Calculus - Chapter 10.5 Exercises

난이도 하

1. **Exercise 1:** Find the vertex, focus, and directrix of the parabola and sketch its graph.
$$x^2 = 8y$$

2. **Exercise 3:** Find the vertex, focus, and directrix of the parabola and sketch its graph.
$$5x + 3y^2 = 0$$

3. **Exercise 11:** Find the vertices and foci of the ellipse and sketch its graph.
$$\frac{x^2}{16} + \frac{y^2}{25} = 1$$

4. **Exercise 13:** Find the vertices and foci of the ellipse and sketch its graph.
$$x^2 + 3y^2 = 9$$

5. **Exercise 19:** Find the vertices, foci, and asymptotes of the hyperbola and sketch its graph.
$$\frac{y^2}{25} - \frac{x^2}{9} = 1$$

6. **Exercise 21:** Find the vertices, foci, and asymptotes of the hyperbola and sketch its graph.
$$x^2 - y^2 = 100$$

7. **Exercise 33:** Find an equation for the conic that satisfies the given conditions. Parabola, vertex $(0, 0)$, focus $(1, 0)$.

8. **Exercise 39:** Find an equation for the conic that satisfies the given conditions. Ellipse, foci $(\pm 2, 0)$, vertices $(\pm 5, 0)$.

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9. **Exercise 5:** Find the vertex, focus, and directrix of the parabola and sketch its graph.
$$(y+1)^2 = 16(x-3)$$

10. **Exercise 7:** Find the vertex, focus, and directrix of the parabola and sketch its graph.
$$y^2 + 6y + 2x + 1 = 0$$

11. **Exercise 15:** Find the vertices and foci of the ellipse and sketch its graph.
$$4x^2 + 25y^2 - 50y = 75$$

12. **Exercise 23:** Find the vertices, foci, and asymptotes of the hyperbola and sketch its graph.
$$x^2 - y^2 + 2y = 2$$

13. **Exercise 27:** Identify the type of conic section whose equation is given and find the vertices and foci.
$$4x^2 = y^2 + 4$$

14. **Exercise 31:** Identify the type of conic section whose equation is given and find the vertices and foci.
$$3x^2 - 6x - 2y = 1$$

15. **Exercise 35:** Find an equation for the conic that satisfies the given conditions. Parabola, focus $(-4, 0)$, directrix $x = 2$.

16. **Exercise 41:** Find an equation for the conic that satisfies the given conditions. Ellipse, foci $(0, 2), (0, 6)$, vertices $(0, 0), (0, 8)$.

17. **Exercise 43:** Find an equation for the conic that satisfies the given conditions. Ellipse, center $(-1, 4)$, vertex $(-1, 0)$, focus $(-1, 6)$.

18. **Exercise 45:** Find an equation for the conic that satisfies the given conditions. Hyperbola, vertices $(\pm 3, 0)$, foci $(\pm 5, 0)$.

19. **Exercise 47:** Find an equation for the conic that satisfies the given conditions. Hyperbola, vertices $(-3, -4), (-3, 6)$, foci $(-3, -7), (-3, 9)$.

20. **Exercise 49:** Find an equation for the conic that satisfies the given conditions. Hyperbola, vertices $(\pm 3, 0)$, asymptotes $y = \pm 2x$.

21. **Exercise 51:** The point in a lunar orbit nearest the surface of the moon is called perilune and the point farthest from the surface is called apolune. The Apollo 11 spacecraft was placed in an elliptical lunar orbit with perilune altitude 110 km and apolune altitude 314 km (above the moon). Find an equation of this ellipse if the radius of the moon is 1728 km and the center of the moon is at one focus.

22. **Exercise 52:** A cross-section of a parabolic reflector is shown. The bulb is located at the focus and the opening at the focus is 10 cm. (a) Find an equation of the parabola. (b) Find the diameter of the opening $|CD|$, 11 cm from the vertex.

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23. **Exercise 38:** Find an equation for the conic that satisfies the given conditions. Parabola, vertical axis, passing through $(0, 4), (1, 3)$, and $(-2, -6)$.

24. **Exercise 50:** Find an equation for the conic that satisfies the given conditions. Hyperbola, foci $(2, 0), (2, 8)$, asymptotes $y = 3 + \frac{1}{2}x$ and $y = 5 - \frac{1}{2}x$.

25. **Exercise 53:** In the LORAN radio navigation system, two radio stations located at A and B transmit simultaneous signals to a ship... Suppose that station B is located 640 km due east of station A on a coastline. A ship received the signal from station B 1200 microseconds (μs) before it received the signal from station A. (a) Assuming that radio signals travel at a speed of 300 m/μs, find an equation of the hyperbola on which the ship lies. (b) If the ship is due north of B, how far off the coastline is the ship?

26. **Exercise 54:** Use the definition of a hyperbola to derive Equation 6 for a hyperbola with foci $(\pm c, 0)$ and vertices $(\pm a, 0)$.

27. **Exercise 56:** Find an equation for the ellipse with foci $(1, 1)$ and $(-1, -1)$ and major axis of length 4.

28. **Exercise 57:** Determine the type of curve represented by the equation $\frac{x^2}{k} + \frac{y^2}{k-16} = 1$ in each of the following cases: (a) $k > 16$, (b) $0 < k < 16$, (c) $k < 0$. (d) Show that all the curves in parts (a) and (b) have the same foci, no matter what the value of k is.

29. **Exercise 58:** (a) Show that the equation of the tangent line to the parabola $y^2 = 4px$ at the point (x_0, y_0) can be written as $y_0 y = 2p(x + x_0)$. (b) What is the x-intercept of this tangent line? Use this fact to draw the tangent line.

30. **Exercise 60:** Show that if an ellipse and a hyperbola have the same foci, then their tangent lines at each point of intersection are perpendicular.