1.4 Areas of knowledge: history, the arts and mathematics

Name: _____ Class: _____ Date: _____ **Total: 30 marks**

KEY WORDS history • hindsight • the arts • mathematics • axiom • proof • interpretation

Objective

Study three more **areas of knowledge**: **history** (knowledge of a past we cannot observe), **the arts** (knowledge through creation and interpretation) and **mathematics** (knowledge by proof).

You must be able to:

- explain how historians produce knowledge from sources
- explain the role of interpretation and hindsight in history
- explain whether the arts produce knowledge
- explain proof, axioms and certainty in mathematics
- compare how certain each area can be

1 Key knowledge and worked examples

History

The past cannot be observed or repeated; historians use **sources** and **interpretation**. Problems: sources are incomplete and biased; **hindsight** shapes what seems important; "history is written by the winners", although modern historians recover the views of the defeated and of ordinary people.

The arts

The arts may give knowledge of **experience**: what war felt like (Picasso's *Guernica*, 1937, after the bombing of Guernica), what another life is like (a novel). Questions: Is this knowledge, or only feeling? Is interpretation free, or limited by the work and its context?

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■ Mathematics

Mathematics proves **theorems** from **axioms** (starting assumptions) by deduction. A proof gives a very high level of certainty *within the system*. Euclid's fifth (parallel) postulate could be replaced to give **non-Euclidean geometries**, which later proved useful in Einstein's general relativity. Kurt Gödel (1931) showed that any consistent system rich enough for arithmetic contains true statements it cannot prove.

Worked proof. The sum of two even numbers is even: $2a + 2b = 2(a + b)$, which is even. This is certain for all whole numbers a, b, unlike any number of measurements in science.

2 Practice

2.1 Explain why **hindsight** can be both a help and a problem for historians. [2]

2.2 Prove that the sum of two **odd** numbers is even, and explain why this proof is more certain than a scientific law. [3]



$7 + 5 = 12$: pairs with none left

2.3 Explain **two** reasons why two historians can disagree about the same event. [4]

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2.4 Evaluate the claim that the arts give us **knowledge**, not just feelings. Use **one** work of art. [6]

3 Exam-style questions

3.1 *(Essay-style.)* "Mathematics gives certainty; history gives only interpretation." Discuss. [10]

axioms → proof

sources → interpretation

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3.2 Explain why the discovery of **non-Euclidean geometry** raises a knowledge question about mathematics. [5]

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Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

help: historians know what happened next, so they can see long-term causes and results; problem: they may see events as inevitable and judge people by what those people could not know

2.2

$(2a + 1) + (2b + 1) = 2a + 2b + 2 = 2(a + b + 1)$, which is even; it follows by deduction from definitions, so it holds for all cases; a scientific law rests on finite observations and could be revised

2.3

any two, explained: different sources or new sources found; different perspectives, e.g. national, political, class; different questions and focus, e.g. economic vs political causes; different times of writing: each generation asks new questions

2.4

a named work in context, e.g. Guernica (1937) after the bombing of Guernica; for: it shows what violence against civilians means, knowledge by acquaintance; it shapes how people understand events; against: it does not give facts or testable claims; interpretations differ; a reasoned judgement about kinds of knowledge

3.1

Mark with the TOK markbands (out of 10): [9-10] excellent: clear, focused, convincing links, well-chosen examples, implications explored; [7-8] good: focused, mostly clear links, relevant examples; [5-6] satisfactory: some focus, links partly explained; [3-4] basic: limited links, description more than analysis; [1-2] rudimentary. Points that may be included: understanding of certainty and interpretation; mathematics: proof from axioms gives certainty within a system; limits: choice of axioms; Gödel's incompleteness; history: interpretation of sources; perspectives; history also has well-established facts and methods of checking; a balanced conclusion

3.2

Euclid's parallel postulate was assumed to be obviously true; mathematicians replaced it and built consistent new geometries; so axioms are chosen, not simply given by reality; non-Euclidean geometry later described space in general relativity; knowledge question, e.g. "Is mathematics discovered or invented?"

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