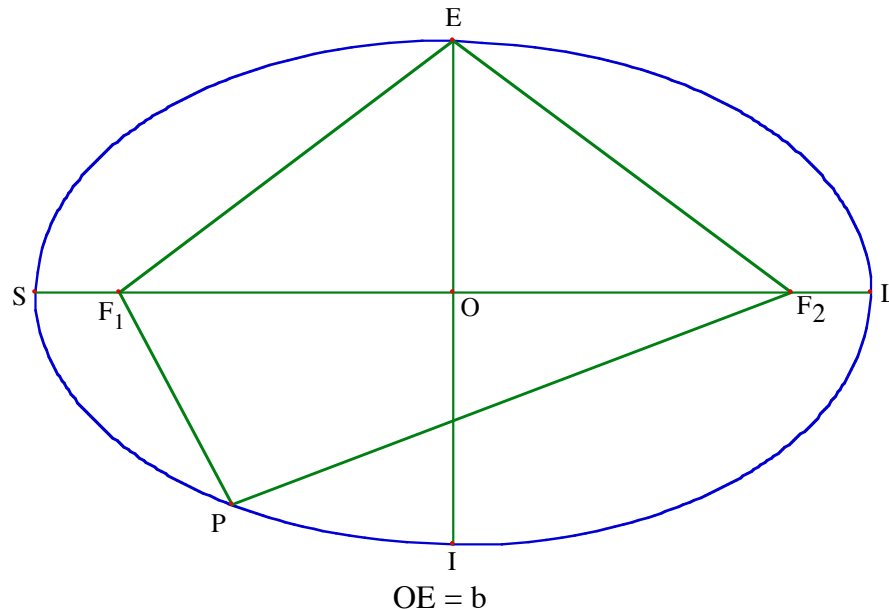


Geometry of the Ellipse



$$OE = b$$

$$OF_1 = OF_2 = f$$

For all points P on this ellipse, $PF_1 + PF_2 = 2a$

Getting to an Equation

1. Write a, b, and f next to the appropriate segments on the figure. (**Hint:** use what you know about $EF_1 + EF_2$.)
2. How are a, b, and f related?
3. Find the length OS in terms of a, b, and/or f. (**Hint:** use what you know about $SF_1 + SF_2$.)
4. How are EF_1 and OS related?
5. Write an equation for the ellipse, assuming
 - a. O is at the origin.
 - b. O has coordinates (h,v).

Definitions: SL is the *major axis*. EI is the *minor axis*. $2f$ is the *focal distance*. PF_1 and PF_2 are the *focal radii*. OS and OL are the *x-radii*. OE and OI are the *y-radii*.

6. What are the x-radius and the y-radius in terms of a, b, and/or f?

Turning It Around

7. Sketch an ellipse centered at the origin, but with the foci on the y-axis. Mark a, b, and f wherever they show up on your sketch. (**Hint:** In this case, the major axis is vertical, and the minor axis is horizontal. The minor axis is still equal to $2b$, and the focal distance is still equal to $2f$.)
8. Write an equation for the ellipse, assuming
 - a. O is at the origin.
 - b. O has coordinates (h,v).
 (**Hint:** the answers are different from #5.)

Equation Challenges

9. Find the equation of an ellipse centered at the origin, with:
 - a. major axis 6, focal distance 8, foci on the x-axis
 - b. one focus at (0,6), sum of the focal radii 16.
10. Where are the foci if the center is at (2,3), the x-radius is 4, and the y-radius is 5.