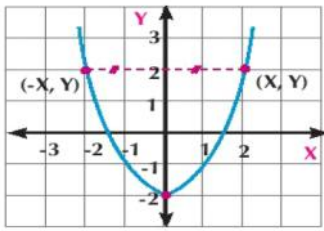


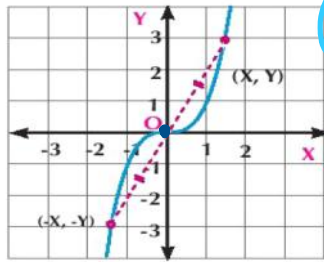
Symmetry about Straight lines

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Symmetry about Straight lines



Symmetry about y-axis figure (1)



Symmetry about origin point figure (2)

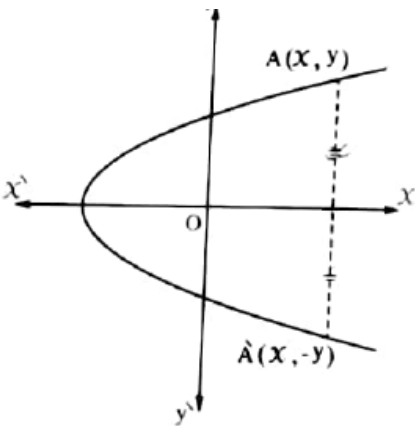
In Figure (1):

The point $(-x, y)$ lying on the curve is the image of the point (x, y) lying on the curve by reflection in y -axis.

sym about

In Figure (2):

The point $(-x, -y)$ lying on the graph of the curve is the image of the point (x, y) lying on the same curve by reflection in origin point.



The graph of a function is symmetric about x -axis if for each point $A(X, y)$ lies on the graph there is a corresponding point $\hat{A}(X, -y)$ lies on the same graph where \hat{A} is the image of A by reflection in x -axis.

x-axis:

$$(x, y) \longrightarrow (x, -y)$$

- ① original point
- ② what is sym.?

- a) y -axis $(x, y) \longrightarrow (-x, y)$
- b) x -axis $(x, y) \longrightarrow (x, -y)$
- c) origin point $(x, y) \longrightarrow (-x, -y)$

$(5, 2)$
original point

origin point

$(-5, -2)$
image point

① y -axis

$$(x, y) \longrightarrow (-x, y)$$

$$(2, 2) \longrightarrow (-2, 2)$$

② origin point

(x, y)
original point

$(-x, -y)$
image point

syn about origin

$(3, 2) \longrightarrow (-3, -2)$

فصول اولين

Important Properties

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choose

Step

If each of f_1 and f_2 is an even function and each of g_1 and g_2 is an odd function, then:

- 1) $f_1 f_2$ is an even function
- 2) $g_1 + g_2$ is an odd function
- 3) $f_1 \times f_2$ is an even function
- 4) $g_1 \times g_2$ is an even function
- 5) $f_1 g_2$ is an odd function
- 6) $f_1 + g_2$ is neither odd nor even

Determine which of the functions defined by the following rules is even, odd or otherwise:

(1) $f(x) = x^2 + \cos x$

(2) $f(x) = x^3 + \sin x$
 odd + odd
 odd

(3) $f(x) = 3x^4 \tan x$
 even * odd
 odd

cos
↓
even

sin & tan
odd

$f(x) = \cos x = \text{even}$
 $f(-x) = \cos(-x) = \cos x$

$f(x) = \sin x$
 $f(-x) = \sin(-x) = -\sin x$
 odd

$f(x) = \tan x$
 $f(-x) = \tan(-x) = -\tan x$
 odd

Determine which of the functions defined by the following rules is even, odd or otherwise:

(1) $f(x) = 3x^4 - 5x^2 + 1$
 (3) $f(x) = \frac{x - \sin 3x}{1 + x^2}$

(2) $f(x) = x^3 + 2x - 5$
 (4) $f(x) = \frac{x - \tan x}{x^3 + x}$

$f(x) = 3x^4 - 5x^2 + 1$
 $f(-x) = 3(-x)^4 - 5(-x)^2 + 1$
 $= 3x^4 - 5x^2 + 1 = f(x)$
 $f(-x) = f(x)$
 even

$f(x) = \frac{x - \sin 3x}{1 + x^2}$
 $f(-x) = \frac{(-x) - \sin 3(-x)}{1 + (-x)^2}$
 $= \frac{-x + \sin 3x}{1 + x^2} = -f(x)$
 $= -\frac{(x - \sin 3x)}{1 + x^2} = -f(x)$
 $f(-x) = -f(x)$
 odd

Even & Odd functions:

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Even & Odd functions:

The even function: the function $f: X \rightarrow Y$ is said to be even if $f(-x) = f(x)$, for all $-x, x \in X$.
The curve of the even function is symmetric about y-axis.

The odd function: the function $f: X \rightarrow Y$ is said to be odd if $f(-x) = -f(x)$ for all $-x, x \in X$.
The curve of the odd function is symmetric about the origin point.

$$f(x) = \sqrt{x+3}$$

$$f(-x) = \sqrt{-x+3} = \sqrt{3-x}$$

neither nor

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$$f(x) = x^3$$

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

$$f(-x) = -f(x)$$

odd fun.

Show the type for each of the following functions (even - odd).

a) $f(x) = x^2$

b) $f(x) = x^3$

c) $f(x) = \sqrt{x+3}$

d) $f(x) = \cos x$

$$f(x) = x^2$$

$$f(-x) = (-x)^2 = x^2 = f(x)$$

$$\therefore f(-x) = f(x) \text{ even fun.}$$

Neither even nor odd

odd \forall , even \forall

Determine the type for each of the following functions whether even, odd or otherwise.

a) $f(x) = \sin x$

b) $f(x) = x^2 + \cos x$

c) $f(x) = x^3 - \sin x$

d) $f(x) = x^2 \cos x$

e) $f(x) = x^3 \sin x$

f) $f(x) = x^3 \cos x$

g) $f(x) = x^3 + x^2$

h) $f(x) = \sin x + \cos x$

i) $f(x) = \sin x \cos x$

Remember that

$$\sin(-x) = -\sin x$$

$$\cos(-x) = \cos x$$

$$\tan(-x) = -\tan x$$

$$f(x) = x^3 \sin x$$

$$f(-x) = (-x)^3 \sin(-x)$$

$$= -x^3 \sin x$$

$$= -x^3 \sin x = -f(x)$$

$$\therefore f(-x) = -f(x)$$

$\therefore f(x)$ is even fun.

$$f(x) = \sin x + \cos x$$

$$f(-x) = \sin(-x) + \cos(-x)$$

$$= -\sin x + \cos x$$

$$\neq f(x)$$

$$f(-x) \neq f(x)$$

neither even nor odd.