By Definition a function has symmetry about the **y-axis if f(-x) =f(x)**. Which means that if you put a –x in for the x's of the function and you end up with the same function you started with, then the graph has y axis symmetry.

Example: $y=\frac{x^2-4}{x^4-x^2}$ $f(-x)=\frac{(-x)^2-4}{(-x)^4-(-x)^2}=\frac{x^2-4}{x^4-x^2}=f(x)$ so this function has y-axis symmetry.

A function with y-axis symmetry is called an **even** function.

There is a shortcut to see if polynomials have y-axis symmetry. If all of the powers of x are even then the function is even; therefore, it has y-axis symmetry.

Example $f(x)=x^4+x^2-1$ is even. (The x of the constant term is x^0 and 0 is considered even)

By Definition a function has symmetry about the **origin if f(-x) = -f(x)**. Which means that if you put a –x in for the x's of the function and you end up with the negative of function you started with, then the graph has origin symmetry.

Example: $y=\frac{x^3-4x}{x^4-x^2}$ $f(-x)=\frac{(-x)^3-4(-x)}{(-x)^4-(-x)^2}=\frac{-x^3+4}{x^4-x^2}=\frac{-(x^3-4)}{x^4-x^2}=-f(x)$ so this function has origin symmetry.

A function with **origin** symmetry is called an **odd** function.

There is a shortcut to see if polynomials have origin symmetry. If all of the powers of x are odd then the function is odd; therefore, it has origin symmetry.

Example $f(x)=x^3+x$ is odd.

If you mix up the types of powers then we say that the function has no symmetry.

Example $f(x)=x^3-5$ has not symmetry (Remember constants are considered even because they have an x^0 there)

If you have a rational function, then you treat the functions like signed numbers. Determine the symmetry of the numerator and denominator.

A) If it is even (y axis symmetry) treat it like a (+)

B) If it is odd (origin symmetry)treat it like a (-)

$y=\frac{\text{even}}{\text{odd}}=\frac{+}{-}=\ -$ which means that the rational function is odd (has origin symmetry)

$y=\frac{\text{even}}{\text{even}}=\frac{+}{+}=\ +$ which means the rational function is even (has y-axis symmetry)

$y=\frac{\text{odd}}{\text{odd}}=\frac{-}{-}=\ +$ which means the rational function is even (has y-axis symmetry)

If the numerator or denominator has no symmetry, that automatically means that the rational function has no symmetry (y-axis or origin).

I. List the symmetry of the following functions.

______________1. $y = \dfrac{x^3 - x}{x^2 - 2}$

______________2. $y = \dfrac{x}{x^2 - 4}$

______________3. $y = \dfrac{2}{x^2}$

______________4. $y = \dfrac{x^2 - x}{x^3 + x - 5}$

______________5. $y = \dfrac{x^3}{x^5 - x}$

______________6. $y = x^3 - x$

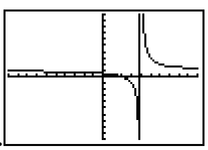
______________7. $y = x^2 + 3$

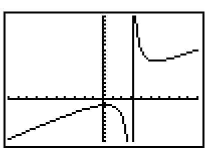
______________8. $y = e^x + 2$

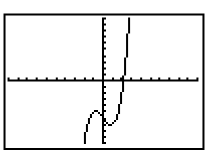
______________9. $y = \cos x + x^2$

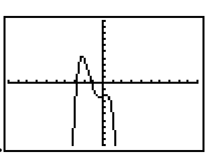
______________10. $y = \dfrac{\sin x}{x^3}$

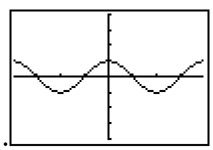
List the type of function given in each graph.(Polynomial, Rational, Trigonometric, Exponential, Logarithmic, Basic Function that doesn't fit a category)

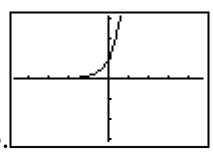
1. 

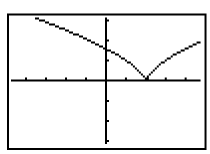
2. 

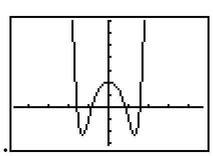
3. 

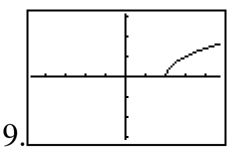
4. 

5. 

6. 

7. 

8. 

9. 

10.