**AR/VR Developer Roadmap**

**1. Foundation Stage**

* **Programming Basics**
  + Learn **C#** (Unity) or **C++** (Unreal Engine).
  + Practice object-oriented programming (classes, inheritance, events).
* **Math & Graphics Basics**
  + Linear algebra (vectors, matrices, transformations).
  + 3D coordinate systems, rotations (Euler vs Quaternion).
* **Design Tools**
  + Start with **Blender** for 3D modeling basics.
  + Explore **Figma/Canva** for UI mockups.

✅ Activity : Create a simple 3D scene with a moving object in Unity or Unreal.

**2. Core AR/VR Development**

* **Game Engine**
  + Learn **Unity** (widely used for AR/VR).
  + Alternative: **Unreal Engine** (high-end visuals).
* **VR Development**
  + Setup XR Interaction Toolkit (Unity).
  + Input systems: grab, teleport, locomotion.
  + Work with devices (Meta Quest, HTC Vive).
* **AR Development**
  + Learn **AR Foundation (Unity)** – works with ARKit (iOS) & ARCore (Android).
  + Explore **Vuforia** or **8thWall** for image targets, ground plane, markerless AR.

✅ Mini Projects:

* VR: Pick & place objects with hand tracking.
* AR: Place furniture in your room with scaling/rotation.

**3. Intermediate Skills**

* **3D & Animation**
  + Rigging, basic animation in Blender.
  + Import animated characters into Unity.
* **UI/UX in XR**
  + Learn world-space UI (buttons, sliders, menus inside VR).
  + Spatial design principles.
* **Networking & Multiplayer**
  + Photon / Netcode for multiplayer AR/VR experiences.
* **Optimization**
  + LOD (Level of Detail), occlusion culling, light baking.

✅ Projects:

* VR Chemistry Lab (simulate experiments).
* AR Museum Guide (scan image → get 3D info).
* Multiplayer VR room where users can chat/interact.

**4. Advanced Stage**

* **Digital Twins & IoT Integration**
  + Connect IoT devices with AR/VR (e.g., control lights via AR app).
* **AI in XR**
  + Speech commands, gesture recognition, object detection with ML.
* **Custom Interaction Systems**
  + Haptic feedback, gesture tracking, full-body avatars.
* **Cross-Platform Deployment**
  + Oculus, Pico, HTC Vive, HoloLens, WebXR.

✅ Big Projects (Portfolio Builders):

* VR Car Simulator with steering & scoring.
* AR Smart Home Controller with IoT devices.
* Digital Twin of a building/industry with real-time sensors.

**5. Professional Stage**

* Build a **portfolio website** with your projects (Unity WebGL, demo videos).
* Contribute to **GitHub AR/VR open-source projects**.
* Follow AR/VR communities: **Unity Forums, Unreal Forums, ARPost, XR Today**.
* Apply for internships or freelance AR/VR gigs.

**🛠️ Tools & Resources**

* **Engines:** Unity (C#), Unreal (C++/Blueprints).
* **SDKs:** AR Foundation, XR Interaction Toolkit, Vuforia, MRTK, OpenXR.
* **Hardware:** Meta Quest 3, HTC Vive, HoloLens (optional but helpful).
* **3D Tools:** Blender, Substance Painter, Mixamo.
* **Learning Platforms:** Unity Learn, Udemy, Coursera, YouTube channels (Valem Tutorials, Dilmer Valecillos).