

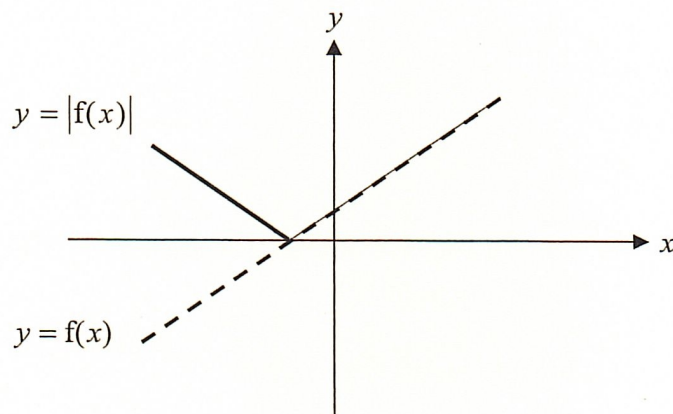


Name: Wen Jun Han (27) Class: 3E1 Date: 24 May

MA302.4.X1 – More Geometrical Transformations

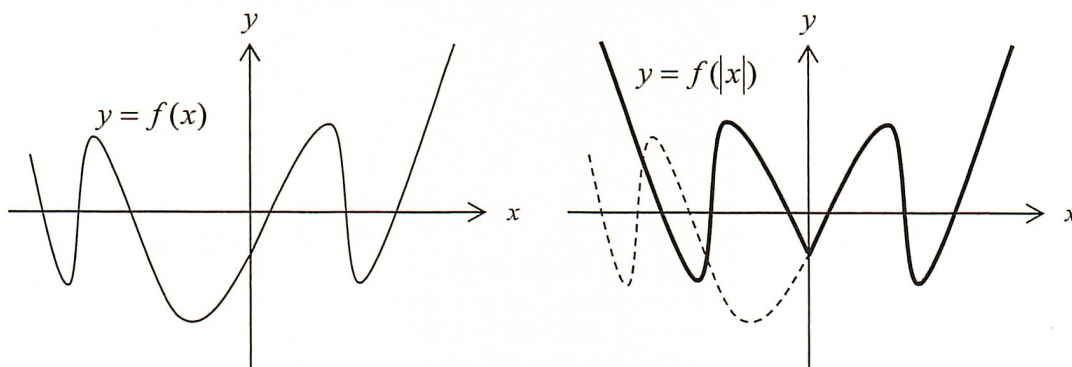
You have already encountered some basic transformation of graphs in the previous topics.

For example, the graph of $y = |f(x)|$ is derived from that of $y = f(x)$ by **reflecting** the portion of the graph which lies below the x -axis **about the x -axis**.

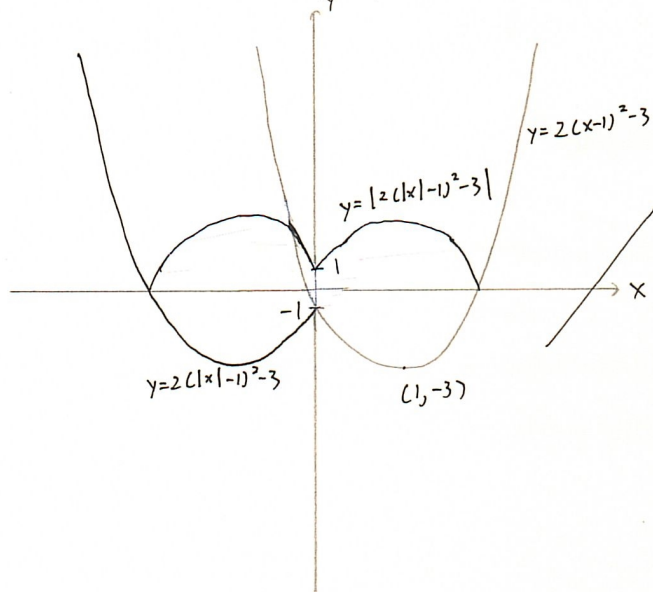


The case of $y = f(|x|)$

Here notice that $f(-x) = f(x)$ so we would expect the graph to be symmetric about the y -axis. The portions of the original graph where $x < 0$ are totally ignored under the transformation.



E1. Draw the graph of $y = 2(x-1)^2 - 3$. Hence or otherwise, draw the graphs of $y = 2(|x|-1)^2 - 3$ and $y = |2(|x|-1)^2 - 3|$, labelling your graphs clearly.

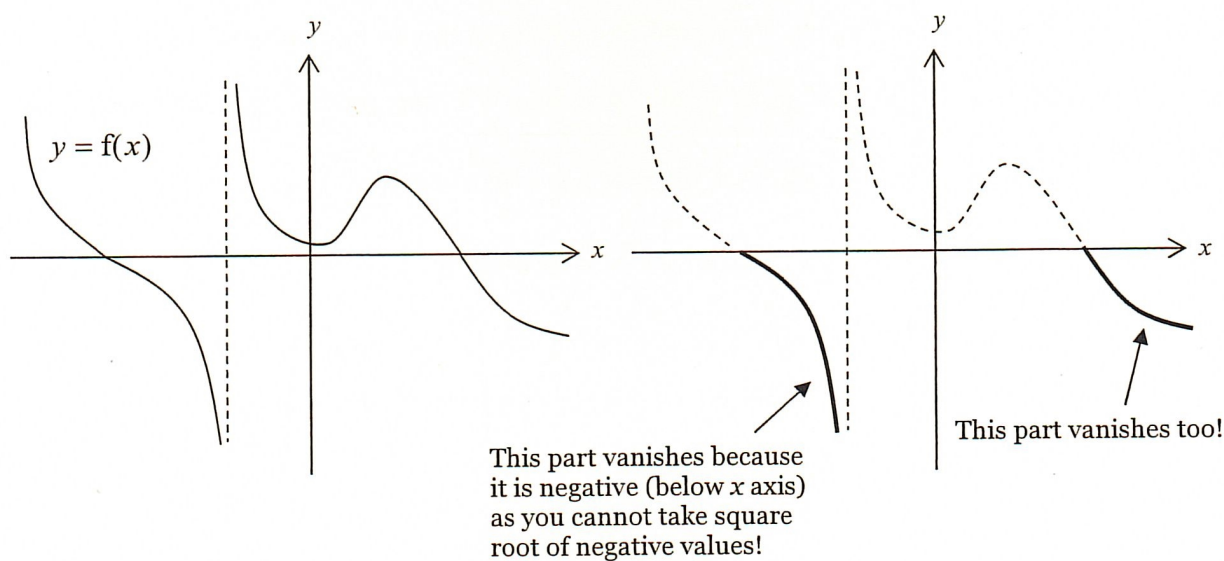


The case of $y^2 = f(x)$

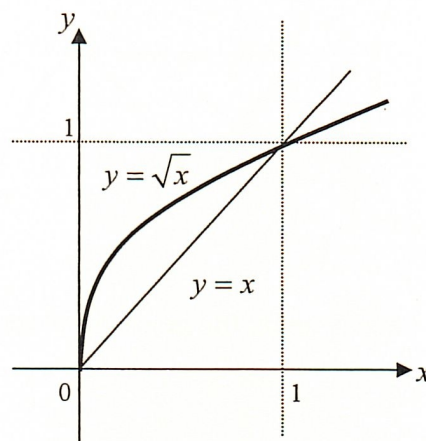
This can be rewritten as $y = \pm\sqrt{f(x)}$. So for each x , there will have two values of y , and they are negatives of each other.

$$(x, y) \mapsto (x, +\sqrt{y}) \text{ \& } (x, -\sqrt{y})$$

Since $\sqrt{y}$ is not real when $y < 0$, we would not expect to see anything happening to the parts of the graph which lie below the x -axis. After the transformation, these parts simply vanish.

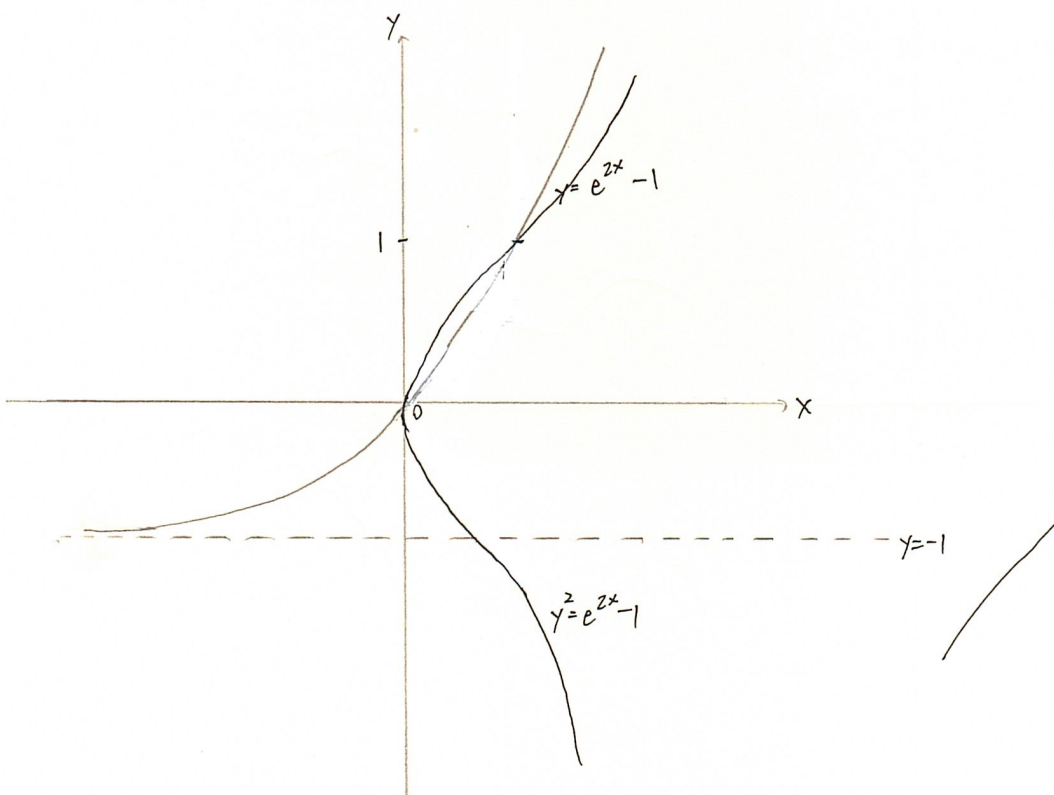


Let us look at the function $f: y \mapsto \sqrt{y}$ closely. We know that if $y > 1$, $\sqrt{y} < y$, whereas for $y = 1$, $\sqrt{y} = y$ (invariant point). For $0 < y < 1$, however, $\sqrt{y} > y$. Hence, while we expect the graph to be 'compressed' when the function undergoes the transformation $f: y \mapsto \sqrt{y}$, the graph actually takes a different 'turn' for values of y between 0 and 1.

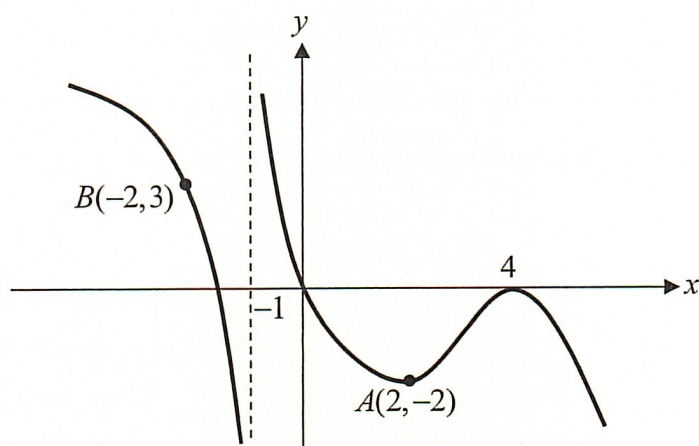


- $y^2 = f(x)$
 $y = \pm \sqrt{f(x)}$
 ① $f(x) < 0$, graph vanishes
 ② $f(x) > 1$ and $f(x) < 1$ intersects
 ③ reflection about x-axis

S1. Sketch the graph of $y = e^{2x} - 1$. Hence sketch the graph of $y^2 = e^{2x} - 1$ on the same axes, showing clearly any intercepts with the axes and asymptotes.



S2. Below is a graph of $y = f(x)$.



- (a) Determine the images of A and B under the graph of $y = |f(x)| + 1$.

$A': (2, 3)$

$B': (-2, 4)$

- (b) Describe what happens to the asymptote $x = -1$ under the graph of $y = 2f(-x)$.

The asymptote will be at $x = 1$

- (c) Sketch the graph of $y = 1 - f(x)$.

