

FUNCTIONS & GRAPHS

Algebraic Tests for Symmetry



EX #1: Show $f(x) = x^4 - 3x^2 + 5$ has *y-axis* symmetry

$$f(-x) = (-x)^4 - 3(-x)^2 + 5 \quad \text{EVEN}$$

$$f(-x) = x^4 - 3x^2 + 5$$

↑
Think $(5x^0)$

Zero is an even number

EX #2: Show $f(x) = x^3 - 6x$ has *origin* symmetry

$$f(-x) = (-x)^3 - 6(-x) \quad \text{ODD}$$

$$f(-x) = -x^3 + 6x$$

$$-f(x) = -(x^3 - 6x) = -x^3 + 6x$$

origin

$f(0) = 0$

EX #3: Determine the symmetry for $f(x) = -x^2 + 5x - 6$

By inspection x^2 x^1 x^0

no symmetry } even 2, 0
 } odd 1

Graph:

neither cx or $-f(x)$

EX. Write an equation in standard form that is symmetric about the y-axis and sketch it.

$x = y^2 + 1$

x	y
1	0
2	-1
2	1

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ALGEBRAIC TESTS FOR SYMMETRY

This is a FREE lesson in the unit on *Functions and Graphs* for students enrolled in PreCalculus. The lesson includes a fully-editable SMART Notebook® lesson and an four-page Folded Book-style Foldable® inspired by the work of Dinah Zike, and is used by permission – see more of her ideas at www.Dinah.com.

You might be interested in my [Activities and Assessments Bundle](#) for **Functions and Graphs**.

The SMART Board lesson can be used in many ways. Teachers can display the presentation using the following:

1. SMART Board®
2. Airliner Wireless Slate®
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4. Through the SMART Notebook Express®
<http://express.smarttech.com/#>
5. Promethean Boards®
6. Other APPS available for tablets

ALGEBRAIC TESTS FOR SYMMETRY

EVEN FUNCTIONS:

Y-Axis Symmetry $f(-x) = f(x)$

ODD FUNCTIONS:

Origin Symmetry $f(-x) = -f(x)$

SUMMARY

- Even functions have y -axis symmetry whenever $\pm x$ produce the same y -value. That is, both (x,y) and $(-x,y)$ will be on the graph.
- Even relationships have x -axis symmetry (not a function) whenever $\pm y$ produce the same x -value. That is, both (x,y) and $(x,-y)$ will be on the graph.
- Odd functions have origin symmetry whenever (x,y) and $(-x,-y)$ are on the graph.



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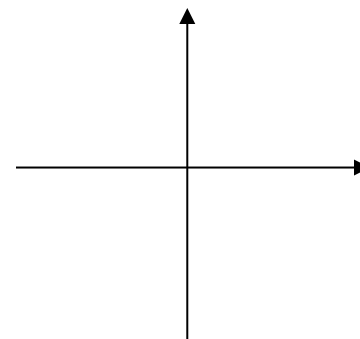
EX #1: Show $f(x) = x^4 - 3x^2 + 5$ has *y-axis* symmetry

EX #2: Show $f(x) = x^3 - 6x$ has *origin* symmetry

EX #3: Determine the symmetry for $f(x) = -x^2 + 5x - 6$

EX #4: Write an equation for a relation that has *x-axis* symmetry. Make a table of values and sketch.

X	Y
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Algebraic Tests for Symmetry

Lesson objectives

Students use the algebraic tests for symmetry and make connections to the graph, a table of values, and the formula.

1.1

Lesson objectives

Teachers' notes

Lesson notes

ALGEBRAIC TESTS FOR SYMMETRY

EVEN FUNCTIONS:

Y-Axis Symmetry $f(-x) = f(x)$

ODD FUNCTIONS:

Origin Symmetry $f(-x) = -f(x)$

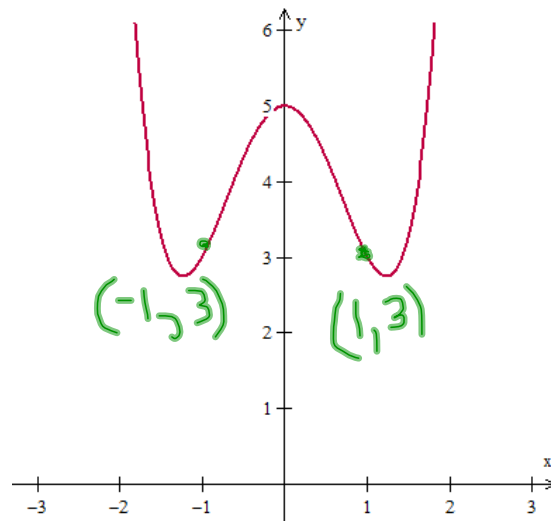
SUMMARY

- Even functions have y -axis symmetry whenever $\pm x$ produce the same y -value. That is, both (x, y) and $(-x, y)$ will be on the graph.
- Even relationships have x -axis symmetry (not a function) whenever $\pm y$ produce the same x -value. That is, both (x, y) and $(x, -y)$ will be on the graph.
- Odd functions have origin symmetry whenever (x, y) and $(-x, -y)$ are on the graph.

EX#1: Show $f(x) = x^4 - 3x^2 + 5$ has *y-axis* symmetry.

$$f(-x) = (-x)^4 - 3(-x)^2 + 5 \quad \text{EVEN}$$

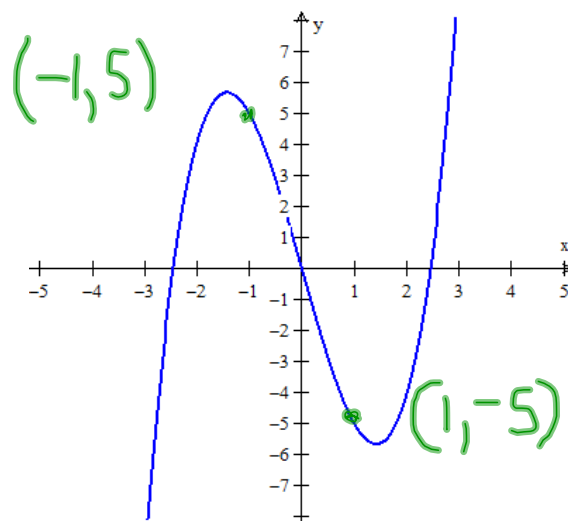
$$f(-x) = x^4 - 3x^2 + 5$$



EX#2: Show $f(x) = x^3 - 6x$ has *origin* symmetry.

$$f(-x) = (-x)^3 - 6(-x) \quad \text{ODD}$$

$$f(-x) = -x^3 + 6x$$

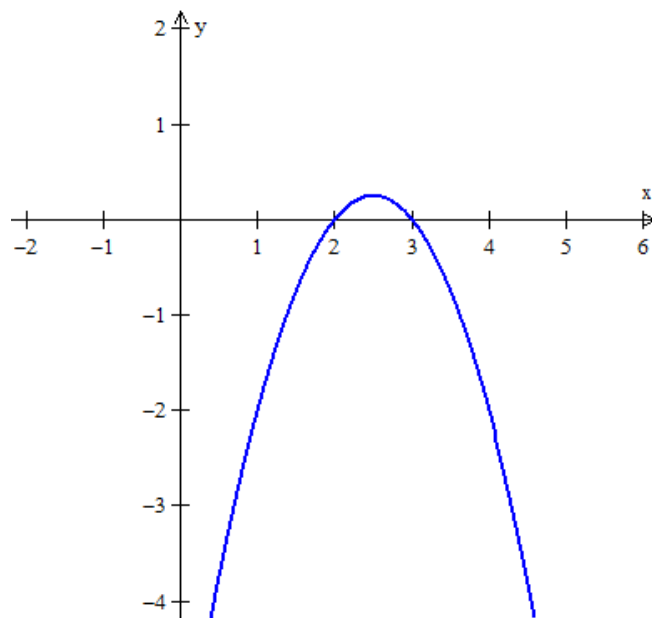


EX#3: Determine the symmetry for $f(x) = -x^2 + 5x - 6$

inspection x^2 x^1 x^0 no symmetry

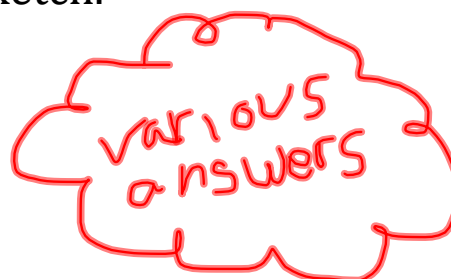
$$f(-x) = -(-x)^2 + 5(-x) - 6$$

$$\left. \begin{array}{l} f(-x) = -x^2 - 5x - 6 \\ f(x) = -x^2 + 5x - 6 \end{array} \right\} \begin{array}{l} \text{neither} \\ \text{symmetry} \end{array}$$

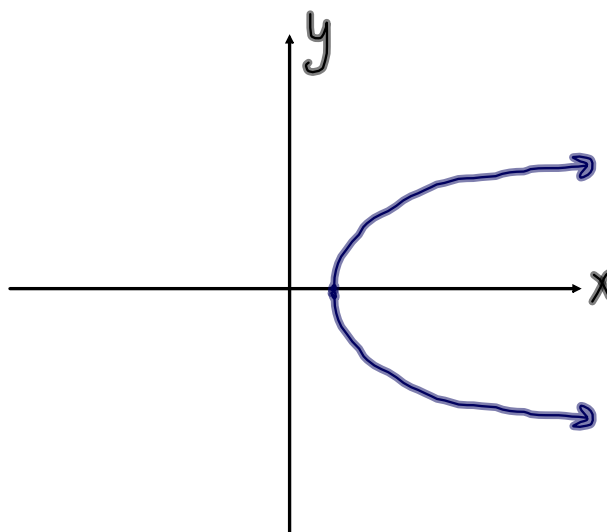


EX#4: Write an equation for a relation that has x-axis symmetry. Make a table of values and sketch.

$$x = y^2 + 1$$

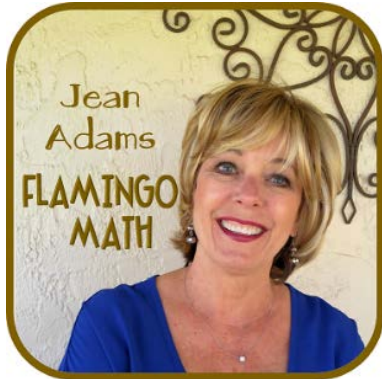


x	y
1	0
2	1
2	-1
5	2
5	-2



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