## 🧠 DSA EXAMPLE: Sliding Window

### 🔩 1. Name

**Sliding Window**

### 💡 2. Core Idea (1-line Summary)

A moving frame (window) over an array that lets us reuse old work instead of starting over.

Instead of recalculating everything, just slide and update.

### 🌟 3. Why It Exists

Brute force recalculates subarrays again and again (O(n²)).  
Sliding Window reuses part of the previous calculation → O(n).

Goal: Same answer, fewer operations.

### ⚙️ 4. When to Use

* When you see subarrays or substrings + conditions like max/min/sum/length.
* When problem says: *“continuous segment” + condition.*
* When shrinking or expanding helps maintain a valid condition.

### 🔍 5. Core Pattern / Template

**Fixed Window (size K)**

def max\_sum\_subarray(arr, k):  
 window\_sum = sum(arr[:k])  
 max\_sum = window\_sum  
  
 for i in range(k, len(arr)):  
 window\_sum += arr[i] - arr[i - k]  
 max\_sum = max(max\_sum, window\_sum)  
 return max\_sum

**Variable Window (expand → shrink)**

left = 0  
for right in range(len(arr)):  
 # expand window  
 while <condition\_invalid>:  
 left += 1 # shrink  
 # record best answer

**Formula to chant:** Expand → Check → Shrink → Record.

### 🧠 6. Example (Manual Walkthrough)

**Find max sum of subarray of size 3 in [2, 3, 4, 5, 6]**

1. Start: [2,3,4] → sum = 9
2. Slide right → remove 2, add 5 → sum = 12
3. Slide right → remove 3, add 6 → sum = 15  
   ✅ Max sum = 15

Time = O(n)

### 🦩 7. Analogy / Story Hook

“Like gossip — drop old news (left), take new drama (right), and keep the hottest story (max).”

Visual cue: two bubbles 💧💧 sliding across the array.

### 🧮 8. Tricks / Traps

✅ Track what **enters** and **leaves** the window.  
✅ Use two pointers (left, right).  
❌ Don’t reset both pointers.  
❌ Don’t recalc everything — that’s brute force.

### 🔁 9. Re-Test Shortcut

Tomorrow ask yourself:  
> “Can I explain Sliding Window in 1 minute?”  
> “Can I write the core skeleton from memory?”

If yes → 🔒 Locked.

### 🗓 10. Revision Log (Optional)

| Date | Confidence (1–10) | Notes |
| --- | --- | --- |
| 19 Oct | 7 | Forget when to shrink window |
| 20 Oct | 9 | Can explain it smoothly |