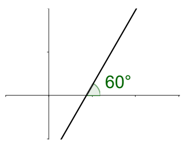
# Chapter 7 Practice Exercises (*Optional)

## 7-01 Lines

**Find the slope of the line with the given inclination.**

1. 


2. $\theta = 120°$

**Find the inclination of the line that goes through the points.**

3. $(-2, 1)$ and $(0, 4)$

4. $(3, 2)$ and $(5, -2)$

**Find the inclination of the line with the given equation.**

5. $y = x + 3$

6. $2x - 3y + 5 = 0$

**Find the angle between the two given lines.**

7. $y = \frac{1}{2}x - 3$ and $y = -\frac{2}{3}x + 1$

8. $y = -x - \frac{1}{2}$ and $y = \frac{3}{2}x + \frac{1}{2}$

9. $2x - y = 0$ and $x + y = 2$

10. $x + 2y + 1 = 0$ and $-3x - 2y + 1 = 0$

**Find the distance from the point to the line.**

11. $x - y = 1$ and $(1, 3)$

12. $2x + y - 2 = 0$ and $(-2, 1)$

13. $y = \frac{1}{3}x - 1$ and $(0, 3)$

14. $y = -\frac{2}{5}x + \frac{3}{5}$ and $(-1, -2)$

**Find the area of the triangle by (a) graphing the three vertices (b) find the equation of side AB (c) find the altitude to side AB and (d) calculate the area of the triangle.**

15. A(0, 2), B(1, 3), C(−2, 5)

**Find the equation of the line with the given inclination and *x*-intercept.**

16. $\theta = 30°$ and $(2, 0)$

**Mixed Review: Let** $m = 2\left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right)$ **and** $n = 4\left(\cos\frac{5\pi}{3} + i\sin\frac{5\pi}{3}\right)$.

17. (6-07) Find $m^2$.

18. (6-07) Find $\frac{n}{m}$.

19. (6-06) Write $m$ and $n$ in standard form.

20. (6-05) Find $\langle 1, \sqrt{3}\rangle \cdot \langle 2, -2\sqrt{3}\rangle$

## 7-02 Parabolas

1. Given the focus and directrix, (a) how do you find the vertex? and (b) how do you know which way the parabola opens?

**Find the vertex, focus, and directrix of the following equations.**

2. $x^2 = -8y$

3. $3y^2 + 16x = 0$

4. $(x - 1)^2 = -16y$

5. $y^2 - 12x - 6y - 15 = 0$

**Graph the parabolas.**

6. $x^2 = -2y$

7. $y^2 - 4x = 0$

8. $(x + 2)^2 = -6(y - 1)$

9. $y^2 - 4x + 8y + 12 = 0$

**Write the standard equation for the parabola with the following properties.**

10. Focus: $(5, 0)$, Directrix: $x = -5$

11. Vertex: $(0, 0)$, Directrix: $y = 6$

12. Focus: $(1, 4)$, Vertex: $(1, 7)$

13. Focus: $(-2, 5)$, Directrix: $x = 1$

**Problem Solving**

14. A thrown ball's path can be modeled by $y = -\frac{1}{40}x^2 + x$ where $x$ is the horizontal distance in feet and $y$ is the vertical distance in feet from the point where the ball was thrown. What is the highest point of the ball's path?

15. The Tyne Bridge in northeast England links Newcastle upon Tyne with Gateshead. It consists of two parabolic arches with a roadway between. If the arch can be modeled by $y = -\frac{1}{125}x^2 + \frac{27}{20}x$ where $x$ is the horizontal distance in meters and $y$ is the vertical distance in meters, find the height of the arch.

*Figure 1: Tyne Bridge. (pixabay/ Michaela Wenzler)*

**Mixed Review**

16. (7-01) Find the inclination of the line that goes through (2, 1) and (5, −3).

17. (7-01) Find the distance from P(0, 5) to the line $y = 2x - 4$.

18. (6-05) Evaluate $\langle 2, -4\rangle \cdot \langle -5, 3\rangle$.

19. (4-02) Evaluate the six trigonometric functions for $\theta = \frac{5\pi}{6}$.

20. (4-02) Evaluate the six trigonometric functions for $\theta = \frac{7\pi}{4}$.

## 7-03 Ellipses and Circles

1. What is the difference between vertices and covertices?

**Find the center, vertices, covertices, and foci of the following ellipses.**

2. $\frac{x^2}{625} + \frac{y^2}{49} = 1$

3. $36x^2 + 16y^2 - 576 = 0$

4. $\frac{(x-3)^2}{9} + \frac{(y+2)^2}{36} = 1$

5. $12x^2 + 5y^2 + 48x + 10y - 7 = 0$

**Find the standard equation of the ellipse with the following properties.**

6. Vertices: $(0, \pm 5)$, Foci: $(0, \pm 1)$

7. Vertices: $(5, 1)$ and $(-7, 1)$, Covertices: $(-1, 4)$ and $(-1, -2)$

8. Foci: $(2, 4)$ and $(2, 0)$, Covertices: $(5, 2)$ and $(-1, 2)$

**Sketch the graph of the following ellipses.**

9. $\frac{x^2}{4} + \frac{y^2}{9} = 1$

10. $x^2 + 9y^2 - 18y = 0$

11. $16x^2 + 9y^2 - 64x + 18y - 71 = 0$

**Eccentricity**

12. Find the eccentricity of the ellipse $\frac{(x+5)^2}{169} + \frac{y^2}{144} = 1$.

13. Find the standard equation of the ellipse with eccentricity of $\frac{2}{3}$ and vertices $(-2, 8)$ and $(-2, -4)$.

**Problem Solving**

14. Mars orbits the sun in an elliptical orbit with a semimajor (half the major) axis of 1.524 astronomical units and eccentricity of 0.0934. Find the equation of the orbit with the sun at a focus, the center at (0, 0), and a vertical standard equation.

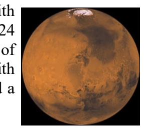


*Figure 2: (wikimedia/NASA/ JPL/USGS)*

15. An equation that models the moon's orbit around the earth is $\frac{x^2}{1.4803\times10^{11}} + \frac{y^2}{1.4758\times10^{11}} = 1$. Find the eccentricity of the moon's orbit.

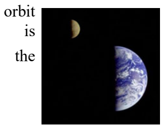


*Figure 3: (wikimedia/NASA/ JPL)*

**Mixed Review**

16. (7-02) Find the vertex, focus, and directrix of $y^2 - 6x - 6y - 3 = 0$.

17. (7-02) Write the standard equation for the parabola with vertex (3, 0) and directrix $x = 0$.

18. (7-01) Find the distance from the point (5, 1) to the line $2x - y + 1 = 0$.

19. (6-05) Evaluate $\langle 2, 0\rangle \cdot \langle 0, -4\rangle$.

20. (6-03) Evaluate $\langle 2, 0\rangle + \langle 0, -4\rangle$ both graphically and algebraically.

## 7-04 Hyperbolas

1. What is the difference between the transverse axis and the conjugate axis? How are they related to the major and minor axes of an ellipse?

**Find the center, vertices, asymptotes, and foci of the following hyperbolas.**

2. $\frac{y^2}{64} - \frac{x^2}{16} = 1$

3. $20x^2 - 25y^2 - 200 = 0$

4. $\frac{(x+6)^2}{9} - \frac{(y-3)^2}{8} = 1$

5. $100x^2 - 81y^2 + 200x + 648y + 6904 = 0$

**Find the standard equation of the hyperbola with the following properties.**

6. Foci: (±4, 0), Vertices: (±2, 0)

7. Vertices: (3, 4) and (3, 10), Covertices: (−1, 7) and (7, 7)

8. Asymptotes: $y = 3 \pm \frac{2}{3}(x-1)$, Vertex: (1, 7)

**Sketch the graph of the following hyperbolas.**

9. $\frac{x^2}{9} - \frac{y^2}{16} = 1$

10. $x^2 - y^2 - 6x + 4y + 9 = 0$

11. $4x^2 - y^2 + 8x + 8y - 16 = 0$

**Eccentricity**

12. Find the standard equation of the hyperbola with $e = \frac{4}{3}$ and vertices (±3, 0).

13. What is the eccentricity of $16x^2 - 9y^2 + 96x + 36y - 36 = 0$?

**Problem Solving**

14. The cooling tower at the electrical power generating station in Michigan City, Indiana, is modeled by a hyperbola and is about 300 feet tall. Write a model for the sides of the tower if the center is at (0, 200), the vertices are (±75, 200), and point at the base is (112.5, 0).

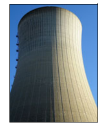


*Figure 4: (pixabay/Kurt Klement)*

15. A sundial is made of a rod that casts a shadow. The shadow falls on a scale to tell the time. The tip of the rod traces a hyperbola over the course of a day. This is called the declination line. If a certain declination line is modeled by $\frac{y^2}{4} - \frac{x^2}{100} = 1$, what is its eccentricity?

*Figure 5: Sundial in Cambridge, UK. (Richard Wright)*

**Mixed Review**

16. (7-03) Find the center, vertices, covertices, and foci of $\frac{(x+1)^2}{16} + \frac{(y-4)^2}{9} = 1$.

17. (7-03) Sketch the graph of $x^2 + 16y^2 + 4x - 12 = 0$.

18. (7-02) Write the standard equation for the parabola with vertex (2, 3) and directrix $y = -1$.

19. (7-01) Find the angle between $y = -4x$ and $2x - y + 3 = 0$.

20. (2-04) Divide using synthetic division: $(2x^3 + 4x^2 - x + 3) \div (x + 1)$.

## 7-05 Rotated Conics

1. When you are using $\cot 2\theta = \frac{A-C}{B}$ and get a negative angle, how do you get the correct positive angle? Do you do this before or after dividing by 2?

**Classify the conic and rewrite it in standard form by eliminating the *Bxy* term.**

2. $2xy = -9$

3. $7x^2 + 4xy + 7y^2 - 45 = 0$

4. $x^2 - 2\sqrt{3}xy + 3y^2 + 8\sqrt{3}x + 8y = 0$

5. $24x^2 - 2\sqrt{3}xy + 22y^2 - 525 = 0$

**Classify the conic, rewrite it in standard form, and sketch its graph.**

6. $7x^2 - 50xy + 7y^2 + 72 = 0$

7. $x^2 + 4xy + 4y^2 - 4x + 2y = 0$

8. $6x^2 + 12xy + y^2 + 3 = 0$

9. $14x^2 + 15xy + 6y^2 - \frac{27}{2} = 0$

10. $2x^2 + 3xy - 2y^2 - 10 = 0$

**Classify the conic and sketch its graph using a graphing utility.**

11. $x^2 + 2xy + y^2 + 2x = 0$

12. $2x^2 + 5xy + y^2 - 3x = 0$

13. $x^2 + 5xy + y^2 - 4y = 0$

14. $x^2 - 2xy + 2y^2 + 2x - 3y = 0$

15. $4x^2 - 4xy + y^2 - 5y - 7 = 0$

**Mixed Review**

16. (7-04) Sketch a graph of $\frac{y^2}{16} - \frac{x^2}{4} = 1$.

17. (7-03) Sketch a graph of $\frac{x^2}{4} + \frac{y^2}{16} = 1$.

18. (7-02) Sketch a graph of $x^2 = -12y$.

19. (7-01) Sketch a graph of a line with inclination of $\frac{\pi}{4}$ and goes through (0, 0).

20. (6-03) Evaluate $\langle 2, -3\rangle + 2\langle 0, 1\rangle$.

## 7-06 Parametric Equations

1. What is a parameter?

**Graph the parametric equations.**

2. $\begin{cases} x = 4t^2 \\ y = 8t + 2 \end{cases}$

3. $\begin{cases} x = 4t + 1 \\ y = 2t^2 \end{cases}$

4. $\begin{cases} x = 3\sec\theta \\ y = 2\tan\theta \end{cases}$

5. $\begin{cases} x = 2\sin\theta \\ y = 4\cos\theta \end{cases}$

**Write a set of parametric equations for the following conditions.**

6. Parabola with vertex at (−2, −1) and focus (−5, −1).

7. Horizontal ellipse with center (0, 0), vertices (±5, 0), and foci (±3, 0).

8. $y = 3x + 1$

9. $(y - 2)^2 = -16x$

**Eliminate the parameter.**

10. $\begin{cases} x = 4t^2 \\ y = 8t + 2 \end{cases}$

11. $\begin{cases} x = 3t \\ y = \dfrac{9}{t} \end{cases}$

12. $\begin{cases} x = 7\sin\theta \\ y = 4\cos\theta \end{cases}$

13. $\begin{cases} x = 6\tan\theta \\ y = 5\sec\theta \end{cases}$

**Problem Solving**

14. On televised baseball games, sometimes the distance of a home run is given, but it was not measured. The distance was calculated. Let $\begin{cases} x = 35t \\ y = -16t^2 + 30t \end{cases}$ model the path of the ball after it was hit. How far did the ball go? (Hint: Let $y = 0$ and find $t$.)

15. A solar oven cooks food by reflecting the sunlight off a parabolic mirror. The food is placed at the focus where all the light is focused. Write a set of parametric equations to model the surface of the mirror if the vertex is at (0, 0) and the focus is 2 feet above the vertex.

*Figure 6: Solar oven. (wikimedia/John Hill)*

**Mixed Review**

16. (7-05) Classify the conic and rewrite it in standard form by eliminating the *Bxy* term. $x^2 - 2xy + y^2 - x - y = 0$.

17. (7-04) Find the standard equation of the hyperbola with vertices (4, ±3) and foci (4, ±5).

18. (7-03) Find the center, vertices, covertices, and foci of the ellipse $\frac{(x+1)^2}{16} + \frac{y^2}{9} = 1$.

19. (7-02) Graph $(x - 1)^2 = 4(y + 2)$.

20. (7-01) Find the distance from the point (2, 0) to the line $2x - y + 4 = 0$.

## 7-07 Polar Coordinates

1. What does each part of the polar coordinate $(r, \theta)$ represent?

**Graph the polar coordinates.**

2. $J\,(3, 0)$ and $K\left(4, \frac{\pi}{3}\right)$

3. $M\left(-1, \frac{4\pi}{3}\right)$ and $N\left(-2, \frac{11\pi}{6}\right)$

4. $Q\left(4, \frac{\pi}{2}\right)$ and $R\left(-4, \frac{3\pi}{2}\right)$

**Find two other ways to write each coordinate.**

5. $\left(2, \frac{\pi}{4}\right)$

6. $\left(-3, \frac{2\pi}{3}\right)$

7. $\left(1, \frac{3\pi}{8}\right)$

**Convert the points from polar to rectangular or rectangular to polar.**

8. $\left(5, \frac{3\pi}{2}\right)$

9. $\left(3, \frac{5\pi}{6}\right)$

10. $\left(2\sqrt{2}, -2\sqrt{2}\right)$

11. $\left(-1, -\sqrt{3}\right)$

**Convert the equations from polar to rectangular.**

12. $r = 5$

13. $\theta = \frac{5\pi}{6}$

14. $r = 5\csc\theta$

15. $r = 4\cos\theta$

**Mixed Review**

16. (7-06) Graph the parametric equations $\begin{cases} x = 3\cos\theta \\ y = 2\sin\theta \end{cases}$

17. (7-06) Eliminate the parameter of $\begin{cases} x = 3\cos\theta \\ y = 2\sin\theta \end{cases}$

18. (7-05) Classify the conic and rewrite it in standard form by eliminating the $Bxy$ term. $xy = 9$

19. (7-04) Find the standard equation of the hyperbola with foci $(0, \pm 10)$ and vertices $(0, \pm 8)$.

20. (7-02) Find the vertex, focus, and directrix $x^2 = 4y$.

## 7-08 Graphs of Polar Equations

**Identify the type of graph.**

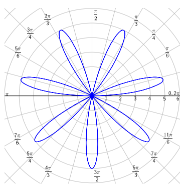
1. 

*Figure 7: $r = 5\sin 7\theta$*

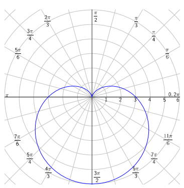
2. 

*Figure 8: $r = 3 - 3\sin\theta$*

**Identify the symmetry of the polar graphs.**

3. $r = 3 - 4\cos\theta$

4. $r = 4\cos\theta$

5. $r = 1 + \sin\theta$

**Find the maximum values of $|r|$ and the zeros of $r$.**

6. $r = 2 + \cos\theta$

7. $r = 4\sin\theta$

8. $r = 3\cos 2\theta$

**Graph the polar equations.**

9. $r = 4\cos\theta$

10. $r = 4\sin\theta$

11. $r = 2 + \cos\theta$

12. $r = 3\cos 2\theta$

13. $r = 2 - 3\sin\theta$

**Use a graphing utility to graph the polar equations.**

14. $r = 5\sin 4\theta$

15. $r = 1 + \cos\theta$

**Mixed Review**

16. (7-07) Convert the point to rectangular coordinates: $\left(2, \frac{5\pi}{4}\right)$.

17. (7-07) Convert the equation to rectangular coordinates: $r = 2\sin\theta$.

18. (7-06) Graph $\begin{cases} x = 2t \\ y = \dfrac{1}{2}t^3 \end{cases}$.

19. (7-05) Classify the conic: $3x^2 - xy + 4y^2 - 12x + 3y + 2 = 0$.

20. (7-03) Find the standard equation of the ellipse with vertices $(\pm 5, 0)$ and foci $(\pm 3, 0)$.

## 7-09 Polar Equations of Conics

1. Review the lessons on ellipses and hyperbolas. What does $a$, $b$, and $c$ stand for? And how do you use them to find $e$?

**Identify the conic and sketch its graph.**

2. $r = \frac{4}{2+\sin\theta}$

3. $r = \frac{3}{1-\cos\theta}$

4. $r = \frac{3}{2-\sin\theta}$

5. $r = \frac{5}{1+4\cos\theta}$

6. $r = \frac{5}{2+3\cos\theta}$

**Use a graphing utility to graph the polar equation. Identify the graph.**

7. $r = \frac{5}{2+2\sin\theta}$

8. $r = \frac{5}{2-\cos(\theta - \pi/4)}$

**Write the polar equation of the conic with its focus at the pole and the given properties.**

9. parabola with directrix $x = 4$

10. hyperbola with eccentricity $e = 2$ and directrix $y = -2$

11. ellipse with eccentricity $e = \frac{2}{3}$ and directrix $y = 6$

12. parabola with vertex $\left(4, \frac{3\pi}{2}\right)$

13. ellipse with vertices $(7, 0)$ and $(3, \pi)$

14. hyperbola with vertices $(3, \pi)$ and $(-5, 0)$

**Problem Solving**

15. The comet Hale-Bopp has an elliptical orbit with eccentricity of 0.995. It has a semi-major axis of about 250 astronomical units. (a) Write an equation for the orbit of Hale-Bopp with the sun at one focus. (b) How close does the comet come to the sun?

**Mixed Review**

16. (7-08) Graph $r = 2\sin\theta$.

17. (7-08) Identify the symmetry of $r = 3\cos\theta$.

18. (7-07) Convert $r = 3\cos\theta$ to rectangular coordinates.

19. (7-04) Find the standard equation of the hyperbola with foci $(\pm 10, 0)$ and vertices $(\pm 6, 0)$.

20. (7-01) Find the angle between the lines $y = \frac{2}{3}x + 1$ and $y = x - 2$.

## 7-Review

**Take this test as you would take a test in class. When you are finished, check your work against the answers. On this assignment round your answers to three decimal places unless otherwise directed.**

1. Find the inclination of $2x + y - 3 = 0$ in degrees.

2. Find the angle between the lines $2x + y - 3 = 0$ and $x - 2y + 1 = 0$.

3. Find the distance between $(2, 4)$ and $2x + y - 3 = 0$.

4. Classify the conic $4x^2 + 9y^2 - 8x + 36y + 4 = 0$.

5. Find the foci of $4x^2 + 9y^2 - 8x + 36y + 4 = 0$.

6. Graph $4x^2 + 9y^2 - 8x + 36y + 4 = 0$.

7. Find the standard form of the equation of the parabola with focus $(3, 0)$ and directrix $x = -1$.

8. Find the standard form of the hyperbola with vertices $(2, 5)$ and $(-4, 5)$ and $b = 5$.

9. Classify the conic $x^2 - 2xy + 2y^2 + 3x - 5y + 12 = 0$.

10. What degree is $x^2 - 2xy + 2y^2 + 3x - 5y + 12 = 0$ rotated?

11. Graph the parametric equations $x = \sqrt{t}$ and $y = 2t^2$.

12. Eliminate the parameter from $x = \sqrt{t}$ and $y = 2t^2$.

13. Convert $\left(4, \frac{\pi}{3}\right)$ to rectangular coordinates.

14. Find another polar coordinate that represents $\left(4, \frac{\pi}{3}\right)$.

15. Convert $r = 4\sec\theta$ to rectangular form.

16. Graph the polar coordinate $\left(2, \frac{7\pi}{6}\right)$.

17. Classify the graph of $r = \frac{6}{1-3\cos\theta}$.

18. Find one focus of $r = \frac{6}{1-3\cos\theta}$.

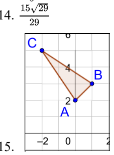
19. Classify the graph of $r = \frac{3}{1+\sin\theta}$.

20. Find the polar equation for an ellipse with directrix $x = -6$ and $e = \frac{1}{3}$.

21. Find the polar equation for a hyperbola with the vertices $\left(2, \frac{\pi}{2}\right)$ and $\left(-6, \frac{3\pi}{2}\right)$.

## Answers

### 7-01

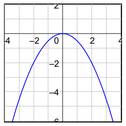
1. $\sqrt{3}$
2. $-\sqrt{3}$
3. 56.31º
4. 116.57º
5. 45º
6. 33.69º
7. 60.26º
8. 78.69º
9. 71.57º
10. 29.74º
11. $\frac{3\sqrt{2}}{2}$
12. $\sqrt{5}$
13. $\frac{6\sqrt{10}}{5}$
14. $\frac{15\sqrt{29}}{29}$
15. 

; $x - y + 2 = 0$; $\frac{5\sqrt{2}}{2}$; $\frac{5}{2}$
16. $\sqrt{3}x - 3y - 2\sqrt{3} = 0$
17. $4\left(\cos\frac{2\pi}{3} + i\sin\frac{2\pi}{3}\right)$
18. $2\left(\cos\frac{4\pi}{3} + i\sin\frac{4\pi}{3}\right)$
19. $m = 1 + \sqrt{3}i$; $n = 2 - 2\sqrt{3}i$
20. $-4$

### 7-02

1. The vertex in the midpoint between the focus and the directrix; The parabola opens around the focus and away from the directrix.
2. V(0, 0); F(0, -2); D: $y = 2$
3. V(0, 0); F$\left(-\frac{4}{3}, 0\right)$; D: $x = \frac{4}{3}$

4. V(1, 0); F(1, −4); D: $y = 4$
5. V(−2, 3); F(1, 3); D: $x = -5$



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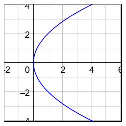

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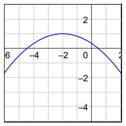

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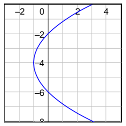


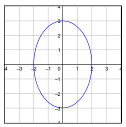
9.

10. $y^2 = 20x$

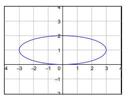
11. $x^2 = -24y$
12. $(x-1)^2 = -12(y-7)$
13. $(y-5)^2 = -6\left(x+\frac{1}{2}\right)$
14. (20, 10), so the ball is 10 feet high when it is 20 feet away from where it was thrown.
15. 57.0 m
16. 126.9°
17. 4.02
18. −22
19. $\sin\frac{5\pi}{6} = \frac{1}{2}$; $\cos\frac{5\pi}{6} = -\frac{\sqrt{3}}{2}$; $\tan\frac{5\pi}{6} = -\frac{\sqrt{3}}{3}$; $\csc\frac{5\pi}{6} = 2$; $\sec\frac{5\pi}{6} = -\frac{2\sqrt{3}}{3}$; $\cot\frac{5\pi}{6} = -\sqrt{3}$
20. $\sin\frac{7\pi}{4} = -\frac{\sqrt{2}}{2}$; $\cos\frac{7\pi}{4} = \frac{\sqrt{2}}{2}$; $\tan\frac{7\pi}{4} = -1$; $\csc\frac{7\pi}{4} = -\sqrt{2}$; $\sec\frac{7\pi}{4} = \sqrt{2}$; $\cot\frac{7\pi}{4} = -1$

## 7-03

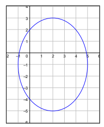
1. Vertices are the ends of the major axis, and covertices are the ends of the minor axis.
2. C(0, 0); V(±25, 0); CV(0, ±7); F(±24, 0)
3. C(0, 0); V(0, ±6); CV(±4, 0); F$(0, \pm 2\sqrt{5})$
4. C(3, −2); V(3, −8), (3, 4); CV(0, −2), (6, −2); F$\left(3, -2 \pm 3\sqrt{3}\right)$
5. C(−2, −1); V$\left(-2, -1 \pm 2\sqrt{3}\right)$; CV$\left(-2 \pm \sqrt{5}, -1\right)$; F$\left(-2, -1 \pm \sqrt{7}\right)$
6. $\frac{x^2}{24} + \frac{y^2}{25} = 1$
7. $\frac{(x+1)^2}{36} + \frac{(y-1)^2}{9} = 1$
8. $\frac{(x-2)^2}{9} + \frac{(y-2)^2}{13} = 1$



9.



10.

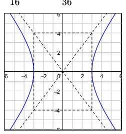


11.

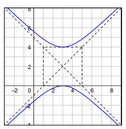
12. $e = \frac{5}{13}$
13. $\frac{(x+2)^2}{20} + \frac{(y-2)^2}{36} = 1$
14. $\frac{x^2}{2.302} + \frac{y^2}{2.323} = 1$
15. 0.055
16. V(−2, 3), F$(-\frac{1}{2}, 3)$, D: $x = -\frac{7}{2}$
17. $y^2 = 12(x-3)$
18. $2\sqrt{5}$
19. 0
20. ⟨2, −4⟩

## 7-04

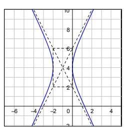
1. The vertices are on the transverse axis. The covertices are on the conjugate axis.
2. C(0, 0), V(0, ±8), A: $y = \pm 2x$, F$(0, \pm 4\sqrt{5})$
3. C(0, 0), V$(\pm\sqrt{10}, 0)$, A: $y = \pm\frac{2\sqrt{5}}{5}x$, F$(\pm 3\sqrt{2}, 0)$
4. C(−6, 3), V(−9, 3) and (−3, 3), A: $y = 3 \pm \frac{2\sqrt{2}}{3}(x+6)$, F$(-6 \pm \sqrt{17}, 3)$
5. C(−1, 4), V(−1, −6) and (−1, 14), A: $y = 4 \pm \frac{10}{9}(x+1)$, F$(-1, 4 \pm \sqrt{181})$
6. $\frac{x^2}{4} - \frac{y^2}{12} = 1$
7. $\frac{(y-7)^2}{9} - \frac{(x-3)^2}{16} = 1$
8. $\frac{(y-3)^2}{16} - \frac{(x-1)^2}{36} = 1$



9.



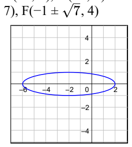
10.



11.

12. $\frac{x^2}{9} - \frac{y^2}{7} = 1$
13. $\frac{5}{3}$
14. $\frac{x^2}{5625} - \frac{(y-200)^2}{32000} = 1$
15. 5.099

16. C(−1, 4), V(−5, 4) and (3, 4), CV(−1, 1) and (−1, 7), F$(-1 \pm \sqrt{7}, 4)$

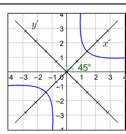


17.

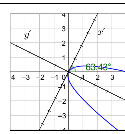
18. $(x-2)^2 = 16(y-3)$
19. 40.60°
20. $2x^2 + 2x - 3 + \frac{6}{x+1}$

## 7-05

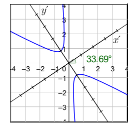
1. Add π before dividing by 2
2. Hyperbola; $\frac{(y')^2}{9} - \frac{(x')^2}{9} = 1$
3. Ellipse; $\frac{(x')^2}{5} + \frac{(y')^2}{9} = 1$
4. Parabola; $(y')^2 = -4x'$
5. Ellipse; $\frac{(x')^2}{25} + \frac{(y')^2}{21} = 1$
6. Hyperbola; $\frac{(x')^2}{4} - \frac{4(y')^2}{9} = 1$;



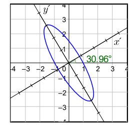

7. Parabola; $(x')^2 = -\frac{2\sqrt{5}}{5}y'$;



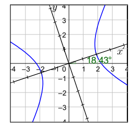

8. Hyperbola; $(y')^2 - \frac{10(x')^2}{3} = 1$;

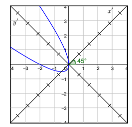



9. Ellipse; $\frac{13(x')^2}{9} + \frac{(y')^2}{9} = 1$;

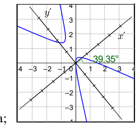



10. Hyperbola; $\frac{(x')^2}{4} - \frac{(y')^2}{4} = 1$;

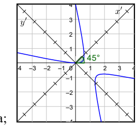


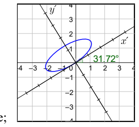
11. Parabola;



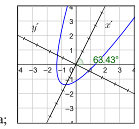

12. Hyperbola;



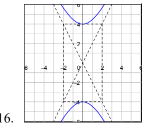

13. Hyperbola;



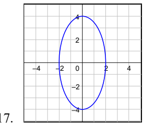

14. Ellipse;



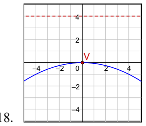

15. Parabola;



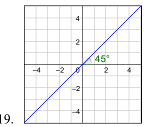
16.



17.




18.

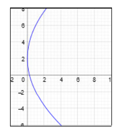



19.

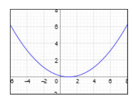
20. ⟨2, −1⟩

## 7-06

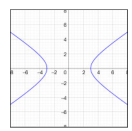
1. The parameter is the value in the equations that is used to calculate $x$ and $y$.



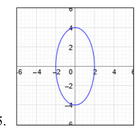
2.



3.

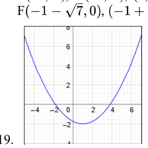


4.



5.

6. $\begin{cases} x = -3t^2 - 2 \\ y = -6t - 1 \end{cases}$
7. $\begin{cases} x = 5\cos t \\ y = 4\sin t \end{cases}$
8. $\begin{cases} x = \dfrac{t}{3} \\ y = t + 1 \end{cases}$
9. $\begin{cases} x = -4t^2 \\ y = -8t + 2 \end{cases}$
10. $(y-2)^2 = 16x$
11. $xy - 27 = 0$
12. $\frac{x^2}{49} + \frac{y^2}{16} = 1$
13. $\frac{y^2}{25} - \frac{x^2}{36} = 1$
14. 65.625 feet
15. $\begin{cases} x = 4t \\ y = 2t^2 \end{cases}$
16. Parabola; $y'^2 = \frac{\sqrt{2}}{2}x'$
17. $\frac{y^2}{9} - \frac{(x-4)^2}{16} = 1$
18. C(−1, 0); V(−5, 0), (3, 0); CV(−1, −3), (−1, 3); F$(-1-\sqrt{7}, 0)$, $(-1+\sqrt{7}, 0)$

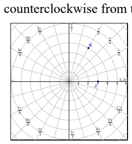


19.

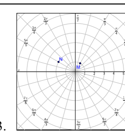
20. $\frac{8\sqrt{5}}{5}$

## 7-07

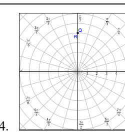
1. $r$ = distance from the origin; θ = angle counterclockwise from the positive $x$-axis.



2.

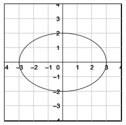


3.

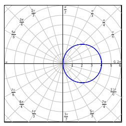
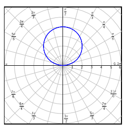
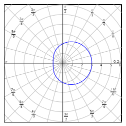
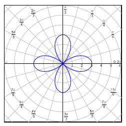
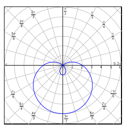
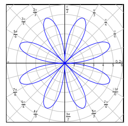
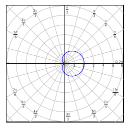
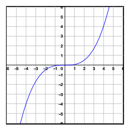


4.

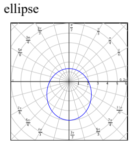
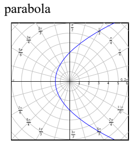
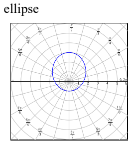
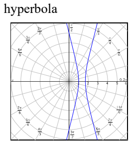
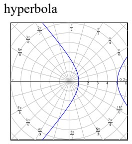
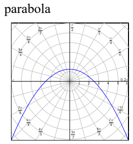
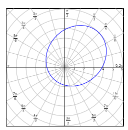
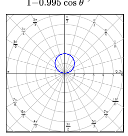
5. $\left(2, \frac{9\pi}{4}\right)$ and $\left(-2, \frac{5\pi}{4}\right)$

6. $\left(-3, \frac{8\pi}{3}\right)$ and $\left(3, \frac{5\pi}{3}\right)$
7. $\left(1, \frac{19\pi}{8}\right)$ and $\left(-1, \frac{11\pi}{8}\right)$
8. $(0, -5)$
9. $\left(-\frac{3\sqrt{3}}{2}, \frac{3}{2}\right)$
10. $\left(4, \frac{7\pi}{4}\right)$
11. $\left(2, \frac{4\pi}{3}\right)$
12. $x^2 + y^2 = 25$
13. $y = -\frac{\sqrt{3}}{3}x$
14. $y = 5$
15. $(x-2)^2 + y^2 = 4$
16. 
17. $\frac{x^2}{9} + \frac{y^2}{4} = 1$
18. Hyperbola; $\frac{(x')^2}{18} - \frac{(y')^2}{18} = 1$
19. $\frac{(y)^2}{64} - \frac{(x)^2}{36} = 1$
20. Vertex: (0, 0); Focus: (0, 1); Directrix: $y = -1$

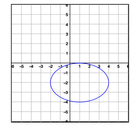
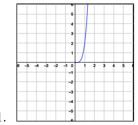
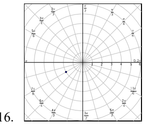
## 7-08

1. Rose curve with 7 petals
2. Cardioid
3. polar axis
4. polar axis
5. line $\theta = \frac{\pi}{2}$
6. Maximums: $\theta = 0, \pi$; Zeros: none
7. Maximums: $\theta = \frac{\pi}{2}, \frac{3\pi}{2}$; Zeros: $\theta = 0, \pi$
8. Maximums: $\theta = 0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}$; Zeros: $\frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$
9. 
10. 
11. 
12. 
13. 
14. 
15. 
16. $\left(-\sqrt{2}, -\sqrt{2}\right)$
17. $x^2 + (y-1)^2 = 1$
18. 
19. Ellipse
20. $\frac{x^2}{25} + \frac{y^2}{16} = 1$

## 7-09

1. $a$ = distance between center and vertex; $b$ = distance between center and covertex; $c$ = distance between center and focus; $e = \frac{c}{a}$
2. ellipse

3. parabola

4. ellipse

5. hyperbola

6. hyperbola

7. parabola

8. ellipse rotated by $\frac{\pi}{4}$

9. $r = \frac{4}{1+\cos\theta}$
10. $r = \frac{4}{1-2\sin\theta}$
11. $r = \frac{12}{3+2\sin\theta}$
12. $r = \frac{8}{1-\sin\theta}$
13. $r = \frac{21}{5-2\cos\theta}$
14. $r = \frac{15}{1-4\cos\theta}$
15. $r = \frac{2.494}{1-0.995\cos\theta}$; 1.25 AU
16. 
17. Polar axis
18. $\left(x - \frac{3}{2}\right)^2 + y^2 = \frac{9}{4}$
19. $\frac{x^2}{36} - \frac{y^2}{64} = 1$
20. 11.3°

## 7-Review

1. 116.6°
2. 90°
3. $\sqrt{5}$
4. Ellipse
5. $(1 \pm \sqrt{5}, -2)$
6. 
7. $y^2 = 8(x-1)$
8. $\frac{(x+1)^2}{9} - \frac{(y-5)^2}{25} = 1$
9. Ellipse
10. 31.7°
11. 
12. $y = 2x^4$
13. $(2, 2\sqrt{3})$
14. $\left(4, \frac{7\pi}{3}\right)$ or $\left(-4, \frac{4\pi}{3}\right)$
15. $x = 4$
16. 
17. Hyperbola with vertical directrix to the left of the pole
18. (0, 0)
19. Parabola with horizontal directrix above the pole
20. $r = \frac{6}{3-\cos\theta}$
21. $r = \frac{6}{1+2\sin\theta}$