Trig 3.1

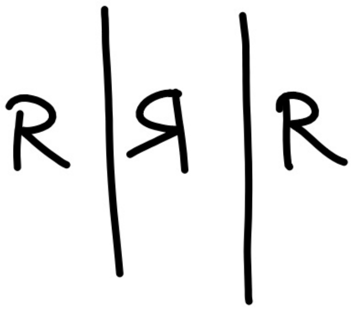
Use algebraic tests to determine whether a graph is symmetrical
Classify functions as even or odd

preimage

A'

image A'

reflection



rotation

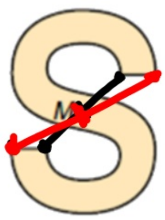
translation

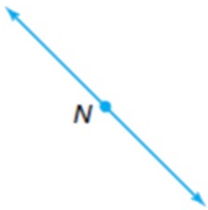
point symmetry (rotation)

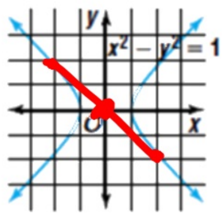
Connect two (corresponding) points. Is M the midpoint?

Point Symmetry Two distinct points P and P' are symmetric with respect to point M if and only if M is the midpoint of $\overline{PP'}$. Point M is symmetric with respect to itself.

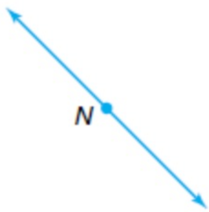
rotation 180°

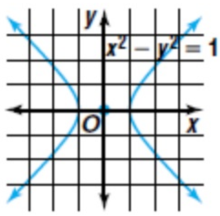






Informally: can it rotate 180 degrees?





Symmetry with Respect to the Origin

The graph of a relation S is symmetric with respect to the origin if and only if $(a, b) \in S$ implies that $(-a, -b) \in S$.

$(2,5)$ $(-2,-5)$

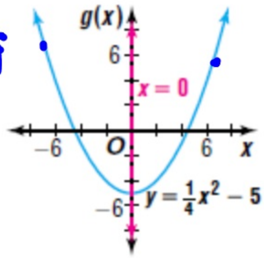
$(a, b) \in S$ means the ordered pair (a, b) belongs to the solution set S.

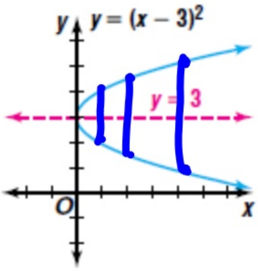
(a,b) and (-a,-b)
"Rotation"= symmetric with origin

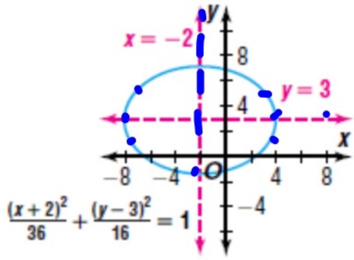
$(a,b) \in S$

Reflection = line symmetry

Line Symmetry	Two distinct points P and P' are symmetric with respect to a line ℓ if and only if ℓ is the perpendicular bisector of $\overline{PP'}$. A point P is symmetric to itself with respect to line ℓ if and only if P is on ℓ.







PP' is bisected by *l*

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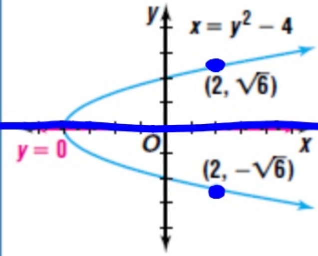
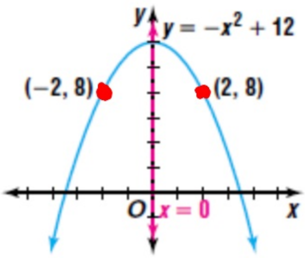
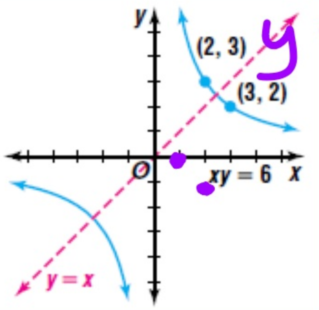
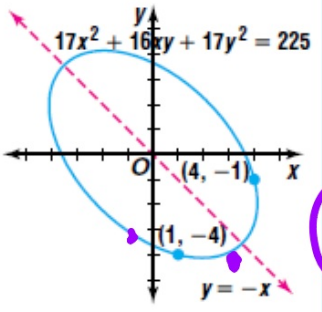
Symmetry with Respect to the:	Definition and Test	Example
y changes to opp x-axis horiz.	e	
y-axis Vert		

(a,b) maps to

$(a,-b)$

(a,b) maps to

$(-a,b)$

$y = x$	$(b, a) \in S$ if and only if $(a, b) \in S$. *Example:* (2, 3) and (3, 2) are on the graph. *Test:* Substituting (a, b) and (b, a) into the equation produces equivalent equations.	
$y = -x$	$(-b, -a) \in S$ if and only if $(a, b) \in S$. *Example:* (4, −1) and (1, −4) are on the graph. *Test:* Substituting (a, b) and $(-b, -a)$ into the equation produces equivalent equations.	

y = x + 0

(a,b) maps to

(b,a)

(a,b) maps to

(-b,-a)

Test each possibility: yes or no

$\boxed{a \cdot b = -2}$

2 Determine whether the graph of $\boxed{xy = -2}$ is symmetric with respect to the x-axis, y-axis, the line $y = x$, the line $y = -x$, or none of these.

no no yes yes

point sym: $(a, b) \to (-a, -b)$ $\quad -a \cdot -b = -2$

yes $\quad ab = -2$

$-x \cdot -y = -2$

line

x-axis $(a, b) \to (a, -b)$ $\quad a \cdot -b = -2$

no $\quad \dfrac{-ab}{-1} = \dfrac{-2}{-1}$

y-axis $(a, b) \to (-a, b)$ $\quad \dfrac{-a \cdot b}{-1} = \dfrac{-2}{-1}$

no

$y = x$ $(a, b) \to (b, a)$

yes $\quad ba = -2$

$y = -x$ (a, b) $(-b, -a)$ $\quad -b \cdot -a = -2$

yes $\quad ab = -2$

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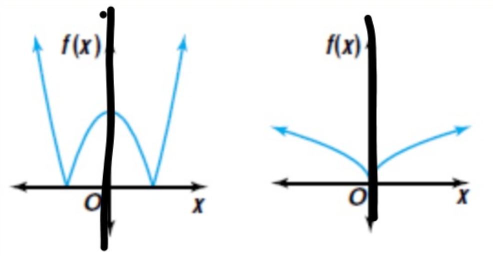
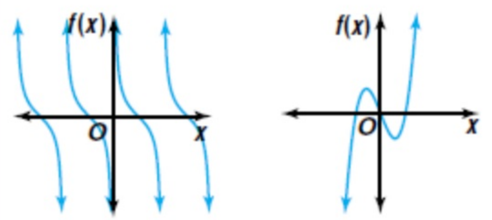
"even" functions	odd functions
	
symmetric with respect to the y-axis	symmetric with respect to the origin

reflect y-axis

$(a,b) \to (-a,b)$

rotate 180

$(a,b) \to (-a,-b)$

y-axis

$(a,b) \to (-a,b)$

$$\boxed{y = (x+1)^2 - 3}$$

$x^2+2x+1-3$

$y = x^2+2x-2$

$b = a^2+2a-2$

$x+1$

$x+1$

odd?

$(-a,-b)$

$\frac{-b}{-1} = \frac{a^2}{-1} \frac{-2a}{-1} \frac{-2}{-1}$

$b = -a^2+2a+2$

$b = -a \cdot -a + 2 \cdot -a - 2$

$b = a^2-2a-2$