

Calculus 1

Mixed Conic Practice Answer Key

Name:

Show the standard form and the key information you use for each problem.

Parabola

1. Rewrite $y = x^2 - 4x + 1$ in vertex form. Identify the vertex and axis of symmetry.

$y = (x - 2)^2 - 3$; vertex $(2, -3)$; axis $x = 2$. Complete the square: $x^2 - 4x = (x - 2)^2 - 4$.

2. Write the equation of a parabola with vertex $(2, -3)$ and focus $(2, -1)$.

$(x - 2)^2 = 8(y + 3)$. The focus is 2 units above the vertex, so $p = 2$ and $4p = 8$.

Circle

3. For $(x - 1)^2 + (y + 2)^2 = 16$, identify the center and radius.

Center $(1, -2)$; radius 4.

4. Write the equation of a circle with center $(-3, 2)$ and radius 4.

$(x + 3)^2 + (y - 2)^2 = 16$.

Ellipse

5. For $x^2/36 + y^2/16 = 1$, find the center, vertices, co-vertices, and foci.

Center $(0, 0)$; $a = 6$, $b = 4$, $c = 2\sqrt{5}$. Vertices $(\pm 6, 0)$; co-vertices $(0, \pm 4)$; foci $(\pm 2\sqrt{5}, 0)$.

6. For $(x - 2)^2/9 + (y + 1)^2/25 = 1$, find the center, vertices, co-vertices, and foci.

Center $(2, -1)$; vertical; $a = 5$, $b = 3$, $c = 4$. Vertices $(2, -6)$, $(2, 4)$; co-vertices $(-1, -1)$, $(5, -1)$; foci $(2, -5)$, $(2, 3)$.

Ellipse

7. Rewrite $4x^2 + 9y^2 - 8x + 36y + 4 = 0$ in standard form.

$$4(x - 1)^2 + 9(y + 2)^2 = 36 \rightarrow (x - 1)^2/9 + (y + 2)^2/4 = 1.$$

Hyperbola

8. For $x^2/16 - y^2/9 = 1$, find the center, vertices, foci, and asymptotes.

$$a = 4, b = 3, c = 5. \text{ Center } (0, 0); \text{ vertices } (\pm 4, 0); \text{ foci } (\pm 5, 0); \text{ asymptotes } y = \pm 3x/4.$$

9. For $(y - 2)^2/9 - (x + 1)^2/16 = 1$, find the center, vertices, foci, and asymptotes.

$$\text{Center } (-1, 2); a = 3, b = 4, c = 5. \text{ Vertices } (-1, -1), (-1, 5); \text{ foci } (-1, -3), (-1, 7); \text{ asymptotes } y - 2 = \pm 3(x + 1)/4.$$

10. Write the equation of a hyperbola with center $(0, 1)$, vertices $(\pm 3, 1)$, and foci $(\pm 5, 1)$.

$$a = 3, c = 5, \text{ so } b^2 = 16. \quad x^2/9 - (y - 1)^2/16 = 1.$$

Mixed Standard Form

11. Classify $x^2 + y^2 + 6x - 4y - 12 = 0$ and write it in standard form.

$$(x + 3)^2 + (y - 2)^2 = 25. \text{ Circle; center } (-3, 2), \text{ radius } 5.$$

12. Classify $9x^2 - 4y^2 - 18x - 8y - 11 = 0$ and write it in standard form.

$$9(x - 1)^2 - 4(y + 1)^2 = 16 \rightarrow (x - 1)^2/(16/9) - (y + 1)^2/4 = 1. \text{ Hyperbola with center } (1, -1).$$