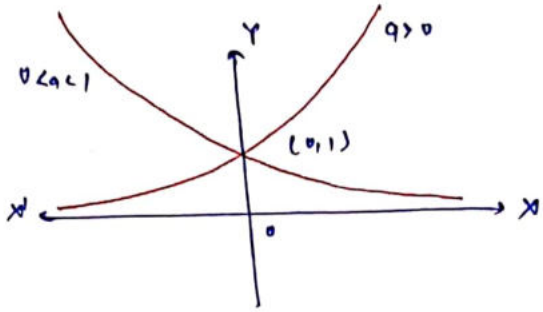
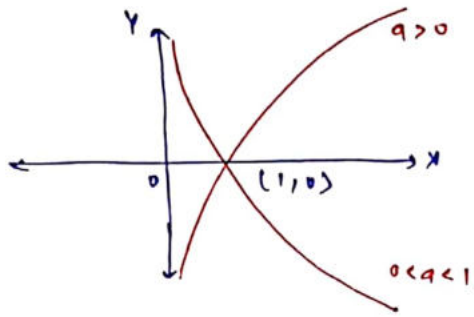
Curve Transformation ----

(v) $y = a^x$ $(a>0, a \neq 1 \ \& \ x \in R)$



(vi) $y = \log_a x$ $(a>0, a \neq 1, x>0)$

(a^x & $\log_a x$ are inverse of each other).



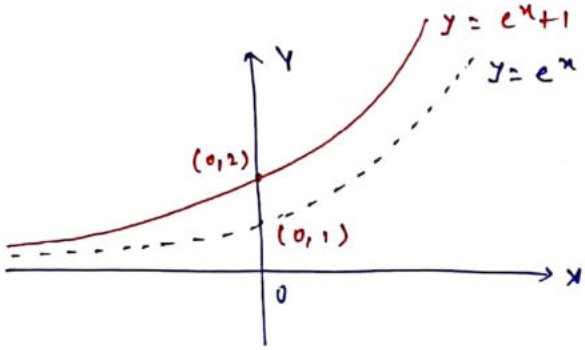
(~~vii~~)

Type (I) : $y = f(x) \pm c$

Example :-

(i) $y = e^x + 1$

In this Transformation curve will shift along y-axis.



Students can try ---

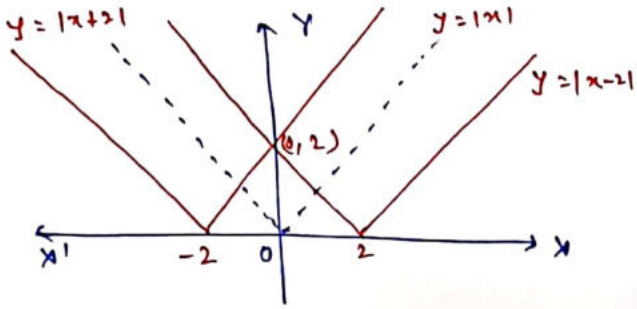
(ii) $y = |x| - 2$ (iii) $y = (\sin^{-1} x) + 1$ (iv) $y = \log_a x + 1$ (v) $y = \log_2(2x)$

Type (II) : $y = f(x \pm c)$

In this case, curve will shift along x-axis.

Example :

(i) $y = |x \pm 2|$



Students can try ----

(ii) $y = \sin(x - \pi/2)$

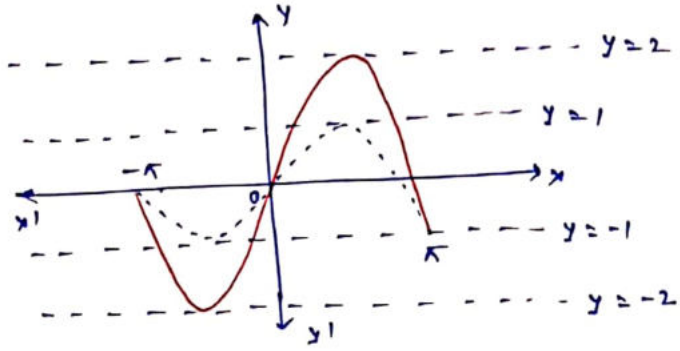
(iii) $y = e^{(x-2)}$

(iv) $y = \ln(x-1)$

Type (III) : $y = a\, f(x)$.

In this case amplitude of the graph changes depending upon multiplier. If '$a>1$', y co-ordinate will increase accordingly & if $0<a<1$, y co-ordinate will decrease accordingly.

Example: (i) $y = 2\sin x$



Students can try ---

(ii) $y = \frac{1}{2}\sin x$

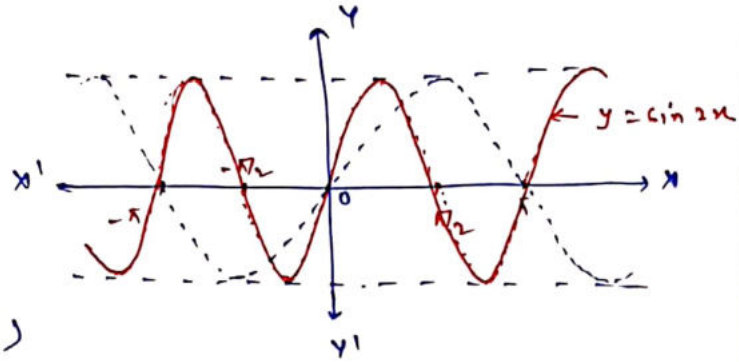
(iii) $y = 2|x|$ & $\frac{1}{2}|x|$

Type (iv): $y = f(ax)$

In this case, graph will shrink or, expand along x-axis.

For example:

(i) $y = \sin 2x$



As we can see from the graph, period of $\sin 2x$ is π

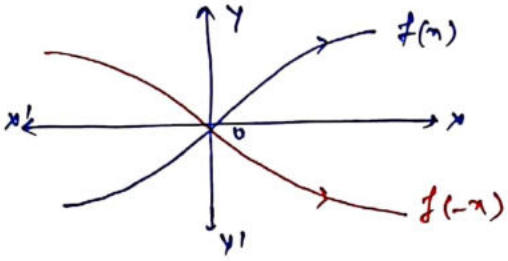
Students can try ---

(ii) $y = \sin x/2$ (iii) $y = \log_2(2x)$

(iv) $y = \sin^{-1}(x/2)$

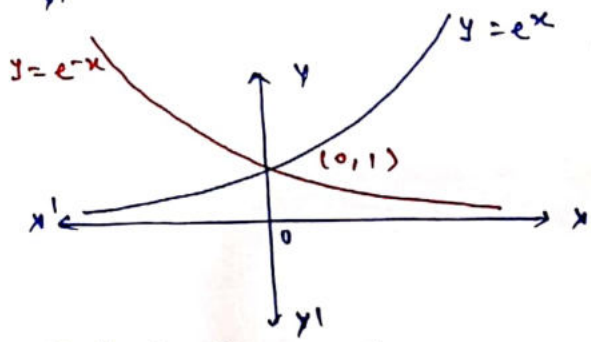
Type (v): $y = f(-x)$

Take the image of the curve $y = f(x)$ in y-axis as a plane mirror.



example:

(i) $y = e^{-x}$



Note:- Turn the graph of $f(x)$ by 180° about x-axis.

Students can try ----

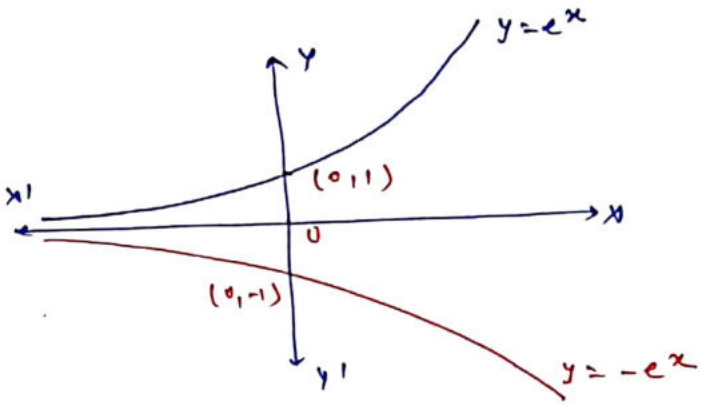
(ii) $y = \log_e(-x)$ (iii) $y = \sin^{-1}(-x)$ (iv) $y = \sin^{-1}(-x)$ (v) $y = |-x|$

Type (vi) : $y = -f(x)$

Take the image of $y = f(x)$ in the x-axis as a plane mirror. Also, we can turn the graph of $f(x)$ by $180°$ about x-axis.

For example :

(i) $y = -e^{+x}$



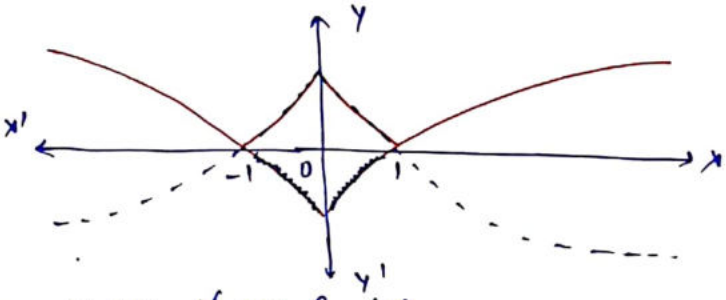
Students can try ---

(ii) $y = -\log x$ (iii) $y = -\{x\}$

(iv) $y = -\cos^{-1} x$ (v) $y = -e^{-x}$

Type (vii) : $y = |f(x)|$

Take the mirror image (in x-axis) of the portions of the graph of $f(x)$ which lies below x-axis.

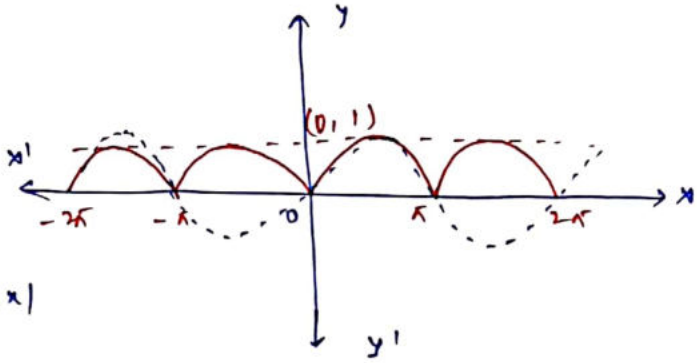


$f(x)$ is differentiable $\forall\, x \in R - \{0\}$.

so, $|f(x)|$ differentiable $\forall\, x \in R - \{-1, 0, 1\}$

For example :

(i) $y = |\sin x|$



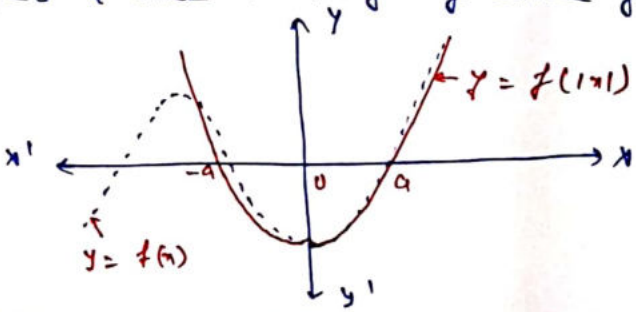
Students can try ---

(ii) $y = |\log x|$ (iii) $y = |x-2|$

(iv) $y = |x^2 - 2x - 2|$ (v) $y = |\sin x|$

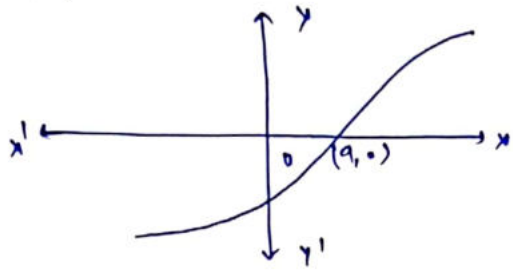
Type (viii) : $y = f(|x|)$

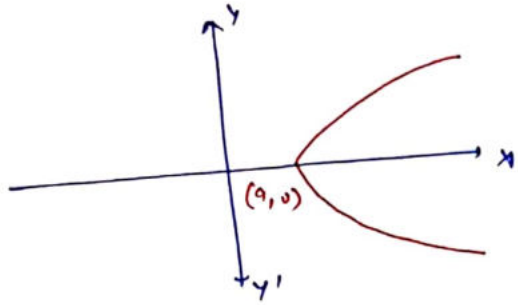
Neglect the curve for $x < 0$ & take the image of curve for $x \geq 0$ about y-axis.



Type : (ix) : $|y| = f(x)$

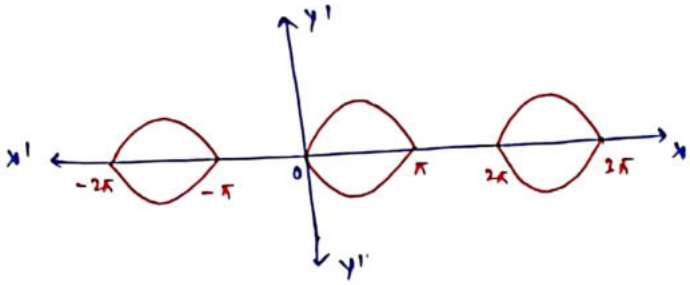
Remove the portion of the graph which lies below x-axis.
plot the remaining portion of the graph, and also its mirror image in the x-axis.





for example :

(i) $|y| = \sin x$



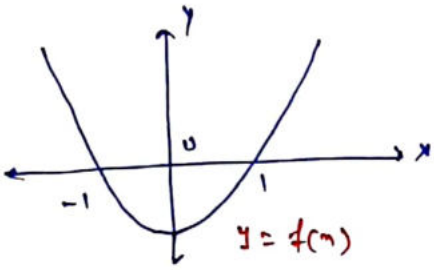
Students can try ---

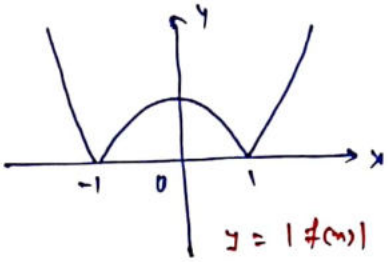
(ii) $|y| = (x-1)(x-2)$

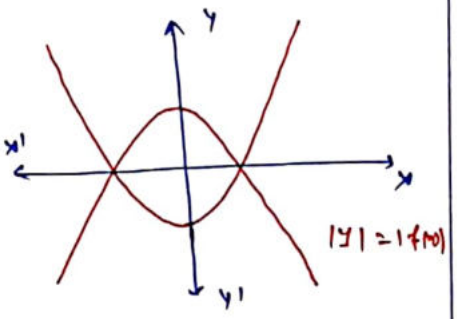
(iii) $|y| = \log_2 x$

(iv) $|x| + |y| = 1$ (v) $|x| - |y| = 1$.

Type (x) : $|y| = |f(x)| \Rightarrow \begin{cases} \text{plot } y = |f(x)| \\ \text{plot } |y| = |f(x)|. \end{cases}$

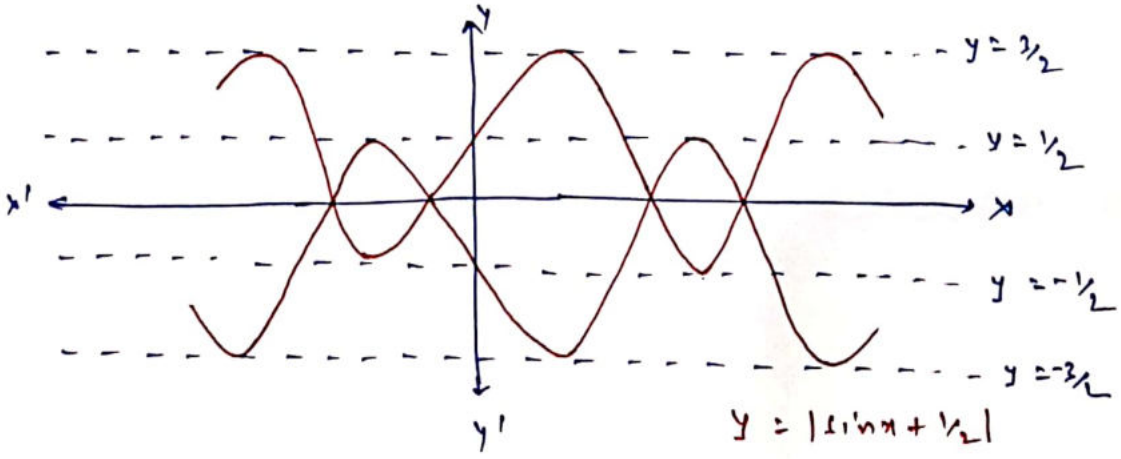






Students can try :-

(i) $|y| = |e^{-x}|$ (ii) $|y| = |e^{x} - 1|$ (iii) $|y| = |\sin x + 1/2|$



Students can further try.

$|y| = |e^{-|x|} - 1/2|$, $|y| = |\log|x||$, $|y| = ||x|^2 - 3|x| - 2|$

Some special Transformation :

Type (x1) : $y = [f(x)]$

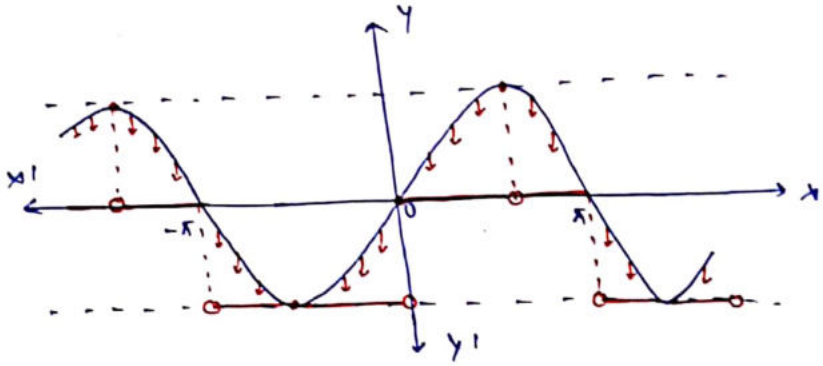
→ plot $f(x)$

→ Mark the intervals of unit length with integers as end points on y-axis.

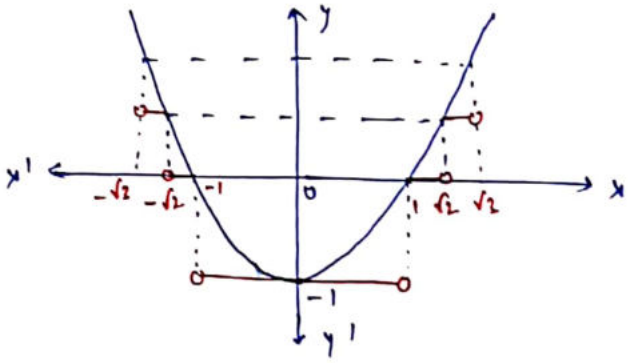
→ Mark the corresponding intervals {with the help of graph $f(x)$} on x-axis.

→ plot the value of $[f(x)]$ for each of the marked intervals.

(i) $y = [\sin x]$



(ii) $y = [x^2 - 1]$, $-2 \le x \le 2$



(iii) $y = [\sqrt{2 - x^2}]$