

## Lesson 6: Ellipses and Hyperbolas

### Question #1

Reference Q.17862

Ellipses are one type of a family of conics. Explain how to create an ellipse using a cone.

### Question #2

Reference Q.17863

- What is the standard equation of an ellipse and what information can we obtain from it?
- What is the general equation of an ellipse and what information can we obtain from it?

### Question #3

Reference Q.17866

Answer the questions based on  $\frac{x^2}{16} + \frac{y^2}{4} = 1$

- Where is the center of the ellipse located?
- What is the length of the semi-major axis,  $a$ ?
  - What are the coordinates of the vertices?
- What is the length of the semi-minor axis,  $b$ ?
  - What are the coordinates of the co-vertices?
- What is the value of  $c$ ?
  - What are the coordinates of the two foci?
- What is the eccentricity of this ellipse?
- What are the equations of the directrix lines?
- Using all of the information found in this question, draw the graph of this ellipse.

### Question #4

Reference Q.17867

Answer the questions based on  $\frac{(x+1)^2}{25} + \frac{(y-2)^2}{9} = 1$

- Where is the center of the ellipse located?
- What is the length of the semi-major axis,  $a$ ?
  - What are the coordinates of the vertices?
- What is the length of the semi-minor axis,  $b$ ?
  - What are the coordinates of the co-vertices?
- What is the value of  $c$ ?
  - What are the coordinates of the two foci?
- What is the eccentricity of this ellipse?
- What are the equations of the directrix lines?
- Using all of the information found in this question, draw the graph of this ellipse.

### Question #5

Reference Q.17868

Answer the questions based on  $\frac{(x-3)^2}{4} + \frac{(y+2)^2}{36} = 1$

- Where is the center of the ellipse located?
- What is the length of the semi-major axis,  $a$ ?
  - What are the coordinates of the vertices?
- What is the length of the semi-minor axis,  $b$ ?
  - What are the coordinates of the co-vertices?
- What is the value of  $c$ ?
  - What are the coordinates of the two foci?
- What is the eccentricity of this ellipse?
- What are the equations of the directrix lines?
- Using all of the information found in this question, draw the graph of this ellipse.

### Question #6

Reference Q.17869

Answer the questions based on  $\frac{(y-3)^2}{16} + \frac{(x-2)^2}{4} = 1$

- a. Where is the center of the ellipse located?
- b.
  - iii. What is the length of the semi-major axis, **a**?
  - iv. What are the coordinates of the vertices?
- c.
  - iv. What is the length of the semi-minor axis, **b**?
  - v. What are the coordinates of the co-vertices?
- d.
  - v. What is the value of **c**?
  - vi. What are the coordinates of the two foci?
- e. What is the eccentricity of this ellipse?
- f. What are the equations of the directrix lines?
- g. Using all of the information found in this question, draw the graph of this ellipse.

### Question #7

Reference Q.17870

Answer the questions based on  $\frac{(x+3)^2}{14} + \frac{(y+1)^2}{12} = 1$

- a. Where is the center of the ellipse located?
- b.
  - iii. What is the length of the semi-major axis, **a**?
  - iv. What are the coordinates of the vertices?
- c.
  - iv. What is the length of the semi-minor axis, **b**?
  - v. What are the coordinates of the co-vertices?
- d.
  - v. What is the value of **c**?
  - vi. What are the coordinates of the two foci?
- e. What is the eccentricity of this ellipse?
- f. What are the equations of the directrix lines?
- g. Using all of the information found in this question, draw the graph of this ellipse.

### Question #8

Reference Q.17871

Answer the questions based on  $\frac{(x+5)^2}{3} + \frac{(y-2)^2}{4} = 1$

- a. Where is the center of the ellipse located?
- b.
  - iii. What is the length of the semi-major axis, **a**?
  - iv. What are the coordinates of the vertices?
- c.
  - iv. What is the length of the semi-minor axis, **b**?
  - v. What are the coordinates of the co-vertices?
- d.
  - v. What is the value of **c**?
  - vi. What are the coordinates of the two foci?
- e. What is the eccentricity of this ellipse?
- f. What are the equations of the directrix lines?
- g. Using all of the information found in this question, draw the graph of this ellipse.

### Question #9

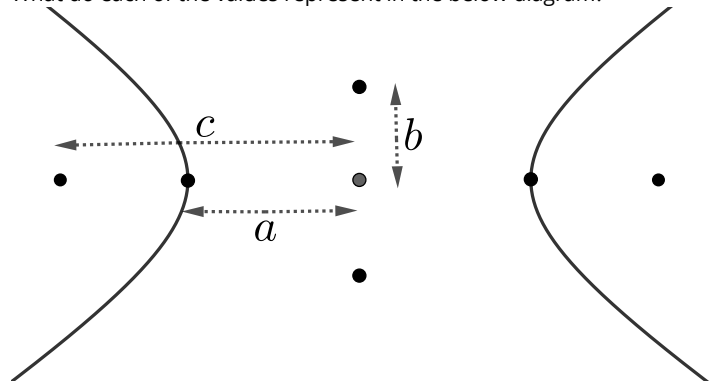
Reference Q.17882

- a. What is the standard equation of a hyperbola and what information can we obtain from it?
- b. What is the general equation of a hyperbola and what information can we obtain from it?

### Question #10

Reference Q.17884

What do each of the values represent in the below diagram?



- a. **a**-value
- b. **b**-value
- c. **c**-value

### Question #11

Reference Q.17885

Answer the questions based on  $\frac{x^2}{16} - \frac{y^2}{4} = 1$

- a. Where is the center of the hyperbola located?
- b.
  - iii. What is the length of the semi-major axis,  $a$ ?
  - iv. What are the coordinates of the vertices?
- c.
  - iv. What is the length of the semi-minor axis,  $b$ ?
  - v. What are the coordinates of the co-vertices?
- d.
  - v. What is the value of  $c$ ?
  - vi. What are the coordinates of the two foci?
- e. What is the eccentricity of this hyperbola?
- f. What are the equations of the directrix lines?
- g. Determine the equations of the asymptotes.
- h. Draw the graph of this hyperbola by plotting the vertices, foci and asymptotes.

### Question #12

Reference Q.17886

Answer the questions based on  $\frac{(x+1)^2}{25} - \frac{(y-2)^2}{9} = 1$

- a. Where is the center of the hyperbola located?
- b.
  - iii. What is the length of the semi-major axis,  $a$ ?
  - iv. What are the coordinates of the vertices?
- c. What is the length of the semi-minor axis,  $b$ ?
- d.
  - v. What is the value of  $c$ ?
  - vi. What are the coordinates of the two foci?
- e. What is the eccentricity of this ellipse?
- f. What are the equations of the directrix lines?
- g. Determine the equations of the asymptotes.
- h. Draw the graph of this hyperbola by plotting the vertices, foci and asymptotes.

### Question #13

Reference Q.17887

Answer the questions based on  $\frac{(y+2)^2}{36} - \frac{(x-3)^2}{4} = 1$

- a. Where is the center of the hyperbola located?
- b.
  - iii. What is the length of the transverse axis,  $a$ ?
  - iv. What are the coordinates of the vertices?
- c. What is the length of the conjugate axis,  $b$ ?
- d.
  - v. What is the value of  $c$ ?
  - vi. What are the coordinates of the two foci?
- e. What is the eccentricity of this hyperbola?
- f. What are the equations of the directrix lines?
- g. Determine the equations of the asymptotes.
- h. Draw the graph of this hyperbola by plotting the vertices, foci and asymptotes.

### Question #14

Reference Q.17888

Answer the questions based on  $\frac{(y-3)^2}{16} - \frac{(x-2)^2}{4} = 1$

- a. Where is the center of the hyperbola located?
- b.
  - iii. What is the length of the transverse axis,  $a$ ?
  - iv. What are the coordinates of the vertices?
- c. What is the length of the conjugate axis,  $b$ ?
- d.
  - v. What is the value of  $c$ ?
  - vi. What are the coordinates of the two foci?
- e. What is the eccentricity of this hyperbola?
- f. What are the equations of the directrix lines?
- g. Determine the equations of the asymptotes.
- h. Draw the graph of this hyperbola by plotting the vertices, foci and asymptotes.

### Question #15

Reference Q.17889

Answer the questions based on  $\frac{(x+3)^2}{14} - \frac{(y+1)^2}{12} = 1$

- Where is the center of the hyperbola located?
- What is the length of the semi-major axis,  $a$ ?
  - What are the coordinates of the vertices?
- What is the length of the semi-minor axis,  $b$ ?
- What is the value of  $c$ ?
  - What are the coordinates of the two foci?
- What is the eccentricity of this hyperbola?
- What are the equations of the directrix lines?
- Determine the equations of the asymptotes.
- Draw the graph of this hyperbola by plotting the vertices, foci and asymptotes.

### Question #16

Reference Q.17890

Answer the questions based on  $\frac{(y-2)^2}{4} - \frac{(x+5)^2}{3} = 1$

- Where is the center of the hyperbola located?
- What is the length of the semi-major axis,  $a$ ?
  - What are the coordinates of the vertices?
- What is the length of the semi-minor axis,  $b$ ?
- What is the value of  $c$ ?
  - What are the coordinates of the two foci?
- What is the eccentricity of this hyperbola?
- What are the equations of the directrix lines?
- Determine the equations of the asymptotes.
- Draw the graph of this hyperbola by plotting the vertices, foci and asymptotes.

### Question #17

Reference Q.17891

Convert the following to general form:  $\frac{(x+5)^2}{3} - \frac{(y-2)^2}{4} = 1$

### Question #18

Reference Q.17892

Convert  $6x^2 - 2y^2 - 36x + 8y + 50 = 0$  to standard form.

### Question #19

Reference Q.17893

Convert  $x^2 - 6y^2 - 2x + 4y - 10 = 0$  to standard form.

### Question #20

Reference Q.17896

Determine the standard equation of a hyperbola with one vertex at  $(1, 0)$ , one co-vertex at  $(3, 3)$  and it opens up and down.

### Question #21

Reference Q.17897

Determine the **standard equation** of the hyperbola given that the directrix equation is  $y \simeq -0.67$ , its closest focus is at  $(-7, 2)$  and the center of the hyperbola is at  $(-7, -1)$ .