🟥 Conditional Workflows in LangGraph

🔹 **1. Recap of What We Learned Before**

- **Sequential Workflow**
  - Tasks run one after another in a linear sequence.
  - Example: Task1 → Task2 → Task3.
- **Parallel Workflow**
  - Multiple tasks execute **simultaneously** after a branching point.
  - Example: Task1 → (Task2 & Task3 in parallel) → Task4.

🔹 **2. What is a Conditional Workflow?**

- Looks **similar** to a parallel workflow (because of branches).
- **Key Difference:**
  - Instead of going into all branches, execution goes into **only one branch** based on a **condition**.
- Works like an **if-else statement in programming**.
- Example:
  - Task1 → Task2 → Task4 **OR**
  - Task1 → Task3 → Task4.
  - Never both at the same time.

👉 Just like **if-elif-else** in Python.

🔹 **3. Why is it Important?**

- In complex workflows, **conditional branching is very common**.
- Almost every real-world AI workflow will need **conditional logic**.
- So, conditional workflows in LangGraph = if-else in programming.

🔹 **4. First Example: Quadratic Equation Solver**

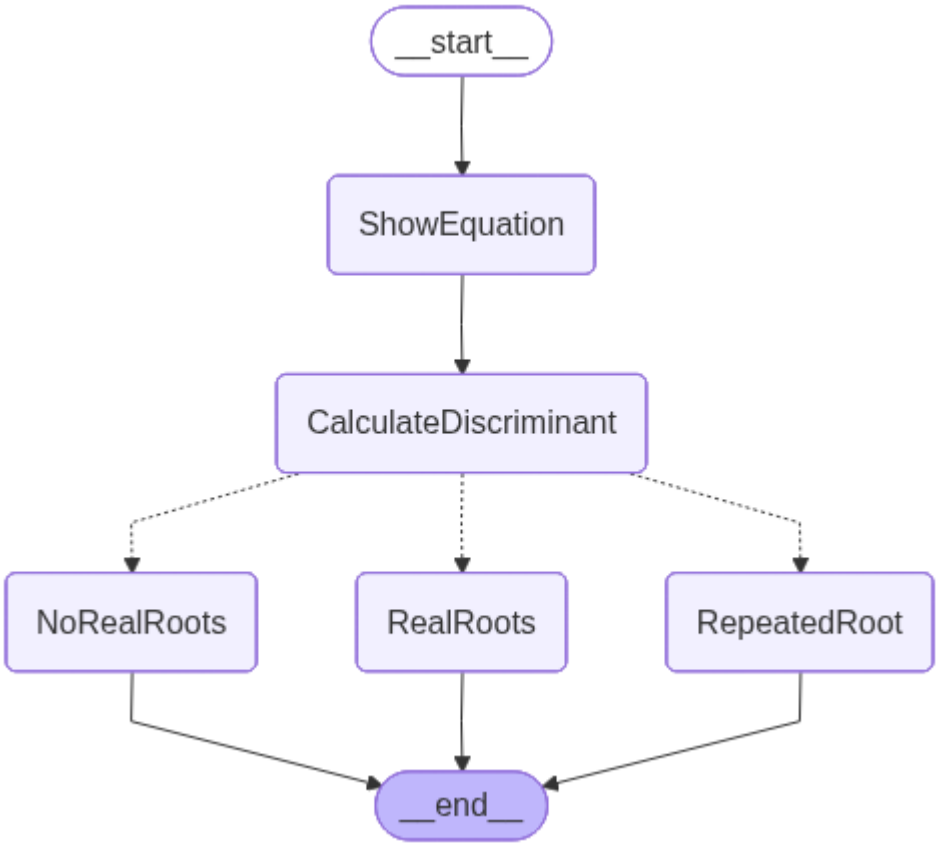
📌 **Workflow Idea:**

- Input: a, b, c (coefficients).
- Process:
  1. **Show Equation** → Print equation.
  2. **Calculate Discriminant** → Formula: $d = b^2 - 4ac$.
  3. **Conditional Branching**:
     - If $d > 0$: Two real roots.
     - If $d == 0$: One repeated root.
     - If $d < 0$: No real roots.
  4. Final Result displayed.

📌 **State Variables:**

- a, b, c → coefficients.
- equation → quadratic equation string.
- discriminant → float.
- result → final solution (string).

📌 **Flowchart:**



🔹 **5. Second Example: Customer Review Sentiment Workflow (LLM Based)**

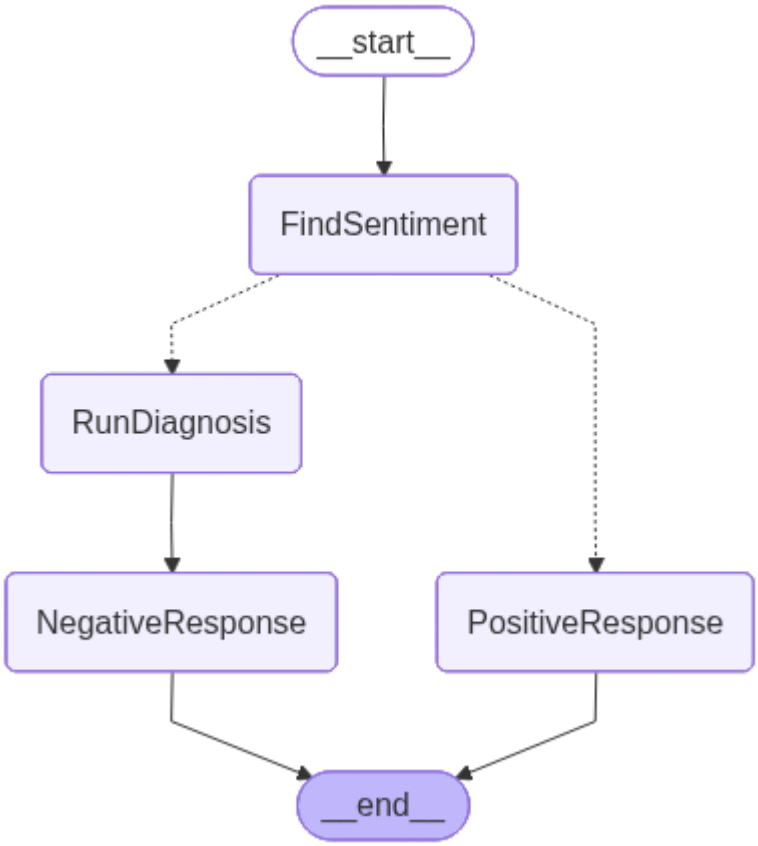
📌 **Goal:**

- Input: Customer Review.
- Output: Suitable AI-generated reply.

📌 **Steps:**

1. **Find Sentiment (Positive/Negative)**
    - Review passed to LLM.
    - Structured output → sentiment = positive or negative.
2. **Conditional Branching**
    - If **positive** → Generate a warm thank-you reply.
    - If **negative** → Run a **diagnosis step**.
3. **Run Diagnosis** (only for negative reviews)
    - Extract:
        - **Issue Type** (UI, Performance, Bug, Support, Other).
        - **Tone** (Anger, Frustration, Neutral, etc.).
        - **Urgency** (Low, Medium, High).
4. **Negative Response Generation**
    - Use extracted info (issue type, tone, urgency).
    - Generate a **personalized, empathetic reply**.

📌 **Flowchart:**



- **6. Key Takeaways**
  - **Conditional Workflows** = branching based on condition (like if-else).
  - Needed for real-world AI pipelines.
  - Two demos:
    - **Non-LLM Example** → Quadratic Equation Solver.
    - **LLM Example** → Customer Review Sentiment Analysis + Response.
  - In LangGraph:
    - You define a **check function** that evaluates conditions.
    - Then connect nodes with **conditional edges**.
