); vertices (2, -1), (2, -5); co-vertices $\left(2+\sqrt{2}, -3\right), \left(2-\sqrt{2}, -3\right)$; foci $\left(2, -3+\sqrt{2}\right), \left(2, -3-\sqrt{2}\right)$; *y*-axis is major axis

12. $y = (x-2)^2 + 4$; V(2, 4); axis of symmetry $x = 2$; F$\left(2, 4\frac{1}{4}\right)$; directrix $y = 3\frac{3}{4}$

13. $(x+2)^2 + (y+5)^2 = 40$

14. $\dfrac{(x-3)^2}{81} + \dfrac{(y+2)^2}{45} = 1$

15. $\dfrac{y^2}{16} - \dfrac{(x-5)^2}{20} = 1$

16. $y = \frac{-3}{4}x - \frac{25}{4}$

17. $x = 2(y+3)^2 + 4$

18. $y = \dfrac{-1}{12}(x+4)^2 + 2$

19. circle, $(x-1)^2 + (y+2)^2 = 25$

20. ellipse; $\dfrac{(x+2)^2}{25} + \dfrac{(y-3)^2}{9} = 1$; C(-2, 3); vertices (-7, 3), (3, 3); co-vertices (-2, 6), (-2, 0); foci (2, 3), (-6, 3)

21. hyperbola; $\dfrac{(y-2)^2}{9} - \dfrac{(x+1)^2}{3} = 1$; center (-1, 2); vertices (-1, 5), (-1, -1); foci $\left(-1, 2+2\sqrt{3}\right)$, $\left(-1, 2-2\sqrt{3}\right)$,

22. $x = \frac{3}{4}(y+2)^2 + 3$; vertex (3, -2); axis of symmetry y = -2; focus $\left(3\frac{1}{3}, -2\right)$, directrix $x = 2\frac{2}{3}$

23. a) 0 b) $\frac{16}{5}$ c) $\frac{9}{10}$ d) 1

24. $\dfrac{y^{3n+1}}{x^{2n-1}}$

25. $\dfrac{1}{4x^{10}y^{14}}$