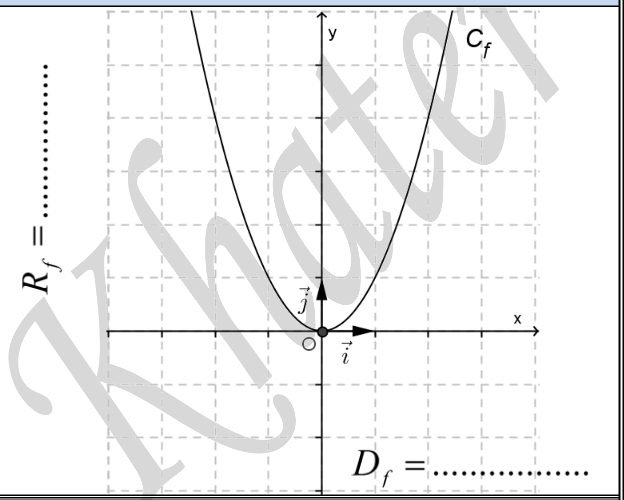
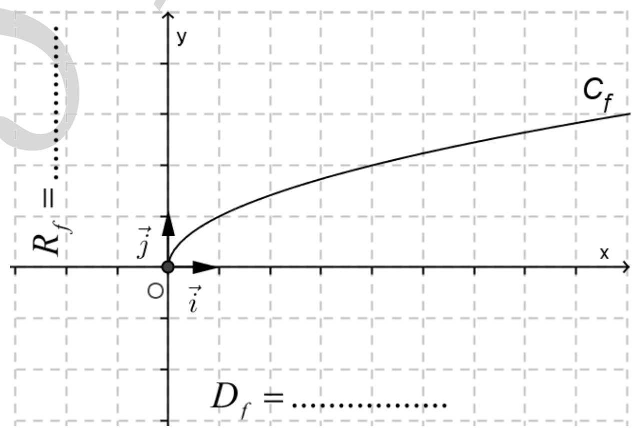
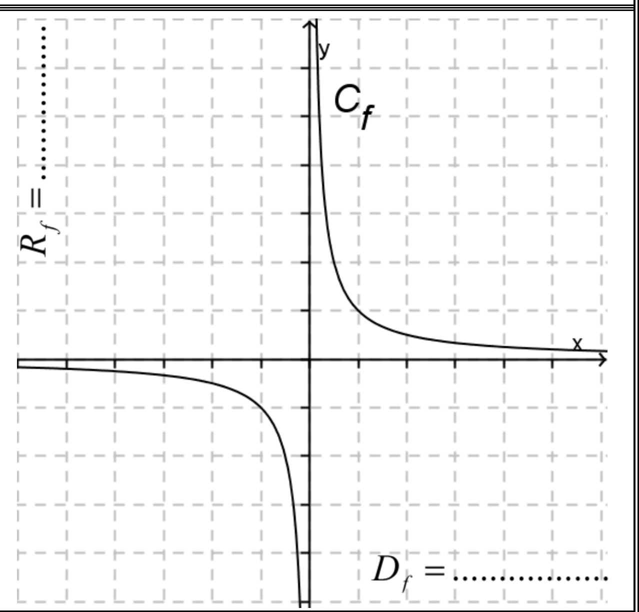
➢ Sketching graphs by Translation

Functions	Relation between $f(x)$ & $g(x)$	Translation vector $\vec{s}(x;y)$	Sketching C_g using C_f by translation
1) $f(x)=x^2$		$g_k(x)$ is the translate of $f(x)$ by:	
$g_1(x)=x^2+2$	$g_1(x)=$..........		
$g_2(x)=x^2-2$	$g_2(x)=$..........		
$g_3(x)=(x-1)^2$	$g_3(x)=$.........		
$g_4(x)=(x+1)^2$	$g_4(x)=$..........		
$g_5(x)=(x+1)^2-2$	$g_5(x)=$..........		
2) $f(x)=\sqrt{x}$			
$g_1(x)=\sqrt{x}+2$	$g_1(x)=$..........		
$g_2(x)=\sqrt{x}-2$	$g_2(x)=$..........		
$g_3(x)=\sqrt{x-1}$	$g_3(x)=$.........		
$g_4(x)=\sqrt{x+1}$	$g_4(x)=$..........		
$g_5(x)=\sqrt{x+1}-2$	$g_5(x)=$..........		
3) $f(x)=\dfrac{1}{x}$			
$g_1(x)=\dfrac{1}{x}+2$	$g_1(x)=$..........		
$g_2(x)=\dfrac{1}{x}-2$	$g_2(x)=$..........		
$g_3(x)=\dfrac{1}{x-1}$	$g_3(x)=$.........		
$g_4(x)=\dfrac{1}{x+1}$	$g_4(x)=$..........		
$g_5(x)=\dfrac{1}{x+1}-1$	$g_5(x)=$..........		

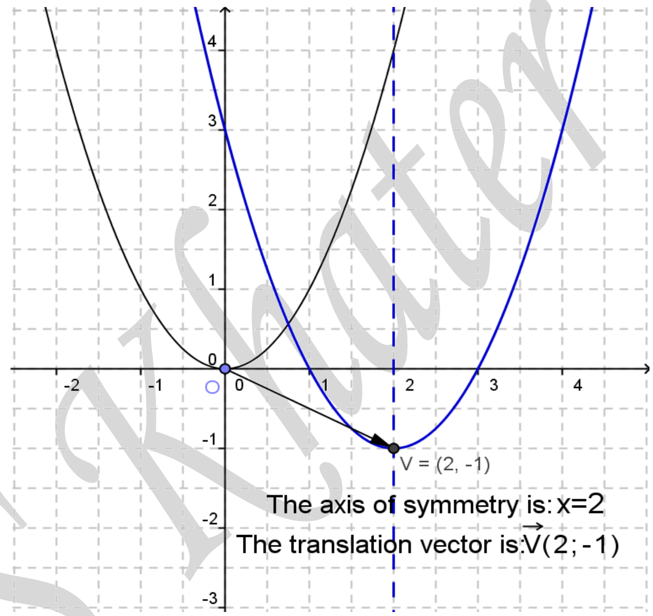
Sketching of basic functions by Translation

A- Parabola:

The graph of $g : g(x) = (x-h)^2 + k$, is similar to that of the basic function,

$f : f(x) = x^2$ ***Shifted:***

Horizontally ***h*** units to the		***Vertically*** ***k*** units	
Right	If, ……	***Upwards***	If, ……
Left	If, ……	***Downwards***	If, ……



✓ ***Note that:***

- The equation of translation is:

$$g(x) = f(x-h) + k$$

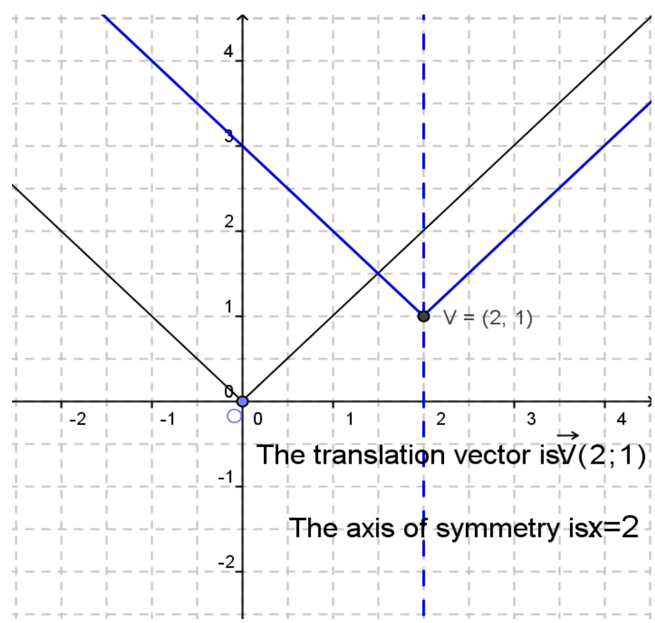
- The ***translation vector*** is: ……………..
- The ***new*** axis of symmetry is: …………
- The **…………………………** is $V(h,k)$

B- Absolute value function:

The graph of $g : g(x) = |x-h| + k$ is similar to that of the basic function:

$f : f(x) = |x|$ ***Shifted:***

Horizontally ***h*** units to the		***Vertically*** ***k*** units	
Right	If, ……	***Upwards***	If, ……
Left	If, ……	***Downwards***	If, ……



✓ ***Note that:***

- The equation of translation is:

$$g(x) = f(x-h) + k$$

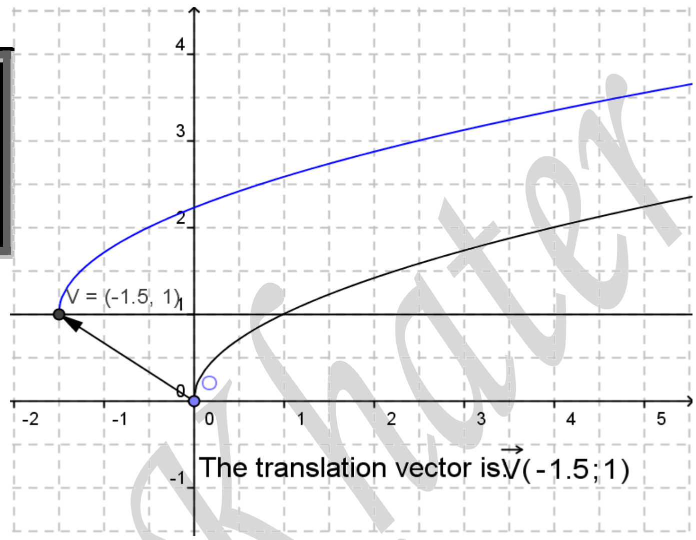
- The ***translation vector*** is $\vec{s}(h,k)$
- The ………………………is $x = h$
- The ***new vertex*** is: ………………

C- Square root function:

The graph of $g: g(x)=\sqrt{x-h}+k$ is similar to that of the basic function,

$f: f(x)=\sqrt{x}$ ***Shifted:***

Horizontally ***h*** units to the		***Vertically*** ***k*** units	
Right	If, ……	***Upwards***	If, ……
Left	If, ……	***Downwards***	If, ……



✓ ***Note that:***

- The equation of translation is:

  ………………………………………

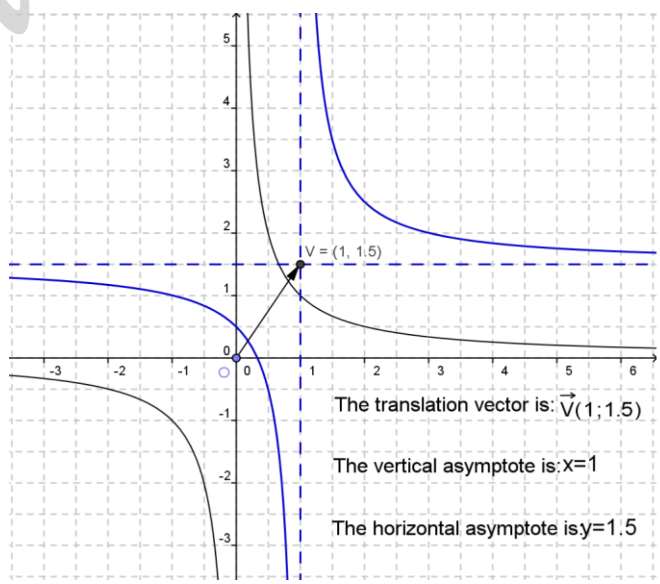
- The ***translation vector*** is: …………
- The ………………………is $x=h$
- The ***new vertex*** is: ………………

D- Rational function:

The graph of $g: g(x)=\dfrac{1}{x-h}+k$ is similar to that of the basic function,

$f: f(x)=\dfrac{1}{x}$ ***Shifted:***

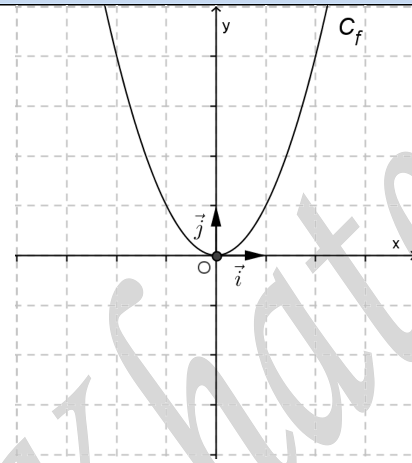
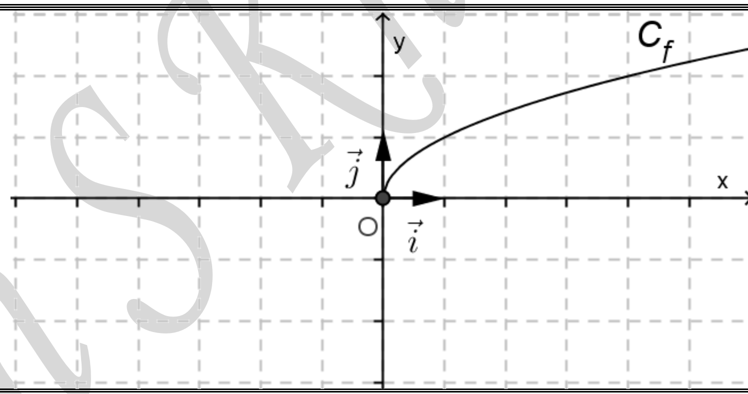
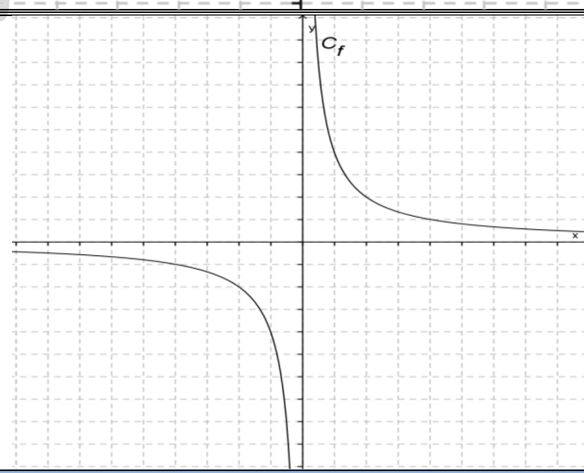
Horizontally ***h*** units to the		***Vertically*** ***k*** units	
Right	If, ……	***Upwards***	If, ……
Left	If, ……	***Downwards***	If, ……



✓ ***Note that:*** C_g admits a

- ***Translation vector*** $\vec{v}(\ldots.,\ldots..)$
- center of symmetry $C(\ldots.,\ldots..)$
- ***Vertical*** asymptote of equation ………..
- ***Horizontal*** asymptote of equation ……..
- ***New vertex*** $V(\ldots.,\ldots..)$
- The ***equation*** of translation is: ………………………………

Sketching graphs of basic functions by symmetry

Functions	*Relation between* $f(x)$ & $g(x)$.	*Type of symmetry between* C_f & C_g.	*Sketching* C_g *using* C_f *by symmetry*
A. $f(x)=x^2$		(C_g)&(C_f) Are symmetric with respect to ………… Since,……… …………… …………… …………… …………… ……………	
$g(x)=-x^2$	$g(x)=$……..		
B. $f(x)=\sqrt{x}$			
$g_1(x)=\sqrt{-x}$	$g_1(x)=$……..		
$g_2(x)=-\sqrt{x}$	$g_2(x)=$……..		
$g_3(x)=-\sqrt{-x}$	$g_3(x)=$……..		
C. $f(x)=\dfrac{1}{x}$			
$g(x)=-\dfrac{1}{x}$	$g(x)=$……..		

Conclusions

If $\forall\ (x;y)\in C_f\ \exists\ (x;-y)\in C_g$ *then* C_f & C_g *are symmetric w.r.t x'ox.* **OR** $(x;y)\xrightarrow{symm\ \ w.r.t\ x'ox}(x;-y)$

If $\forall\ (x;y)\in C_f\ \exists\ (-x;y)\in C_g$ *then* C_f & C_g *are symmetric w.r.t y'oy.* **OR** $(x;y)\xrightarrow{symm\ \ w.r.t\ y'oy}(-x;y)$

Deduce the element of symmetry of a function around the origin:
……………………………………………………………………………………………………