Role-based & Chain-of-Thought Prompting

Objective:

To understand how **role-based prompting** and **step-by-step reasoning (chain-of-thought)** prompting affect the clarity and detail of AI-generated responses.

Definitions

Role-based Prompting
A prompting technique where the model is assigned a specific **role** (e.g., teacher, doctor, lawyer, scientist).
This role shapes tone, vocabulary, and style to match the assigned perspective and audience.

Chain-of-Thought Prompting
A prompting technique that instructs the model to **reason step-by-step** before producing an answer.
It helps create logical, structured, and accurate explanations, especially in multi-step reasoning tasks.

Tasks:

Explain how photosynthesis works.

Explain the water cycle.

Explain the Pythagoras theorem.

Prompts & Outputs Table:

Type	Prompt	Model Output	Reflection
Role-based Prompting *(Photosynthesis)*	*"You are a high school biology teacher. Explain photosynthesis to students in simple words."*	Plants use sunlight, water, and carbon dioxide to make food (glucose). Chlorophyll captures sunlight, water comes from roots, CO_2 from air. Oxygen is released.	Uses simple language; assumes non-technical audience; good for beginners.
Chain-of-Thought Prompting *(Photosynthesis)*	*"Explain photosynthesis step by step, reasoning each step clearly."*	1. Leaves capture sunlight. 2. Roots absorb water. 3. Leaves take in CO_2. 4. Light splits water into hydrogen & oxygen. 5. Hydrogen + CO_2	Logical, ordered process; suitable for detailed understanding.

		→ glucose. 6. Oxygen released.	
Role-based Prompting *(Water Cycle)*	*"You are a storyteller explaining the water cycle to children."*	Water travels in a big loop: the sun makes it evaporate, it forms clouds, then falls as rain, filling rivers and lakes.	Adds creativity and engagement; keeps concepts simple.
Chain-of-Thought Prompting *(Water Cycle)*	*"Explain the water cycle step by step with reasoning."*	1. Sun heats water (evaporation). 2. Water vapor rises. 3. Cools into droplets (condensation). 4. Clouds get heavy. 5. Rain falls (precipitation). 6. Water collects and cycle repeats.	Sequential, factual, clear for process-based learning.
Role-based Prompting *(Pythagoras Theorem)*	*"You are a math tutor teaching a 10-year-old. Explain Pythagoras theorem."*	In a right triangle, the square of the long side (hypotenuse) equals the sum of the squares of the other two sides. Example: If sides are 3 and 4, hypotenuse is 5.	Simplifies the concept with an easy numeric example; audience-friendly.
Chain-of-Thought Prompting *(Pythagoras Theorem)*	*"Explain Pythagoras theorem step by step, reasoning each step."*	1. Take a right triangle. 2. Identify shorter sides (a, b) and hypotenuse (c). 3. Square a and b. 4. Add results. 5. Take square root to find c. 6. Example: $3^2 + 4^2 = 9 + 16 = 25$; $\sqrt{25} = 5$.	Detailed and procedural; ensures full understanding of calculation.

Observations:

1. Role-based prompting adapts tone, style, and difficulty level to match the target audience.
2. Chain-of-thought prompting emphasizes structure and reasoning, making it ideal for procedural tasks.
3. Combining both often gives the best results: audience-appropriate and logically organized.

Conclusion:

Role-based prompting is useful when tone and audience adaptation matter, while chain-of-thought prompting is best for clear, logical reasoning. Both are essential skills for prompt engineering, and mastering them allows precise control over AI outputs.