

ELLIPTICAL ORBIT Teaching Guidelines

Subject: Mathematics

Topics: Algebra, Coordinate Systems, Expressions and Equations

Grades: 6 - 9

Knowledge and Skills:

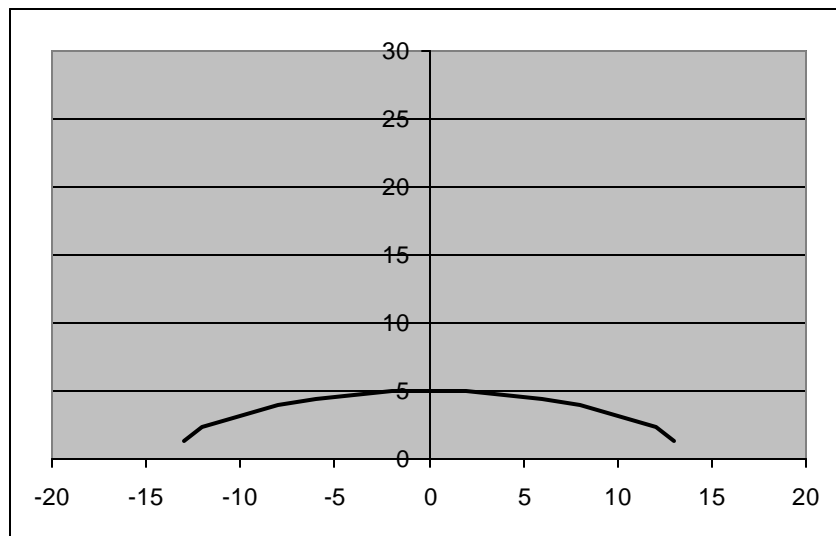
- Can evaluate expressions by substituting values for variables
- Can simplify expressions using correct order of operations
- Can plot a point in a two-dimensional coordinate system, given the coordinates, or determine the coordinates of a given point

Answers

1.

x	-13	-12	-8	-6	-4	-2	0	2	4	6	8	12	13
y	0.00	1.92	3.94	4.44	4.76	4.94	5.00	4.94	4.76	4.44	3.94	1.92	0.00

2.



3. 26,000 miles

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Elliptical Orbit

If the Space Shuttle were to make a maintenance trip out to a satellite in geosynchronous orbit, the Shuttle would need to enter into an elliptical orbit around the earth. That orbit could be described by this equation:

$$y = b \sqrt{\left(1 + \frac{x}{a}\right) \left(1 - \frac{x}{a}\right)}$$

where a and b are numbers that determine the shape of the ellipse.

If all distances are measured in thousands of miles, then an actual orbit might be described by this equation:

$$y = 5 \sqrt{\left(1 + \frac{x}{13.5}\right) \left(1 - \frac{x}{13.5}\right)}$$

1. Find the value of y for each value of x (to two decimal places):

x	-13	-12	-8	-6	-4	-2	0	2	4	6	8	12	13
y													

2. Plot the ordered pairs from the table above and sketch the curve that connects them.
3. In this orbit, the Earth would be at the position $(-12.5, 0)$, and the satellite would be at the position $(13.5, 0)$. Plot these points on your graph. How far is the earth from the satellite?