Certainty in Mathematics

Lesson 4: Writing a TOK Essay

Focus: *How can knowledge users develop strong, structured arguments?*

Objectives	● **Write a fully developed TOK essay claim using the TOK essay structure.** ● **Apply real-world examples and counterclaims to support arguments.** ● **Engage critically with TOK concepts (e.g., certainty, power, and perspective).**
Steps	**1. Introduction (5 mins)** ● **Guiding Question:** *"How do we develop a strong argument in a TOK essay?"* ● **Recap:** What makes a TOK essay unique? ● Focus on knowledge (not merely opinions). ● Use real-world examples drawn from multiple Areas of Knowledge (AOKs). ● Include counterclaims. ● Refer to TOK concepts. ● Reflect on the implications and limitations of your argument. ○ Teacher Tip: Show a quick visual of the TOK essay structure (introduction, body claims, conclusion), highlighting where this developed paragraph fits in. **2. Examining a Strong TOK Essay Claim (10 mins)** ● Break down an example paragraph of your choice with students. Ask them to annotate: ○ Claim: The stance or argument addressing the TOK prompt. ○ Example: A real-world situation supporting or illustrating the claim. ○ Counterclaim: A contrasting perspective that challenges the claim. ○ TOK Links: Explicit connection to TOK concepts and reflection on how knowledge is produced or validated. ● Discussion Questions: ○ How does the example strengthen the claim? ○ Which Ways of Knowing (WOKs) or Areas of Knowledge (AOKs) are relevant here? ○ Does the counterclaim effectively challenge the claim, encouraging deeper exploration? **3. Writing Task: Drafting a TOK Paragraph (15 mins)** ● Select a prompt: Provide students with a list of essay prompts to choose from. These could be prompts that you have prepared (e.g., "To what extent does certainty of mathematical models influence truth in society?") or a prescribed title from the official IB list. ● Students plan the paragraph, including notes on: ○ Claim: A statement connecting directly to the prompt. ○ Example: A real-life scenario that demonstrates the claim. ○ Counterclaim: An alternative viewpoint or critique that challenges the initial argument. ○ TOK Link: Reference how the TOK concepts influence what is considered reliable scientific knowledge. ● Write the paragraph: Emphasise clarity, coherence, and the TOK focus (not just describing the event but analysing how it affects knowledge).

	○ Teacher Tip: Remind students to refer to the AOK and avoid simply praising or criticizing—instead, focus on how knowledge is formed, judged, and communicated. **Peer Review & Refinement (10 mins)** ● Students exchange their writing in pairs or small groups, and use the essay checklist to give feedback. Use the following discussion points to help students' develop their feedback: ○ Claim: Is it clearly stated, and does it tie back to the prompt? ○ Example: Is it concrete, relevant, and well-explained? ○ Counterclaim: Is it meaningfully different or just a weaker version of the claim? ○ TOK Link: Does it show awareness of how knowledge is justified, constructed, or challenged? ○ Language and Clarity: Are there any vague statements or unclear references? ● If time permits, students revise immediately based on peer feedback.
Reflection	Discuss the following reflection questions in open discussion or exit ticket format: ● What was the most challenging part of writing this? ● How do different perspectives influence debates on mathematical models? ● How does this practice help prepare for the TOK essay assessment? Extension / Homework ● Option A: Expand the paragraph by adding another real-world example or a deeper analysis of the counterclaim. ● Option B: Research a different context (another region or era) to see if the claim holds universally or changes with cultural/political conditions. ● Option C: Draft an introductory or concluding paragraph linking the argument to a broader TOK theme.
Resources	Lesson Slides Example TOK Essay prescribed titles
TOK Concepts	**Certainty:** What responsibilities do mathematicians, corporations, and governments have when presenting models as objective or certain? Should efficiency and profit ever outweigh the duty to acknowledge assumptions, bias, and uncertainty? **Power:** How do mathematical models shift power between individuals, corporations, and states? Who ultimately decides which models are legitimate, trustworthy, or acceptable to use in education, justice, or politics? **Perspective:** How do different cultural and political contexts shape trust in mathematical models (e.g., predictive policing in the U.S. vs. risk assessment in Europe)? Can mathematical applications ever be universally "fair," or are they always influenced by context and values?
Critical Thinking Concepts	● **Bias & Power** ○ Challenging Neutrality Bias: Students examine the assumption that mathematics is inherently neutral, questioning how funding priorities, government agendas, or corporate interests shape how models are constructed, applied, or interpreted. ○ Interrogating Authority: Students consider who decides what counts as legitimate mathematical knowledge — pure mathematicians, applied scientists, policymakers, or corporations — and how definitions of "truth" are shaped by institutional power. ● **Exploring Contexts and Expert Opinions** ○ Evaluating Credibility: Students reflect on how institutional authority (e.g., peer-reviewed journals, regulatory approval,

	corporate patents) influences perceptions of credibility — and how this authority may mask hidden assumptions or selective use of data. ○ Analyzing Framing: Students explore how political, social, or economic pressures (e.g., financial risk modeling, climate change policy, AI scoring systems) shape whether mathematical models are trusted as objective knowledge or criticized as manipulative tools. ● **Responsiveness and Flexibility of Thought** ○ Weighing Competing Views: Students compare the ideal of mathematics as certain and universal with real-world examples of flawed or biased models (e.g., 2008 financial crisis, teacher evaluation algorithms, predictive policing). They consider whether the issue lies in the mathematics itself or the way institutions apply it. ○ Revising Beliefs: Students reflect on whether their understanding of mathematical certainty has shifted after examining contested cases, and reconsider what counts as reliable or trustworthy mathematical knowledge. ● **Extrapolation and Reapplication of Principles** ○ Making Real-World Links: Students connect issues of algorithmic bias, flawed risk models, and opaque proofs to broader debates about democracy, social justice, and public trust in institutions. ○ Ethical Reasoning: Students consider the responsibilities of mathematicians, corporations, and governments when applying mathematical models, and weigh the moral cost when assumptions, transparency, or fairness are compromised.