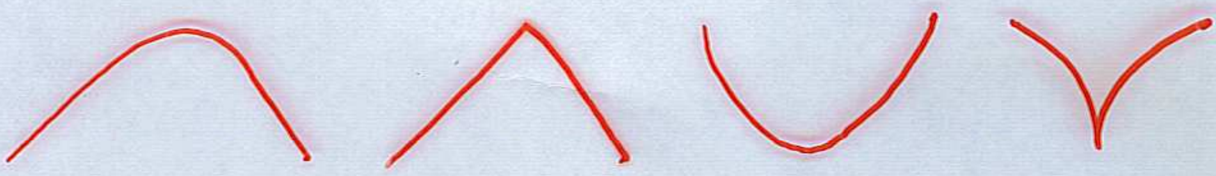
Yesterday: applications where derivatives are used to measure "rates of change".

Today: applications where derivatives are used to measure the "slope of a tangent".

At points where a function $f(x)$ is a maximum or a minimum



we have that either the derivative $f'(x)$ is zero <u>or</u> $f'(x)$ does not exist at the point.

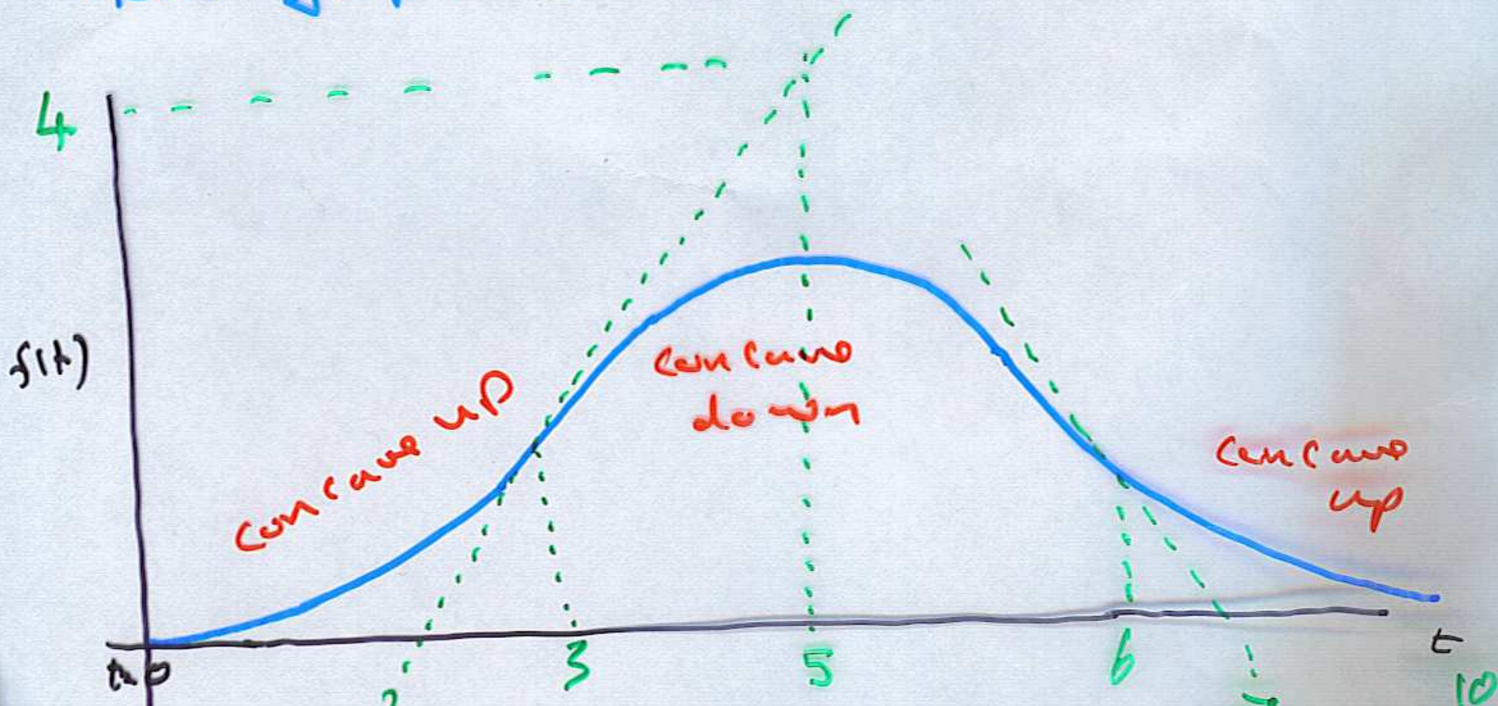
Tuesday: derivatives & rates of change

Wed: derivatives and maxima & minima

Today: derivatives and curves

Understanding graphs of functions

Illustration: A car drives on a long straight track. At time t its distance from the start is $f(t)$. The graph of $f(t)$ is:



f' + + + + + + + ++ 0 − − − − − − − − − −

f'' + + + + + + +0 − − − − − − − −0 + + + + ++

Determine when :

1) speed is positive Ans: $[0, 5]$

2) speed negative Ans: $[5, 10]$

3) car is accelerating Ans: $[0, 3] \cup [6, 10]$

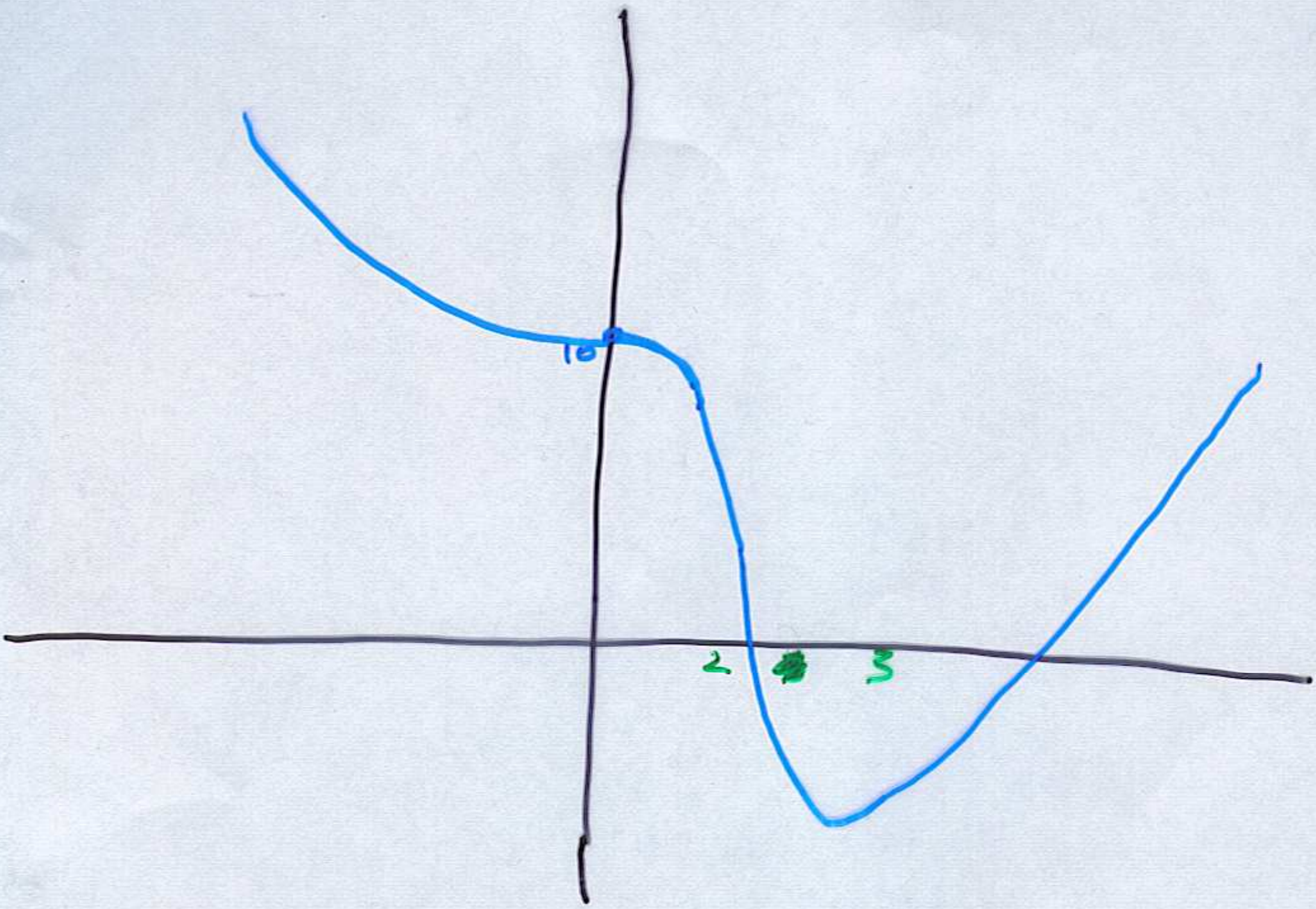
4) car is decelerating Ans $[3, 6]$

5) ~~how fast is the car moving at t =~~
what is fastest car is moving between $t = 0$ and $t = 5$. Ans $= \frac{4}{3}$

<u>Example</u> Graph $y = x^4 - 4x^3 + 10$

$$y' = 4x^3 - 12x^2 = 4x^2(x - 3)$$

$$y'' = 12x^2 - 24x = 12x(x - 2)$$



y' - - - - - - - - - - 0 - - 0 + + + + + + + + + + + + +

y'' + + + + + + + + + + 0 - - 0 + + + + + + + + + + + +

x		0	2	3	
y	↘		↘		↗
	Concave ✓		Concave down		Concave up