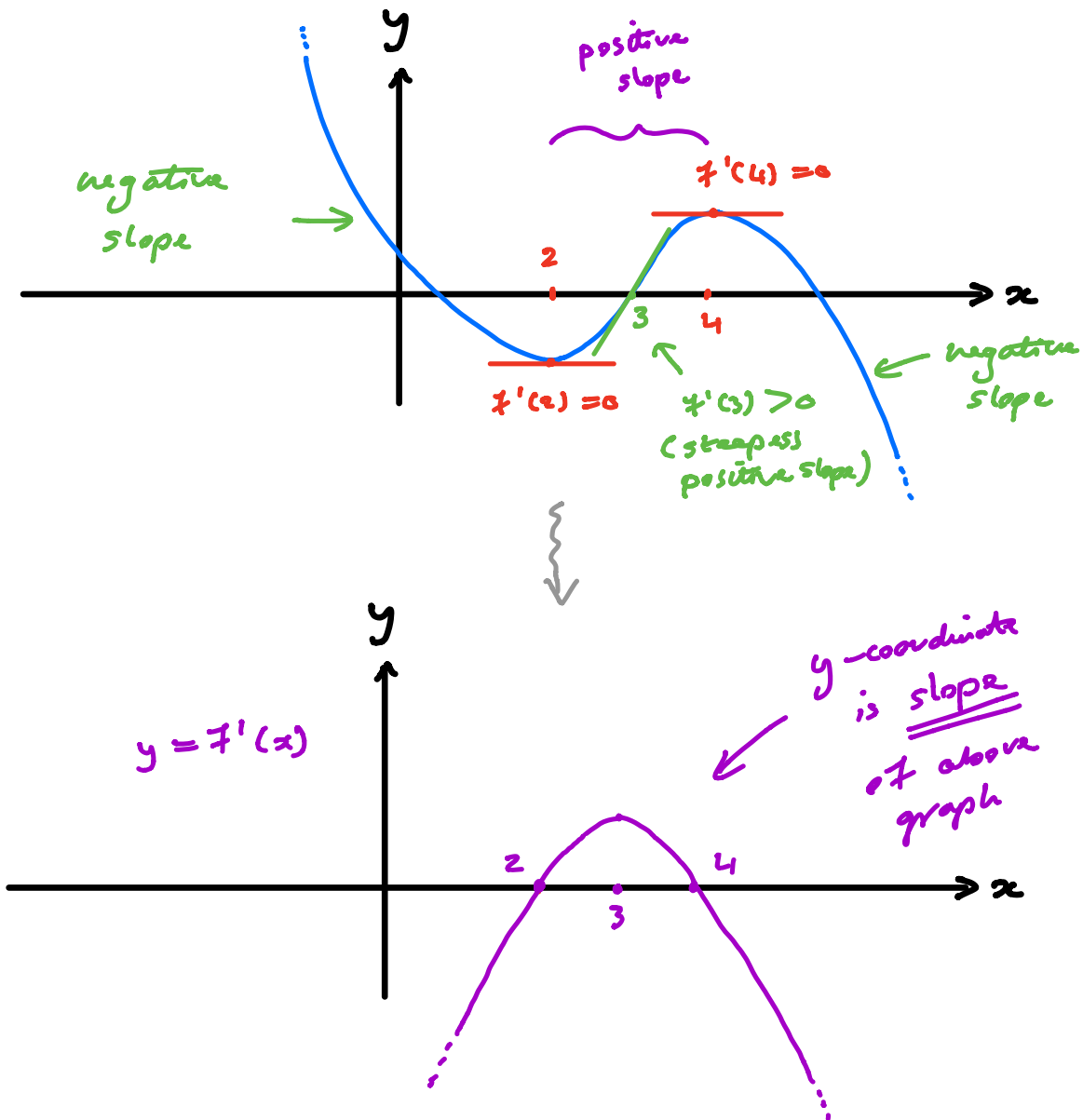
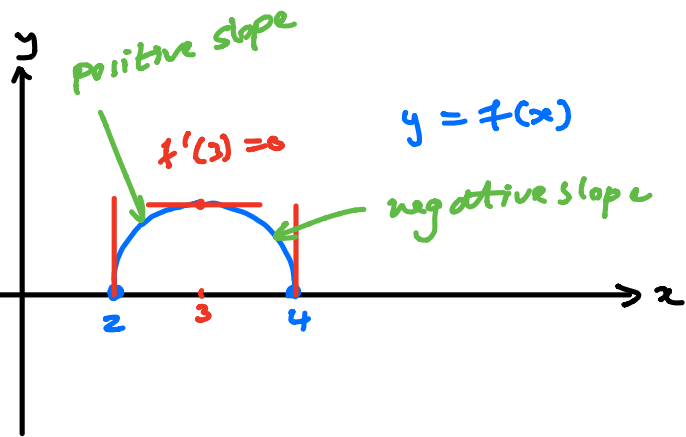
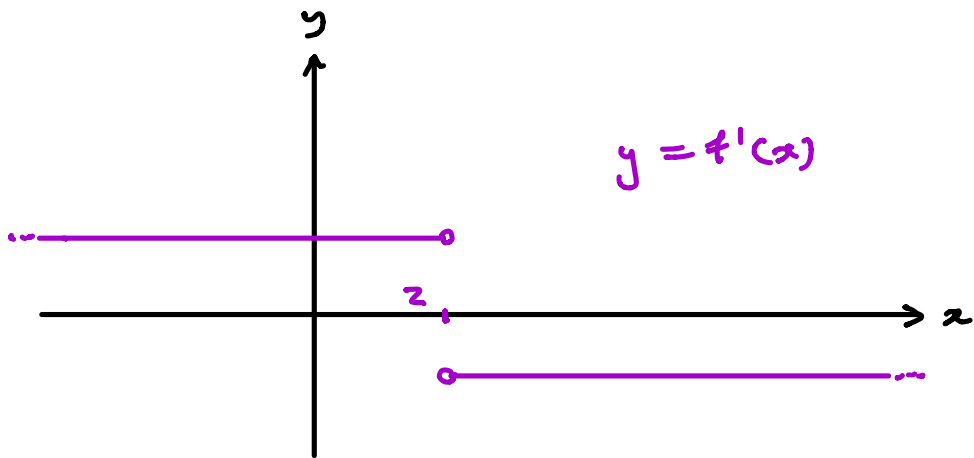
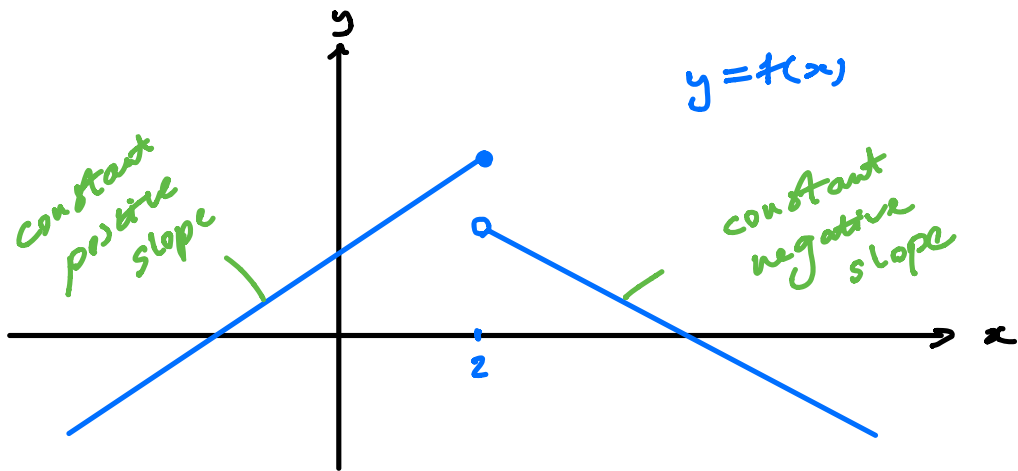


# Graphical Differentiation

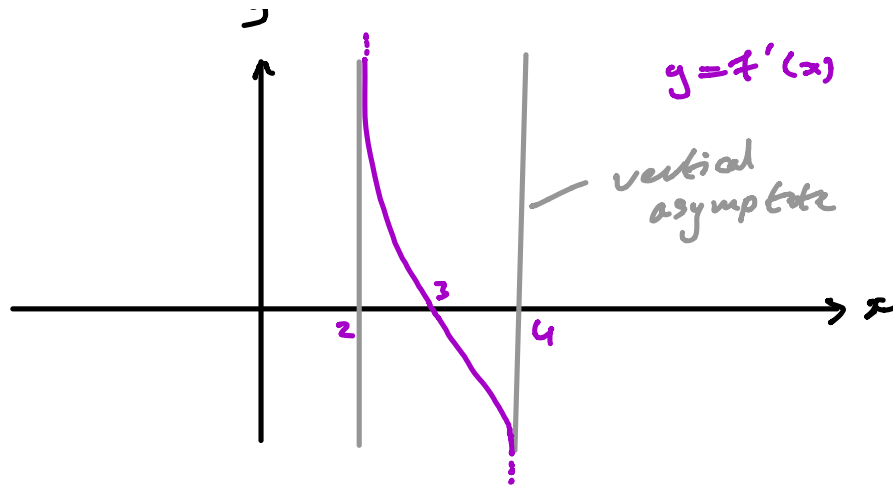
How can we understand the derivative of a function if we are only given a graph?

## Examples





2

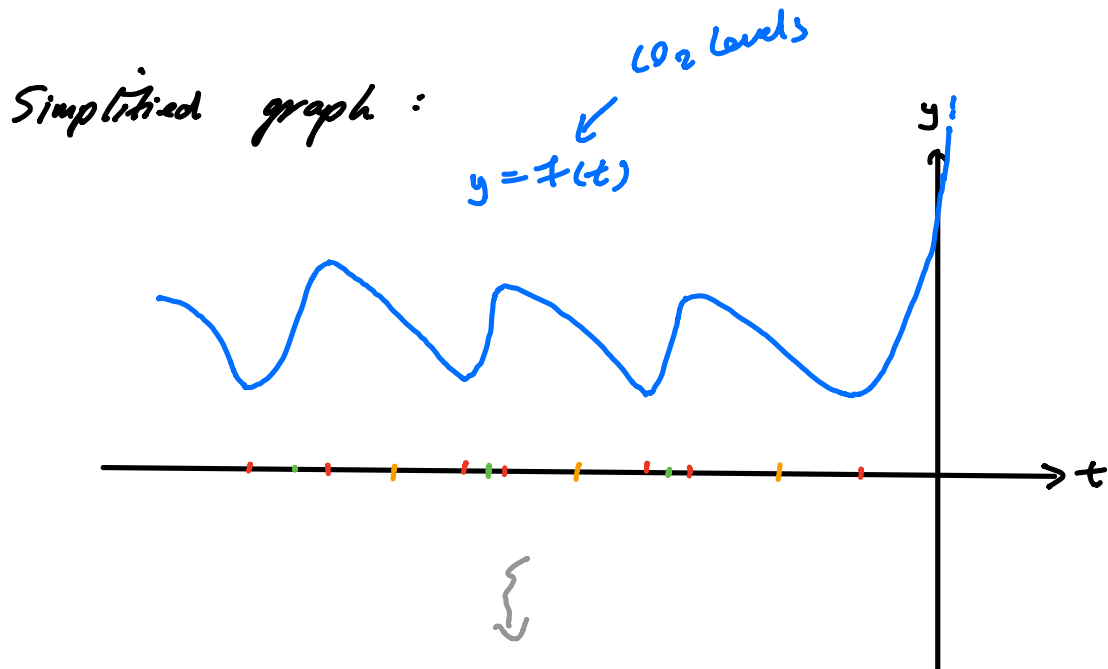
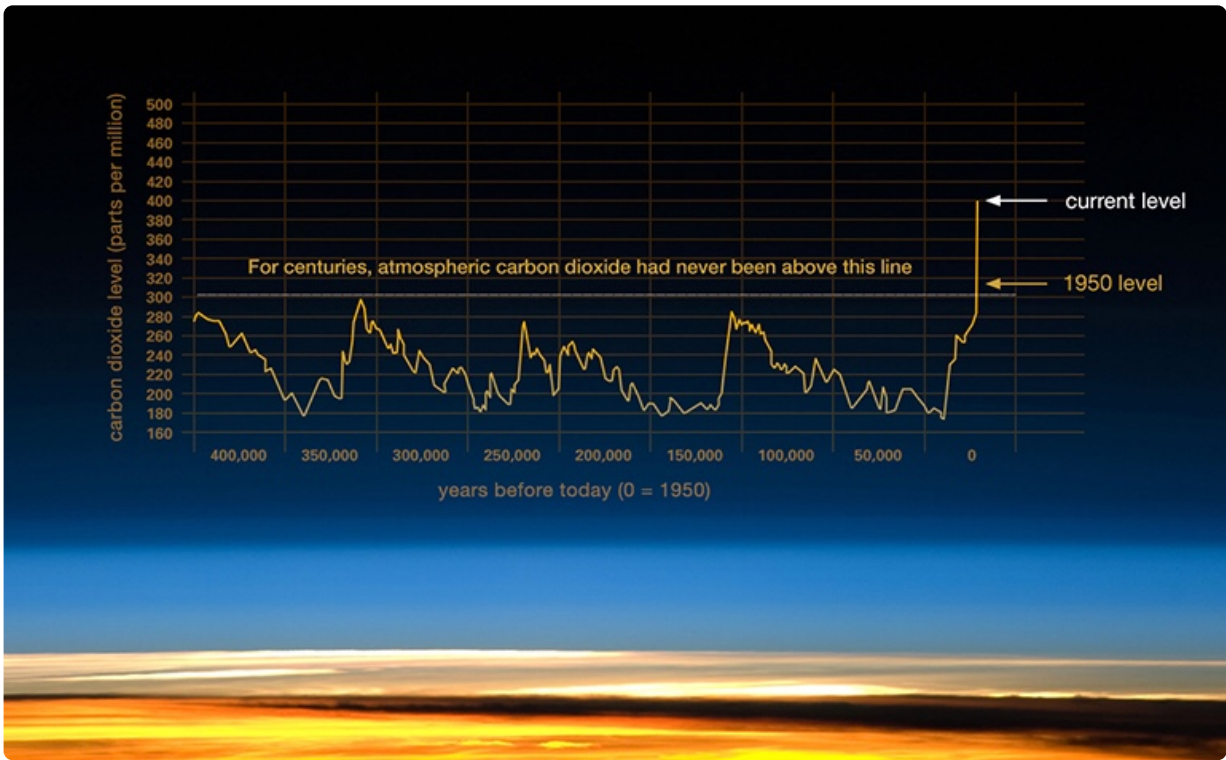


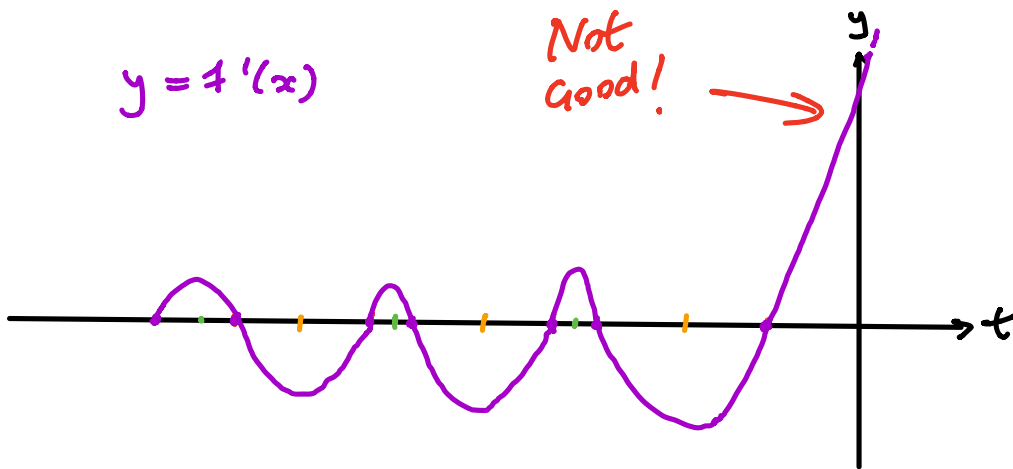
### Conclusion :

- 1/ Find where tangent is horizontal.  
These are where  $y = f'(x)$  will cross  $x$ -axis
- 2/ Find points of max/min steepness.  
These will be max/min points in graph of  $y = f'(x)$
- 3/ Look for straight lines. These will be constant parts of graph  $y = f'(x)$ .
- 4/ Look for vertical tangent lines. These will be vertical asymptotes in graph of  $y = f'(x)$ .
- 5/ Be careful of corners, discontinuities, etc.  
The graph  $y = f'(x)$  will have a gap (0) there.

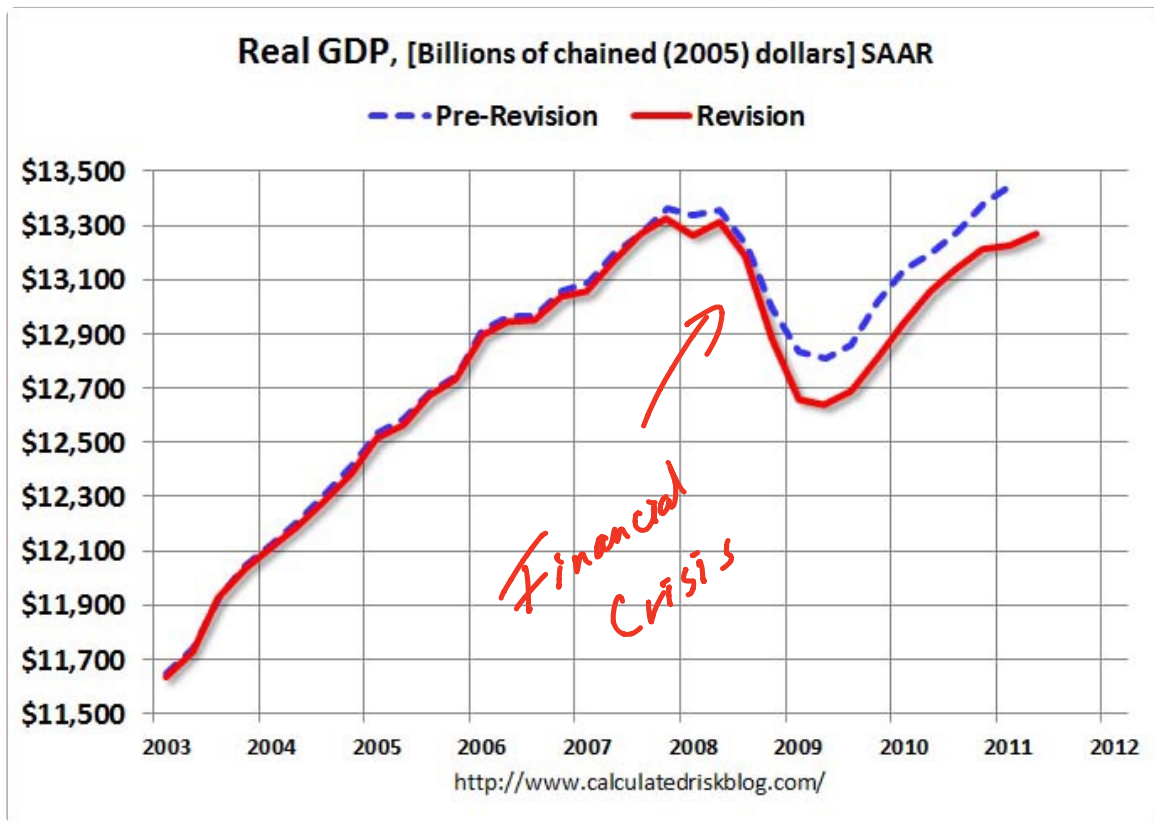
## Real Examples :

1/ CO<sub>2</sub> levels in atmosphere.

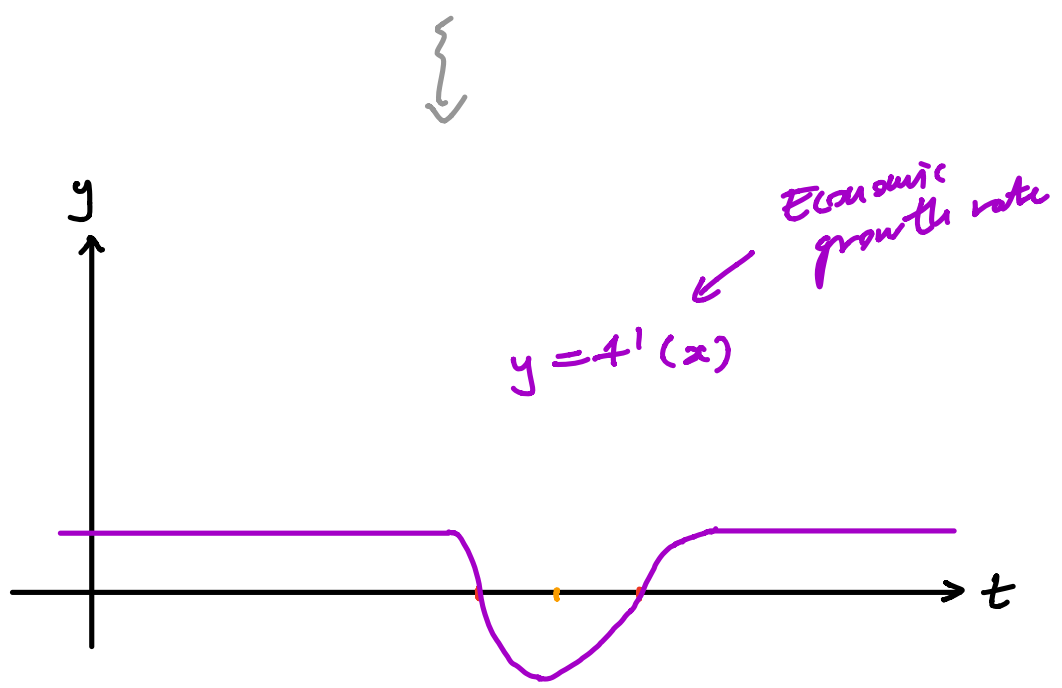
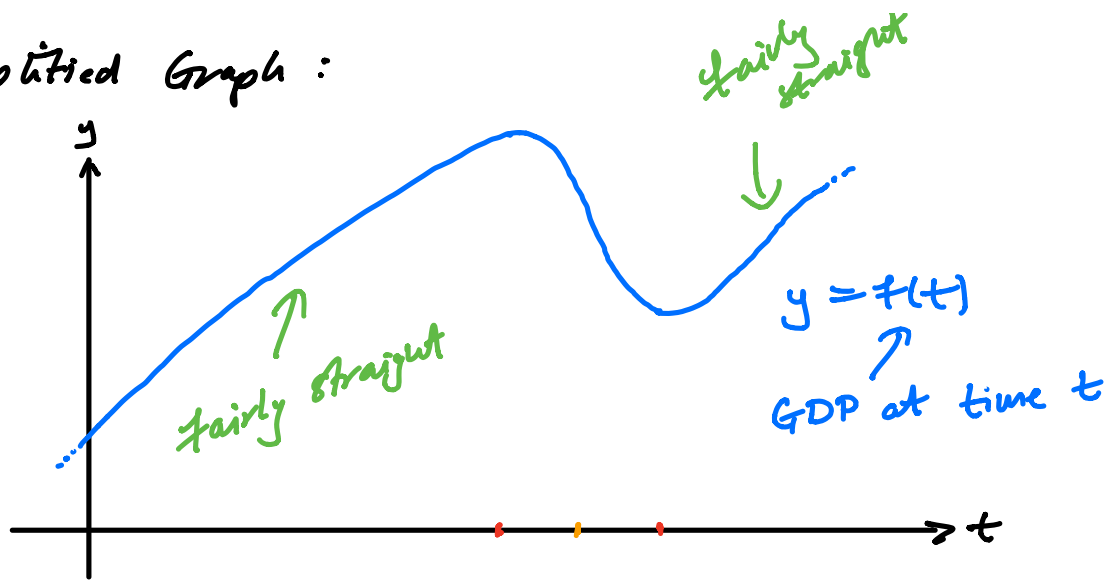




2/ GDP (Gross Domestic Product) over time.  
 Total value of all goods and services in country



Simplified Graph :



3/

