Last Monday: derivatives & rates of change

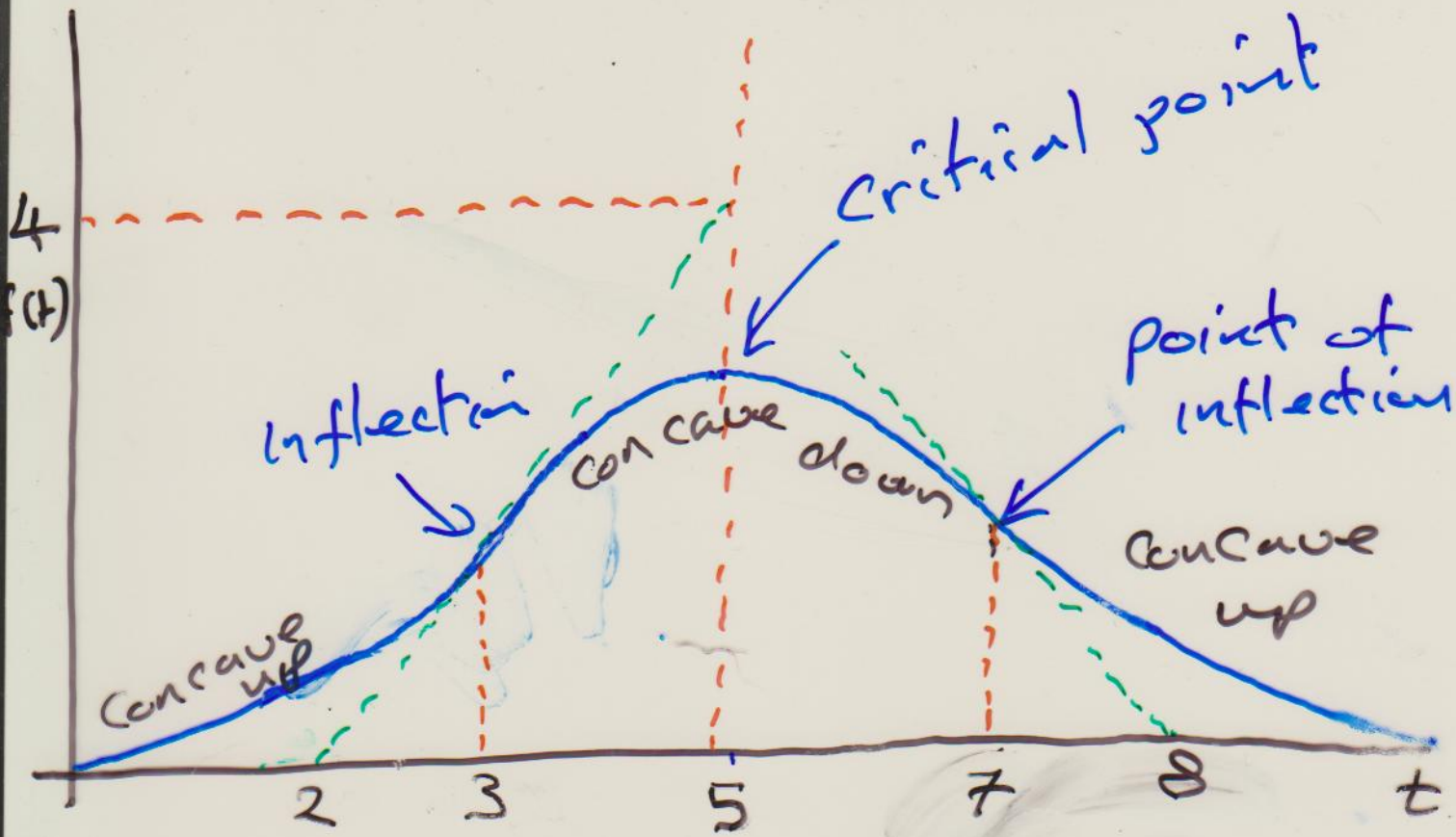
Last Tuesday: derivatives & finding maxima, minima.

Today: derivatives & 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:




Determine when:

1) speed is positive — Ans: $[0, 5)$
2) speed negative — Ans: $(5, 10]$
3) car is accelerating — $[0,3] \cup [7, 10]$
4) car is decelerating — $[3, 7]$
5) what is fastest speed between $t=0$ & $t=5$? — $\frac{4}{3}$

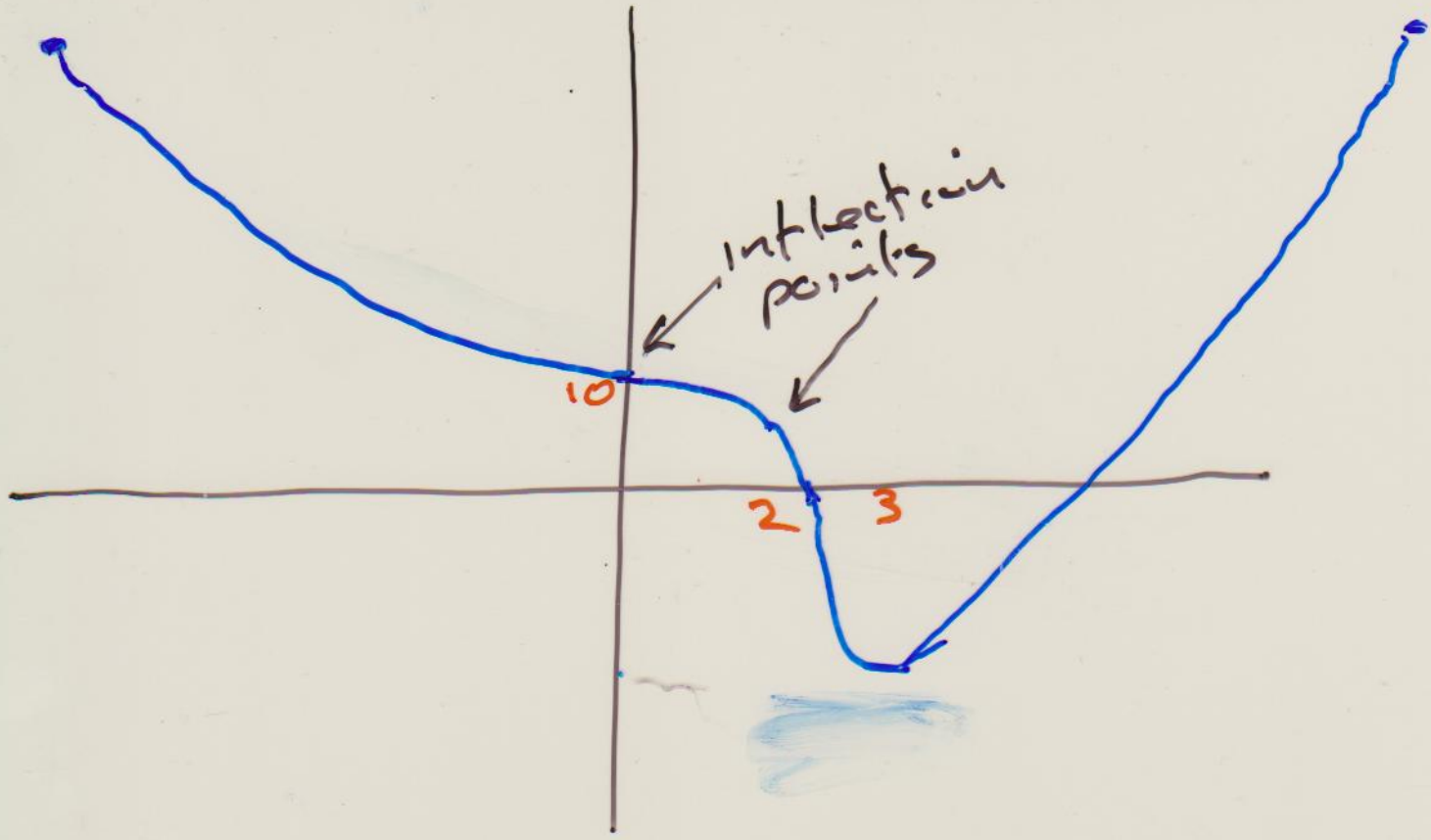
Example Graph $y = x^4 - 4x^3 + 10$

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

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

$y(2) > 0$

$y(3) < 0$




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

concave down

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

concave up

concave up

y + + + + + + +

**Defn** if $f''(x) < 0$ concave down

if $f''(x) > 0$ concave up

concavity changes: point of inflection

if $f'(x) = 0$ or not exist, critical point