

1) Start Appium (in a terminal)

Make sure your SDK vars exist in that terminal (only needed once per terminal session):

```
export ANDROID_SDK_ROOT=$HOME/Android/Sdk  
export ANDROID_HOME=$ANDROID_SDK_ROOT  
export PATH=$PATH:$ANDROID_SDK_ROOT/platform-tools:$ANDROID_SDK_ROOT/emulator
```

Then ensure you're on Node 22 and start Appium:

```
nvm use 22  
appium
```

You want to see:

- “AndroidUiautomator2Driver has been successfully loaded”
- “listener started on <http://0.0.0.0:4723>”

2) If you get “port already in use”

That means Appium is already running. Kill the old one:

```
lsof -i :4723  
kill -9 <PID>
```

Then run `appium` again.

3) Run your Python test in PyCharm

Run `test_android_web.py` again.

Final checklist (all must be true)

- `adb devices` → device
- `which appium` → node 22 path
- `echo $ANDROID_SDK_ROOT` → Android SDK path
- `appium` → server running on :4723

If all four are true, **your setup is correct**.

MOBILE WEB

Practical upgrades:

- 1) Explicit waits - Add a wait like “wait until element is visible”
- 2) User-visible assertion, not <title>
- 3) Configurable chromedriver instead of hard-coded path – Next, driver directory auto-selection??

Debug and mobile-specific upgrades:

- 4) Screenshot + page source on failure - instant screenshot + HTML
- 5) Scroll + viewport (visible area) handling - elements may be off-screen

Test architecture upgrades:

- 6) Page Object Pattern (LoginPage) with secure sign in authentication
- 7) Run the same test on a **real Android phone**

MOBILE APP

???