

1. Brute force

- checks every possible line for every pair of points

$$O(n^2)$$

check all points in the graph again  $\rightarrow n$

$$\therefore \text{Total} = O(n^2 \cdot n) = O(n^3) \text{ time}$$

$$O(1) \text{ memory!}$$

Very inefficient but simple to understand

2) Graham scan  $\rightarrow$  uses polar angle w.r.t lowest reference  
Works with blank

find min  $O(n)$

sort by polar angle  $\rightarrow O(n \log n)$

stack (push / pop)  $\rightarrow O(n)$

$\therefore \text{net} = O(n \log n)$  time

memory  $O(n)$  worst

Very efficient, Low overhead

3) Divide and conquer  $\rightarrow$  convex hull on each half  $\rightarrow$  merge  
 $2T\left(\frac{n}{2}\right)$   
 Recurrence relation  $T(n) = 2T\left(\frac{n}{2}\right) + O(n)$   
 as proved previously

Very efficient for net complexity  $= O(n \log n)$   
 large number of points, has significant overhead