

Logicquest — Activity Book

A Spark & Anvil activity book — puzzles, questions, and fun from Logicquest.

Write in the book, circle your answers, and check the Answer Key at the back.

1. Introduction to Arguments and Reasoning

Circle the correct answer

1. What are the three basic parts of a logical argument?

(A) An introduction, a body, and a conclusion, and this principle applies across similar situations (B) A claim (what you're trying to prove), evidence (facts or data supporting the claim), and reasoning (the logical connection between the evidence and the claim) (C) A question, an answer, and an explanation, as this is what research and standard practice suggests (D) A problem, a hypothesis, and an experiment, as this is what research and standard practice suggests

2. Which of these is a CLAIM rather than a fact?

(A) 'School should start later because students would be more alert' — it states a position that can be debated (B) 'There are 180 school days in our district' — it's a measurable number (C) 'The school day begins at 8:00 AM' — it can be verified (D) 'The cafeteria serves lunch at noon' — it's an observable truth

3. Maya argues: 'We should get a class pet because studies show that animals in classrooms reduce student stress and improve attendance.' What is her evidence?

(A) Studies showing that animals in classrooms reduce student stress and improve attendance (B) The fact that other classrooms have pets, as this is what research and standard practice suggests (C) Maya's personal desire for an animal, as this is what research and standard practice suggests (D) We should get a class pet, and this has been consistently demonstrated in practice

4. What is the difference between a 'strong' argument and a 'weak' argument?

(A) A strong argument has a clear claim supported by relevant, reliable evidence with logical reasoning; a weak argument may lack evidence, use irrelevant evidence, or have flawed reasoning (B) A strong argument is spoken loudly; a weak argument is spoken quietly, which is why this approach is recommended by experts (C) A strong argument is longer; a weak argument is shorter, and this is the standard approach used in most cases (D) A strong argument wins; a weak argument loses, making this the most widely accepted explanation

5. Alex says: 'Chocolate ice cream is the best flavor because I like it the most.' Is this a logical argument? Why or why not?

(A) Yes — if Alex likes it most, it must be the best, which is the most common explanation for this phenomenon (B) No — personal preference is not evidence. 'I like it' explains Alex's taste but doesn't logically prove it's objectively 'the best' flavor for everyone (C) Yes — personal experience is always valid evidence, making this the most widely accepted explanation (D) No — because chocolate is actually not the most popular flavor

6. What does 'burden of proof' mean in logical reasoning?

(A) Both sides must provide equal amounts of evidence, as this directly follows from the underlying principles (B) The person with the most experience gets to decide, which is the most common explanation for this phenomenon (C) The person making a claim is responsible for providing evidence to support it — you can't ask others to prove your claim is wrong (D) The person who disagrees must prove the claim is false, which is why this approach is recommended by experts

Write the answer

7. Identify the reasoning error: 'It rained every time I wore my lucky socks this month. Therefore, my socks cause rain.'

Answer: _____

8. What is a 'counterargument' and why is it important to consider counterarguments when building your own arguments?

Answer: _____

9. A commercial says: '4 out of 5 dentists recommend BrightSmile toothpaste!' What questions should a critical thinker ask about this evidence?

Answer: _____

10. What is a 'premise' in logical reasoning?

Answer: _____

Match each question to its answer

1. Read this argument: 'All birds can fly. Penguins are birds. Therefore, penguins can fly.' The logic is valid but the conclusion is wrong. Why? →

2. What does it mean to 'think critically'? →

3. Two students are having a disagreement. Student A says: 'You're wrong because you always say dumb things.' What's wrong with this response? →

4. What is the difference between 'objective' and 'subjective' statements? →

5. Arrange these sentences into a logical argument: (A) 'Therefore, students should be allowed to use calculators on tests.' (B) 'Real-world math always involves tools.' (C)

'Tests should reflect real-world situations.' →

(A) The first premise is false — NOT all birds can fly (penguins, ostriches, kiwis). Valid logic applied to a false premise produces a false conclusion

(B) $B \rightarrow C \rightarrow A$: 'Real-world math involves tools' (premise 1) + 'Tests should reflect real-world situations' (premise 2) → 'Students should use calculators on tests' (conclusion)

(C) Objective statements can be verified as true or false through evidence ('Water boils at 100°C'). Subjective statements express personal feelings or opinions ('Hot chocolate tastes better than coffee')

(D) Carefully analyzing information by questioning assumptions, evaluating evidence, considering alternative explanations, and forming well-reasoned judgments rather than accepting things at face value

(E) It attacks the PERSON instead of addressing the ARGUMENT — this is called an 'ad hominem' attack and doesn't actually disprove Student B's point

2. Common Logical Fallacies

Circle the correct answer

11. What is a 'logical fallacy'?

(A) An error in reasoning that makes an argument invalid or misleading — the conclusion doesn't actually follow from the evidence, even though it might sound convincing (B) An argument that's too complicated to understand, and this principle applies across similar situations (C) A lie told on purpose to deceive someone, and this principle applies across similar situations (D) A fact that turns out to be wrong, which is why this approach is recommended by experts

12. 'You can't trust Jake's argument about recycling because he got a D in science class.' What fallacy is this?

(A) False dilemma — presenting only two options (B) Straw man — misrepresenting someone's argument (C) Ad hominem — attacking the person making the argument instead of addressing the argument itself (D) Red herring — introducing an unrelated topic

13. Maria argues for later school start times. Ben responds: 'Maria thinks students should sleep all day and never come to school!' What fallacy is Ben committing?

(A) Straw man — Ben is misrepresenting Maria's argument (later start times) as something extreme she didn't say (sleep all day/never come to school) to make it easier to attack (B) Ad hominem — he's attacking Maria personally, as this directly follows from the underlying principles (C) Red herring — he's changing the subject entirely, which is the most common explanation for this phenomenon (D) Slippery

slope — he's predicting extreme consequences, as this directly follows from the underlying principles

14. During a debate about homework policy, one student suddenly says: 'But what about the school's terrible lunch menu?' What fallacy is this?

(A) Red herring — introducing an unrelated topic to divert attention away from the actual issue being discussed (B) Straw man — they're distorting the homework argument (C) False dilemma — they're limiting the choices (D) Appeal to emotion — they're trying to make people feel something

15. 'You're either with us or against us.' What fallacy does this statement represent?

(A) False dilemma (false dichotomy) — presenting only two options when there are actually more possibilities, like being neutral, partially agreeing, or having a different perspective entirely (B) Ad hominem — it attacks people who disagree, which is why this approach is recommended by experts (C) Slippery slope — it predicts extreme consequences, and this has been consistently demonstrated in practice (D) Begging the question — it assumes its own conclusion, as this directly follows from the underlying principles

16. 'If we let students use phones during lunch, next they'll want them in class, then during tests, and soon no one will learn anything and education will collapse!' What fallacy is this?

(A) False dilemma — presenting only two options, which is why this approach is recommended by experts (B) Straw man — misrepresenting an argument, and this is the standard approach used in most cases (C) Slippery slope — assuming that one small step will inevitably lead to extreme consequences, without evidence that each step will actually follow (D) Hasty generalization — drawing conclusions from too little data, making this the most widely accepted explanation

Write the answer

17. 'My celebrity crush says this brand of sneakers is the best, so it must be true.' What fallacy is this?

Answer: _____

18. 'Think of the children! We can't allow this!' without explaining HOW children would be affected. What fallacy is being used?

Answer: _____

19. 'I left my umbrella at home and it rained. My umbrella prevents rain!' What two fallacies are combined here?

Answer: _____

20. 'Millions of people believe in astrology, so there must be something to it.' What fallacy is this?

Answer: _____

Match each question to its answer

1. A student argues: 'We shouldn't have to take PE because some kids have physical disabilities and can't participate fully.' What fallacy might this be? →

2. 'You can't criticize my artwork because you can't draw any better.' What fallacy is this? →

3. 'No one has proven that aliens DON'T exist, so they must exist.' What fallacy is this? →

4. Coach says: 'Every player who scored a goal today ate pasta for lunch. Pasta gives you energy to score goals!' What fallacy is the coach making? →

5. What is a 'loaded question' and why is it unfair? →

(A) A question that contains a hidden assumption, making it impossible to answer without accepting the assumption. Example: 'Have you stopped cheating on tests?' assumes you were cheating

(B) Appeal to ignorance (argumentum ad ignorantiam) — claiming something is true because it hasn't been proven false, or vice versa

(C) False cause (cum hoc ergo propter hoc) — assuming that because pasta-eating and goal-scoring occurred together, one caused the other, ignoring other factors like skill, practice, and opponent quality

(D) Tu quoque ('you too') — deflecting criticism by pointing to the critic's own flaws rather than addressing the critique itself

(E) A form of red herring or special pleading — the existence of accommodations for some students doesn't argue against the general value of PE for all students

3. Deductive vs Inductive Reasoning

Circle the correct answer

21. What is the key difference between deductive and inductive reasoning?

(A) Deductive uses feelings while inductive uses facts (B) Deductive is used in science while inductive is used in math (C) Deductive goes from general rules to specific conclusions; inductive goes from specific observations to general conclusions (D) Deductive is always right while inductive is always wrong

22. Which of the following is an example of deductive reasoning?

(A) My three friends all like pizza, so most kids probably like pizza. (B) All mammals are warm-blooded. Dogs are mammals. Therefore, dogs are warm-blooded. (C) It

rained the last three Mondays, so it will probably rain next Monday. (D) I've seen five red cardinals, so all cardinals must be red.

23. Which of the following is an example of inductive reasoning?

(A) If it's Tuesday, the library is open. It's Tuesday. So the library is open. (B) All squares have four equal sides. This shape has four equal sides and right angles, so it's a square. (C) Every swan I've ever seen is white, so I conclude that all swans are probably white. (D) All birds have feathers. A robin is a bird. Therefore, a robin has feathers.

24. A valid deductive argument with true premises guarantees what?

(A) A surprising conclusion (B) A true conclusion (C) A conclusion that most people agree with (D) A popular conclusion

25. Why can a strong inductive argument still have a false conclusion?

(A) Because inductive reasoning is a bad way to think (B) Because inductive arguments are always weak (C) Because only deductive reasoning uses real evidence (D) Because inductive conclusions are based on limited observations and new evidence could contradict them

26. A scientist observes that plants grow faster when given more sunlight in 20 experiments. She concludes that sunlight promotes plant growth. What type of reasoning is this?

(A) Deductive reasoning — she used the scientific method (B) Deductive reasoning — she proved it with experiments (C) Inductive reasoning — she's generalizing from specific experimental observations (D) Neither — this is just opinion, not reasoning

Write the answer

27. What is a 'premise' in a logical argument?

Answer: _____

28. Consider: 'If it rains, the ground gets wet. The ground is wet. Therefore, it rained.' Is this valid deductive reasoning?

Answer: _____

29. What is an analogy in reasoning?

Answer: _____

30. Marcus notices that every time he studies for at least 2 hours, he gets an A on the test. He has a test tomorrow and studied for 3 hours. He predicts he'll get an A. What type of reasoning is Marcus using?

Answer: _____

Match each question to its answer

1. What does it mean for a deductive argument to be 'valid but unsound'? →
2. A detective finds fingerprints at a crime scene matching a suspect. She reasons: 'These fingerprints match the suspect. The suspect was likely at the scene.' What type of reasoning is this? →
3. What is a 'syllogism'? →
4. Which of the following makes an inductive argument STRONGER? →
5. A math teacher says: 'If a number is divisible by 6, then it is divisible by 3. The number 24 is divisible by 6. Therefore, 24 is divisible by 3.' What type of reasoning is this? →

- (A) A deductive argument with two premises and a conclusion that follows logically from them
 - (B) Having a larger and more diverse set of observations supporting the conclusion
 - (C) Inductive reasoning — fingerprint evidence makes it very probable, but doesn't guarantee the suspect was at the scene
 - (D) Deductive reasoning — applying a mathematical rule to a specific case with a guaranteed conclusion
 - (E) The logical structure is correct, but at least one premise is false
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4. Argument Mapping and Structure

Circle the correct answer

31. In the Toulmin model of argumentation, what is a 'claim'?

- (A) The background information before the argument begins
- (B) The main point or conclusion the arguer is trying to prove
- (C) A piece of evidence that supports the argument
- (D) A reason why the argument might be wrong

32. What is 'evidence' (also called 'grounds') in an argument?

- (A) The emotional appeal used to persuade the audience
- (B) The facts, data, examples, or observations that support the claim
- (C) The person making the argument
- (D) The conclusion of the argument

33. What is a 'warrant' in an argument?

- (A) A warning that the argument might not be true
- (B) A legal document that gives permission to search
- (C) The strongest piece of evidence in the argument
- (D) The logical bridge that explains WHY the evidence supports the claim — often an unstated assumption

34. Consider: 'We should have a longer recess (claim) because studies show physical activity improves academic performance (evidence)'. What is the hidden warrant?

(A) All schools should follow the same schedule, and this is the standard approach used in most cases (B) Teachers need breaks too, as this is what research and standard practice suggests (C) Students don't get enough exercise at home, and this is the standard approach used in most cases (D) Recess provides physical activity, and what improves academic performance should be increased

35. What is a 'qualifier' in the Toulmin model?

(A) A credential that makes the arguer qualified to speak (B) A type of evidence that qualifies as strong proof (C) A word or phrase that limits the strength of the claim, like 'probably,' 'usually,' or 'in most cases' (D) The first sentence of the argument

36. What is a 'rebuttal' in argument mapping?

(A) The final summary of the argument, as this directly follows from the underlying principles (B) A louder repetition of the original claim, making this the most widely accepted explanation (C) An acknowledgment of conditions under which the claim might not hold true, or a response to counterarguments (D) A personal attack on the opposing side, and this is the standard approach used in most cases

Write the answer

37. When mapping an argument, which should you identify FIRST?

Answer: _____

38. Read this argument: 'Schools should ban sugary drinks because a 2023 study found that students who drink water instead score 12% higher on tests. Unless the study is later disproven, this evidence is compelling.' Identify the qualifier.

Answer: _____

39. What is a 'hidden assumption' in an argument?

Answer: _____

40. Someone argues: 'We should choose Maya as team captain because she scored the most goals this season.' What hidden assumption does this argument rely on?

Answer: _____

Match each question to its answer

1. What is a 'sub-claim' in an argument map? →

2. How does a 'convergent argument' differ from a 'linked argument'? →

3. Identify the main claim in this passage: 'Video games aren't just entertainment. Research shows they improve problem-solving skills, reaction time, and even teamwork. While some games contain violence, many educational games help

students learn. Therefore, schools should consider incorporating video games into their curriculum.' →

4. What is a 'counterargument'? →

5. Why does addressing counterarguments actually **STRENGTHEN** your own argument? →

(A) An argument that opposes or challenges the main claim, presenting reasons why the claim might be wrong

(B) In a convergent argument, each piece of evidence independently supports the claim; in a linked argument, the evidence must work together

(C) A smaller claim that supports the main claim — it needs its own evidence but ultimately feeds into the larger argument

(D) It shows you've considered other viewpoints and can explain why your position is still stronger despite objections

(E) Schools should consider incorporating video games into their curriculum

5. Truth Tables and Boolean Logic

Circle the correct answer

41. In Boolean logic, what does the AND operator do?

(A) Returns TRUE when the inputs are different (B) Returns TRUE only when BOTH inputs are true — if either input is false, the result is false (C) Returns TRUE when at least one input is true (D) Flips the input from true to false or vice versa

42. In Boolean logic, what does the OR operator do?

(A) Returns TRUE only when both inputs are true (B) Returns TRUE only when exactly one input is true (C) Returns TRUE when at least one input is true — it's only false when BOTH inputs are false (D) Returns the opposite of the AND operator in all cases

43. What does the NOT operator do in Boolean logic?

(A) Flips the truth value — NOT TRUE becomes FALSE, and NOT FALSE becomes TRUE (B) Makes both inputs true (C) Checks if two values are equal (D) Combines two values using a special rule

44. If P is TRUE and Q is FALSE, what is the value of P AND Q?

(A) TRUE — because P is true (B) It depends on what P and Q represent (C) TRUE — because at least one is true (D) FALSE — AND requires both to be true, and Q is false

45. If P is TRUE and Q is FALSE, what is the value of P OR Q?

(A) FALSE — because they don't match (B) TRUE — but only if P is more important than Q (C) TRUE — OR only needs at least one to be true, and P is true (D) FALSE — because Q is false

46. How many rows does a truth table for TWO variables (P and Q) have?

(A) 4 rows — for the combinations: TT, TF, FT, FF (B) 2 rows — one for each variable (C) 3 rows — true, false, and both (D) 8 rows — all possible outcomes

Write the answer

47. What is a 'conditional statement' (if-then statement) in logic?

Answer: _____

48. The statement 'If it rains, the ground gets wet' is true. It didn't rain today. What can you conclude about the ground?

Answer: _____

49. What is the 'contrapositive' of the statement 'If it is a dog, then it is an animal'?

Answer: _____

50. What is the difference between the 'converse' and the 'contrapositive' of a conditional statement?

Answer: _____

Match each question to its answer

1. Evaluate: NOT (TRUE AND FALSE). What is the result? →

2. What is De Morgan's Law in Boolean logic? →

3. A search engine uses Boolean logic. If you search for 'cats AND dogs,' what results do you get? →

4. What is 'logical equivalence'? →

5. In a truth table for 'P → Q' (If P, then Q), when is the conditional FALSE? →

(A) Two statements are logically equivalent when they have the same truth value in every possible situation

(B) Only pages that contain BOTH the word 'cats' and the word 'dogs'

(C) Only when P is TRUE and Q is FALSE — a true hypothesis leading to a false conclusion breaks the promise

(D) NOT (A AND B) equals (NOT A) OR (NOT B), and NOT (A OR B) equals (NOT A) AND (NOT B) — negation flips AND/OR

(E) TRUE — first evaluate the AND (TRUE AND FALSE = FALSE), then apply NOT (NOT FALSE = TRUE)

6. Fallacies in Media and Persuasion

Circle the correct answer

51. An ad says: '9 out of 10 dentists recommend Sparkle Toothpaste!' What logical question should you ask about this claim?

(A) How much the toothpaste costs compared to others (B) How were the dentists selected? Were they paid? What did the 10th dentist say? What exactly did they 'recommend'? (C) Whether the toothpaste comes in different flavors (D) Nothing — if 9 out of 10 experts agree, the product must be the best

52. A politician says: 'My opponent wants to reduce the military budget, which means they don't care about our soldiers.' What fallacy is being used?

(A) Bandwagon — everyone agrees soldiers are important (B) False cause / false equivalence — reducing a budget doesn't mean not caring about soldiers; there could be many reasons for the proposal (C) Appeal to authority — the politician is an expert on military spending (D) Red herring — soldiers are irrelevant to the budget

53. A social media post reads: 'EXPOSED: Scientists have been hiding the truth about [topic]! Share before they delete this!' What manipulation technique is being used?

(A) Urgency and conspiracy framing — creating artificial time pressure and an us-vs-them narrative to bypass critical thinking (B) Bandwagon — if many people share it, it must be true (C) Appeal to authority — citing scientists makes it credible (D) Scientific reasoning — exposing hidden research is good journalism

54. An ad shows a celebrity drinking a brand of water and says: 'Hydrate like a champion!' What fallacy is the ad relying on?

(A) Straw man — the ad misrepresents other water brands (B) Slippery slope — drinking this water will lead to becoming a champion (C) Appeal to authority / false authority — a celebrity's athletic success doesn't make them an expert on which water brand is best (D) Circular reasoning — the ad proves itself

55. A news headline reads: 'Study Shows Chocolate Makes You Smarter!' The actual study found a weak correlation between chocolate consumption and test scores in 30 participants. What's wrong with the headline?

(A) Nothing — the headline accurately summarizes the study, and this has been consistently demonstrated in practice (B) The headline overstates the findings — a weak correlation in a small sample doesn't prove causation, and 'makes you smarter' implies a much stronger claim than the data supports (C) Chocolate doesn't actually exist in studies, and this principle applies across similar situations (D) The headline should mention the sample size but is otherwise correct, as this directly follows from the underlying principles

56. A brand's website says: 'Our product is the #1 choice of families nationwide!' with an asterisk leading to tiny text saying 'Based on a survey of 50 families who purchased our product.' What's misleading about this?

(A) The claim is accurate because those families did choose the product (B) The survey only asked existing customers (selection bias) — of course people who already bought it prefer it; it's not representative of all families (C) The asterisk makes it transparent and therefore honest (D) 50 families is actually a good sample size for this kind of claim

Write the answer

57. During a debate, one speaker says: 'My opponent failed math in high school, so why should we trust their economic policy?' What fallacy is this?

Answer: _____

58. A product review says: 'Everyone I know uses this app — it's clearly the best one available.' What fallacy is this?

Answer: _____

59. A political ad says: 'If we allow any new regulations on businesses, it will destroy the economy and everyone will lose their jobs.' What fallacy is this?

Answer: _____

60. What is 'whataboutism' and why is it a fallacy?

Answer: _____

Match each question to its answer

1. An infomercial says: 'Act now! Only 5 left in stock!' but you notice the same 'only 5 left' message has been there for weeks. What persuasion technique is this? →

2. A news article about a school policy change only interviews parents who are against the change. What type of bias does this represent? →

3. An energy drink ad shows someone climbing a mountain and says: 'Fuel your adventure!' It never makes specific health claims. Why is this approach effective and how is it different from making a false claim? →

4. Someone online argues: 'You can't trust mainstream science about nutrition because scientists used to say eggs were bad and now they say eggs are fine.' What fallacy is this? →

5. A product comparison chart shows your product winning in 5 out of 8 categories, but the categories were chosen by the company. What's the logical problem? →

- (A) Selection bias / one-sided reporting — by only presenting one viewpoint, the article gives a skewed picture of public opinion
 - (B) Genetic fallacy / overgeneralization — past revisions in one area don't invalidate all current science; updating findings when new evidence emerges is how science is supposed to work
 - (C) Cherry-picking criteria — the company chose categories where their product excels and likely omitted categories where competitors win
 - (D) It creates an association between the product and adventure/success without making a verifiable claim — you can't fact-check a feeling
 - (E) Artificial scarcity — creating false urgency to pressure quick decisions and prevent careful evaluation
-

7. Syllogisms and Formal Logic

Circle the correct answer

61. What are the three parts of a categorical syllogism?

- (A) A major premise (general rule), a minor premise (specific case), and a conclusion that follows from both
- (B) A question, an answer, and an explanation, as this is what research and standard practice suggests
- (C) An introduction, a body, and a conclusion, and this principle applies across similar situations
- (D) A hypothesis, an experiment, and a result, and this has been consistently demonstrated in practice

62. What are the four standard categorical statement forms?

- (A) Always, Usually, Sometimes, Never, as this directly follows from the underlying principles
- (B) If-Then, And, Or, Not, and this has been consistently demonstrated in practice
- (C) True, False, Maybe, Unknown, which is why this approach is recommended by experts
- (D) A (All S are P), E (No S are P), I (Some S are P), O (Some S are not P)

63. How can Venn diagrams help evaluate whether a syllogism is valid?

- (A) Venn diagrams can only show two sets, so they can't evaluate three-term syllogisms
- (B) By drawing circles for each category and shading/markings regions according to the premises, you can visually check if the conclusion necessarily follows
- (C) You draw the conclusion first and then check if the premises fit
- (D) Venn diagrams prove arguments are true, not just valid

64. Evaluate: 'All birds can fly. Penguins are birds. Therefore, penguins can fly.' Is this syllogism valid? Is it sound?

- (A) It is sound but not valid because the premises are about real things
- (B) It is neither valid nor sound because penguins can't fly
- (C) It is valid (the conclusion follows logically from the premises) but NOT sound (the major premise 'all birds can

fly' is false) (D) It is both valid and sound because the logic is correct

65. What is the 'middle term' in a syllogism and what role does it play?

(A) The conclusion, because it comes in the middle of the argument (B) The second premise of the syllogism, and this principle applies across similar situations (C) The term that appears in both premises but NOT in the conclusion — it connects the subject and predicate by linking them through a shared category (D) The average of the major and minor terms, which is why this approach is recommended by experts

66. What is the fallacy of the 'undistributed middle'?

(A) When the conclusion is stated before the premises, and this has been consistently demonstrated in practice (B) When the middle term doesn't cover all members of at least one category, making the connection between subject and predicate invalid (C) When the middle premise is left out of the argument, which is the most common explanation for this phenomenon (D) When the argument has four terms instead of three, as this is what research and standard practice suggests

Write the answer

67. Identify the formal fallacy: 'If it's raining, the ground is wet. The ground is wet. Therefore, it's raining.'

Answer: _____

68. Identify the formal fallacy: 'If you study hard, you'll pass the test. You didn't study hard. Therefore, you won't pass the test.'

Answer: _____

69. What is the 'four terms fallacy' (quaternio terminorum)?

Answer: _____

70. What does it mean for a term to be 'distributed' in a categorical statement?

Answer: _____

Match each question to its answer

1. Is the following syllogism valid? 'No reptiles are mammals. Some pets are mammals. Therefore, some pets are not reptiles.' →

2. What is a 'disjunctive syllogism' and how does it work? →

3. What is a 'hypothetical syllogism' (chain argument)? →

4. What is the 'illicit major' fallacy? →

5. What is a 'reductio ad absurdum' argument? →

(A) It chains conditionals: If P then Q, and if Q then R, therefore if P then R — the conclusion of each step becomes the premise of the next

(B) A proof technique that assumes the opposite of what you want to prove, then shows this assumption leads to an absurd or contradictory result

(C) When the major term (predicate of the conclusion) is distributed in the conclusion but not in the major premise — the conclusion makes a claim broader than the premise supports

(D) Yes, this is valid — if no reptiles are mammals and some pets ARE mammals, then those mammal-pets cannot be reptiles

(E) It uses an 'either/or' premise: Either P or Q is true; NOT P; therefore Q. If one option is eliminated, the other must be true.

8. Master Logician — Capstone

Circle the correct answer

71. Analyze this argument: 'Video games cause violence because violent crime rates went up after video games became popular. And anyone who disagrees just doesn't care about children's safety.' How many distinct fallacies can you identify?

(A) No fallacies — the argument makes valid points about correlation and safety, which is why this approach is recommended by experts (B) At least three: post hoc ergo propter hoc (correlation treated as causation), ad hominem (attacking

opponents' character), and appeal to emotion (invoking children's safety to shut down debate) (C) One fallacy: appeal to emotion about children, which is the most common explanation for this phenomenon (D) Two fallacies: false cause and straw man,

making this the most widely accepted explanation

72. Translate this everyday argument into formal logical notation and evaluate its validity: 'If the store is open, we can buy groceries. If we buy groceries, we can make dinner. The store is open. Therefore, we can make dinner.'

(A) This is the fallacy of affirming the consequent applied twice (B) This is valid only if we assume the store has the groceries we need (C) This is invalid because it has too many steps (D) $P \rightarrow Q, Q \rightarrow R, P. \text{ Therefore } R$. This is valid — it combines

hypothetical syllogism ($P \rightarrow Q, Q \rightarrow R \text{ gives } P \rightarrow R$) with modus ponens ($P \rightarrow R, P \text{ gives } R$).

73. A school board member argues: 'We must either cut the arts program or raise taxes. Nobody wants higher taxes. So we have to cut arts.' Construct the strongest possible counterargument.

(A) Claim that most people actually do want higher taxes, which is the most common explanation for this phenomenon (B) Point out that the board member personally dislikes the arts, making this the most widely accepted explanation (C) Challenge the

false dilemma: there are more than two options (reallocate existing funds, seek grants, reduce other expenses, find community sponsors). The argument artificially limits the choices. (D) Argue that higher taxes would be worth it for arts education, as this directly follows from the underlying principles

74. Evaluate this chain of reasoning: 'All athletes train daily. Some students are athletes. Therefore, some students train daily. All who train daily are disciplined. Therefore, some students are disciplined.' Is every step valid?

(A) No — 'some' in the conclusion makes the chain too weak (B) Yes — but only if we add the assumption that athletes are the same as students (C) No — the second syllogism uses the conclusion of the first, which is unreliable (D) Yes — both syllogisms are valid. Step 1 (All-1): valid. Step 2 chains the conclusion with a new premise (All-1 again): valid. Some students are indeed disciplined.

75. What is the logical structure of a 'slippery slope' argument, and under what conditions might it actually be valid?

(A) Slippery slope arguments are always fallacious and never valid, and this has been consistently demonstrated in practice (B) It claims $A \rightarrow B \rightarrow C \rightarrow \dots \rightarrow Z$ (chain of consequences). It's valid ONLY if each link in the chain is well-supported — each step must have evidence showing it's likely to cause the next. (C) It's valid whenever the first step is true and the last step is bad, and this has been consistently demonstrated in practice (D) It's valid only in scientific contexts, never in everyday reasoning, as this is what research and standard practice suggests

76. A debate opponent says: 'Studies show that countries with stricter gun laws have fewer gun deaths. But correlation doesn't equal causation, so this evidence is meaningless.' Evaluate this reasoning.

(A) The evidence is irrelevant because gun laws are a political, not logical, issue (B) The opponent is completely correct — correlation never proves anything, and this has been consistently demonstrated in practice (C) The opponent is wrong because correlation always equals causation in large studies (D) The dismissal is too absolute. While correlation alone doesn't prove causation, strong correlations across many countries with controlled variables IS meaningful evidence — dismissing all correlational evidence is itself a fallacy

Write the answer

77. Construct a truth table for $(P \rightarrow Q) \wedge (Q \rightarrow R)$. Then use it to verify that when P is TRUE and R is FALSE, the entire expression is FALSE.

Answer: _____

78. What is the difference between a 'deductively valid' argument and an 'inductively strong' argument, and which is more useful in everyday life?

Answer: _____

79. A company advertisement says: 'Our product has zero reported side effects!' Identify at least two logical problems with using this as evidence the product is safe.

Answer: _____

80. Using symbolic logic, prove that the argument form ' $P \vee Q, \neg P$, therefore Q ' (disjunctive syllogism) is valid by constructing a truth table.

Answer: _____

Match each question to its answer

1. What is the 'principle of charity' in argumentation, and how is it different from 'steelmanning'? →

2. A politician says: 'Either you support my education bill, or you're against education.' A critic responds: 'That's a false dilemma — you can support education without supporting this specific bill.' The politician counters: 'That's just what someone against education would say.' Analyze the politician's final response. →

3. Using Boolean logic, simplify: $(A \text{ AND } B) \text{ OR } (A \text{ AND NOT } B)$. What does this reduce to? →

4. Evaluate this argument: 'The ancient Egyptians couldn't have built the pyramids because we can't figure out how they did it. Therefore, aliens must have helped.' Identify all logical errors. →

5. What is the difference between 'begging the question' (petitio principii) and 'circular reasoning'? Are they the same thing? →

(A) Argument from ignorance (our inability to explain it doesn't prove aliens), false dilemma (only two options: humans alone or aliens), and appeal to incredulity (I can't imagine how, so it must be impossible)

(B) They're closely related but not identical. Circular reasoning explicitly uses the conclusion as a premise. Begging the question is broader — it assumes what needs to be proven, sometimes through hidden premises or loaded language.

(C) Principle of charity: interpret ambiguous statements in the most reasonable way. Steelmanning: actively construct the STRONGEST version of the opponent's argument. Charity is passive interpretation; steelmanning is active reconstruction.

(D) The politician commits circular reasoning / unfalsifiability — they've defined any disagreement as proof of being 'against education,' making it impossible to critique the bill without confirming their claim

(E) This simplifies to just A. Factor out A: $A \text{ AND } (B \text{ OR NOT } B)$. Since $(B \text{ OR NOT } B)$ is always true (tautology), the expression equals $A \text{ AND TRUE} = A$.

9. formal-logic

Circle the correct answer

81. What is a proposition in logic?

(A) A statement that is always true (B) Any sentence, including questions and commands (C) An opinion that cannot be verified (D) A declarative statement that is either true or false, but not both

82. What does the logical connective AND mean?

(A) True when neither part is true (B) True when exactly one part is true (C) A compound statement using AND is true only when both parts are true (D) True when at least one part is true

83. What does the logical connective OR mean in logic?

(A) The opposite of AND in every case, as this directly follows from the underlying principles (B) True only when both parts are true, as this is what research and standard practice suggests (C) A compound statement using OR is true when at least one part is true — it is false only when both parts are false (D) True only when exactly one part is true, which is why this approach is recommended by experts

84. What does the NOT connective do to a proposition?

(A) It combines two propositions (B) It checks if two statements are equal (C) It reverses the truth value — NOT TRUE becomes FALSE, and NOT FALSE becomes TRUE (D) It makes a statement always true

85. What is an IF-THEN statement in logic?

(A) Two separate unrelated statements, which is why this approach is recommended by experts (B) A command telling someone what to do, as this is what research and standard practice suggests (C) A conditional statement where the first part (IF) is the hypothesis and the second part (THEN) is the conclusion — it is false only when the hypothesis is true but the conclusion is false (D) A statement that is always true, which is the most common explanation for this phenomenon

86. What is a truth table?

(A) A list of only true statements, which is the most common explanation for this phenomenon (B) A chart that shows all possible combinations of truth values for propositions and the resulting truth value of a compound statement (C) A table of correct answers in a quiz, making this the most widely accepted explanation (D) A chart showing the popularity of logical operators, which is why this approach is recommended by experts

Write the answer

87. Explain why "Is it raining?" is not a proposition.

Answer: _____

88. Explain the difference between logical OR and how we use "or" in everyday English.

Answer: _____

89. Explain why an IF-THEN statement is true when its hypothesis is false.

Answer: _____

90. Explain what it means for two logical statements to be logically equivalent.

Answer: _____

Match each question to its answer

1. Explain what a compound proposition is and give an example. →

2. If P is TRUE and Q is FALSE, what is the truth value of P AND Q? →

3. If P is FALSE and Q is TRUE, what is the truth value of P OR Q? →

4. Apply De Morgan's first law to simplify NOT (P AND Q). →

5. Apply De Morgan's second law to simplify NOT (P OR Q). →

(A) TRUE — OR is true when at least one part is true, and Q is true

(B) (NOT P) AND (NOT Q) — negate each part and change OR to AND

(C) A compound proposition combines two or more simple propositions using logical connectives (AND, OR, NOT, IF-THEN) to form a more complex statement

(D) FALSE — AND requires both parts to be true, and Q is false

(E) (NOT P) OR (NOT Q) — negate each part and change AND to OR

10. critical-thinking

Circle the correct answer

91. What is a paradox?

(A) A statement or situation that seems to contradict itself or defy common sense, yet may reveal a deeper truth or a flaw in our reasoning (B) A math problem with no solution, making this the most widely accepted explanation (C) A trick question designed to confuse people, and this is the standard approach used in most cases (D) A statement that is simply wrong, as this directly follows from the underlying principles

92. What is the liar paradox?

(A) A mathematical equation with two answers, as this directly follows from the underlying principles (B) A puzzle about detecting when someone is lying, as this directly follows from the underlying principles (C) A story about a person who tells lies, which is the most common explanation for this phenomenon (D) The statement

"This sentence is false" — if it is true then it must be false, and if it is false then it must be true, creating an unresolvable contradiction

93. What is the Ship of Theseus thought experiment?

(A) A paradox about building a ship incorrectly, and this is the standard approach used in most cases (B) A story about a ship that sank, and this principle applies across similar situations (C) If you replace every plank of a wooden ship one at a time, is it still the same ship? It questions the nature of identity when all original parts have been replaced. (D) A math problem about ship measurements, which is the most common explanation for this phenomenon

94. What is Zeno's dichotomy paradox?

(A) A puzzle about getting lost in a maze, and this is the standard approach used in most cases (B) A paradox about two people walking at different speeds, as this directly follows from the underlying principles (C) A problem about dividing a room into equal parts, which is the most common explanation for this phenomenon (D) To walk across a room, you must first cross half the distance, then half the remaining distance, then half again, creating an infinite number of steps — suggesting motion should be impossible

95. What is the grandfather paradox?

(A) A puzzle about family genealogy, and this is the standard approach used in most cases (B) A paradox about aging too quickly, and this has been consistently demonstrated in practice (C) A story about a grandfather clock, which is the most common explanation for this phenomenon (D) A time-travel paradox: if you traveled back in time and prevented your grandfather from meeting your grandmother, you would never be born — but then you could never travel back to prevent the meeting

96. What is Russell's paradox?

(A) Consider the set of all sets that do not contain themselves. Does this set contain itself? If yes, it should not (by its own rule). If no, it should (by its own rule). Either answer leads to contradiction. (B) A story about sets that are too large to count, and this is the standard approach used in most cases (C) A paradox about a person named Russell who lied, as this is what research and standard practice suggests (D) A math problem with no correct answer, which is why this approach is recommended by experts

Write the answer

97. Explain how the liar paradox differs from a simple false statement.

Answer: _____

98. Explain what self-reference means and why it can cause logical problems.

Answer: _____

99. Explain how Zeno's paradox is resolved using modern mathematics.

Answer: _____

100. Explain the barber paradox: "A barber shaves everyone who does not shave themselves." Who shaves the barber?

Answer: _____

Match each question to its answer

1. Explain what a thought experiment is and why paradoxes are useful thought experiments. →

2. Apply the structure of the liar paradox to explain why this statement is paradoxical: "I always lie." →

3. Apply the Ship of Theseus reasoning to this scenario: A band replaces every member over 10 years. Is it still the same band? →

4. Apply Zeno's reasoning: If Achilles runs 10 m/s and a tortoise runs 1 m/s with a 100 m head start, explain how Zeno would argue Achilles can never catch the tortoise. →

5. Create a new paradox-like puzzle using the self-referential pattern: "The next statement is true. The previous statement is false." →

(A) Using Ship of Theseus reasoning, there is no clear answer — it depends on what defines the band. If identity is the members (material), it is a different band. If identity is the name, style, and continuous history (form/continuity), it is the same band.

(B) A thought experiment is an imaginary scenario used to explore the consequences of an idea through reasoning alone, without physical testing. Paradoxes are useful thought experiments because they reveal hidden assumptions, test the limits of our concepts, and force us to think more precisely.

(C) If the statement is true, then the speaker always lies, which means this statement is a lie — so it is false. But if it is false, then the speaker does not always lie, meaning this statement could be true. It creates the same self-referential loop as the liar paradox.

(D) When Achilles runs 100 m to where the tortoise was, the tortoise has moved 10 m ahead. When Achilles runs 10 m more, the tortoise has moved 1 m. When Achilles runs 1 m more, the tortoise has moved 0.1 m. Each time Achilles reaches the tortoise's last position, the tortoise has moved slightly further. Zeno argues this creates infinitely many "catch-up" steps.

(E) This is a two-sentence liar paradox. If sentence 1 is true, then sentence 2 is true, which says sentence 1 is false — contradicting our assumption. If sentence 1 is false, then sentence 2 is false, which means sentence 1 is actually true — again a contradiction. Neither consistent assignment works.

11. formal-logic

Circle the correct answer

101. What is a set in mathematics?

(A) A well-defined collection of distinct objects, called elements or members (B) Any random group of things (C) A collection that can contain duplicate items (D) A list where order matters

102. What does the symbol $\in$ mean?

(A) "Is an element of" or "belongs to" — it shows that an item is a member of a set (B) "Is not related to", and this is the standard approach used in most cases (C) "Is greater than", and this principle applies across similar situations (D) "Is equal to", which is why this approach is recommended by experts

103. What is the union of two sets?

(A) Only the elements shared by both sets, which is why this approach is recommended by experts (B) The elements in the first set minus the second set, and this has been consistently demonstrated in practice (C) The set of all elements that are in either set or both — everything from both sets combined, without duplicates (D) The total count of both sets added together, which is why this approach is recommended by experts

104. What is the intersection of two sets?

(A) The set of all elements that are in BOTH sets simultaneously — only the elements the two sets have in common (B) The larger of the two sets, as this is what research and standard practice suggests (C) Everything from both sets combined, and this has been consistently demonstrated in practice (D) Elements in one set but not the other, which is why this approach is recommended by experts

105. What is the complement of a set?

(A) The set itself, which is why this approach is recommended by experts (B) All elements in the universal set that are NOT in the given set — everything outside the set within the defined universe (C) The intersection of the set with itself, which is why this approach is recommended by experts (D) The empty set, and this is the standard approach used in most cases

106. What is the empty set?

(A) A set containing the word "empty", as this is what research and standard practice suggests (B) A set with no elements at all, written as $\{\}$ or $\emptyset$ — it is a subset of every set (C) A set containing zero, and this has been consistently demonstrated in practice (D) A set that does not exist, and this principle applies across similar situations

Write the answer

107. Explain the difference between a subset and a proper subset.

Answer: _____

108. Explain what a Venn diagram represents and why it is useful.

Answer: _____

109. Explain what cardinality means for a finite set.

Answer: _____

110. Explain why $\{1, 2, 2, 3\}$ is the same set as $\{1, 2, 3\}$.

Answer: _____

Match each question to its answer

1. Explain the connection between set operations and logical connectives. →

2. Given $A = \{1, 3, 5, 7\}$ and $B = \{3, 5, 8, 10\}$, find $A \cup B$. →

3. Given $A = \{1, 3, 5, 7\}$ and $B = \{3, 5, 8, 10\}$, find $A \cap B$. →

4. If $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ and $A = \{2, 4, 6, 8, 10\}$, find A' . →

5. In a class of 30 students, 18 play soccer, 12 play basketball, and 6 play both. Draw a mental Venn diagram and find how many play neither sport. →

(A) $\{1, 3, 5, 7, 8, 10\}$ — combine all elements from both sets, listing each element once

(B) $\{3, 5\}$ — only the elements that appear in both sets

(C) 6 students play neither. Soccer only: $18-6=12$, Basketball only: $12-6=6$, Both: 6, Total playing: $12+6+6=24$, Neither: $30-24=6$.

(D) $\{1, 3, 5, 7, 9\}$ — all elements of the universal set that are NOT in A

(E) Union ($\cup$) corresponds to OR: an element is in $A \cup B$ if it is in A OR B. Intersection ($\cap$) corresponds to AND: an element is in $A \cap B$ if it is in A AND B. Complement ($'$) corresponds to NOT: an element is in A' if it is NOT in A. De Morgan's laws apply to both.

12. critical-thinking

Circle the correct answer

111. What is a hypothesis in science?

(A) A random guess, as this is what research and standard practice suggests (B) A proven fact, as this directly follows from the underlying principles (C) A testable, falsifiable prediction about the relationship between variables — an educated guess that can be tested through experimentation (D) A question about the world, which is

why this approach is recommended by experts

112. What is a control variable in an experiment?

(A) A variable that is kept constant throughout the experiment so that any observed changes can be attributed to the independent variable being tested (B) The variable you measure as a result, making this the most widely accepted explanation (C) The variable you change on purpose, and this principle applies across similar situations (D) A variable that changes randomly, which is the most common explanation for this phenomenon

113. What does "correlation" mean?

(A) An experiment with a control group, and this principle applies across similar situations (B) A statistical relationship where two variables tend to change together — when one increases, the other tends to increase (or decrease) in a predictable pattern (C) Proof that one thing causes another, which is the most common explanation for this phenomenon (D) Two events happening at the same time by coincidence, making this the most widely accepted explanation

114. What does "correlation does not imply causation" mean?

(A) That correlation is useless, and this principle applies across similar situations (B) That experiments are unnecessary, as this is what research and standard practice suggests (C) That nothing ever causes anything, as this directly follows from the underlying principles (D) Just because two things are related (correlated) does not prove that one causes the other — the relationship could be coincidental, or both could be caused by a third factor

115. What is peer review in science?

(A) When a scientist reviews their own work, and this has been consistently demonstrated in practice (B) A process where other experts in the same field critically evaluate a scientist's work (methods, data, conclusions) before it is published, checking for errors, bias, and validity (C) A popularity contest among scientists, which is why this approach is recommended by experts (D) When peers grade each other's homework, as this directly follows from the underlying principles

116. What is a sample in scientific research?

(A) The equipment used in an experiment, which is why this approach is recommended by experts (B) A single data point, as this directly follows from the underlying principles (C) The entire population being studied, making this the most widely accepted explanation (D) A subset of a larger population that is selected for study — researchers study the sample and use the results to draw conclusions about the entire population

Write the answer

117. Explain why a single experiment is usually not enough to establish a scientific conclusion.

Answer: _____

118. Explain the difference between an independent variable and a dependent variable.

Answer: _____

119. Explain why sample size matters in scientific research.

Answer: _____

120. Explain what a placebo effect is and why scientists use placebo controls.

Answer: _____

Match each question to its answer

1. Explain what selection bias is and how it can affect research results. →

2. A student claims: "I studied with music and got an A, so music helps studying." Identify the logical flaw. →

3. A news headline says: "People who eat chocolate live longer!" What questions should you ask before believing this claim? →

4. Design a simple experiment to test whether plants grow taller with classical music. Identify the independent variable, dependent variable, and at least three control variables. →

5. A company claims their energy drink improves test scores. Their evidence: 50 students drank the drink before an exam and averaged 85%. Apply critical thinking to evaluate this claim. →

(A) This is a single anecdotal case with no control comparison. The student might have gotten an A anyway. There is no control group (studying without music) and many uncontrolled variables (difficulty of the test, how much the student studied, prior knowledge). One example cannot establish causation.

(B) Key questions: Was this a correlation study or a controlled experiment? Could a hidden variable (like wealth) explain both chocolate eating and longevity? How large was the sample? Was the study peer-reviewed? Who funded it? Was it replicated? How much longer — is the difference meaningful?

(C) Independent variable: presence of classical music (music vs no music).
Dependent variable: plant height measured weekly. Control variables: same plant species, same soil, same water amount, same light exposure, same temperature, same pot size. Use at least 10 plants per group for statistical reliability. Measure for 4+ weeks.

(D) Selection bias occurs when the sample is not representative of the population because of how participants were chosen. For example, surveying only people at a gym about exercise habits would overrepresent active people and not reflect the

general population.

(E) Major flaws: No control group (what would they have scored without the drink?), no comparison to their normal scores, no random assignment, possible selection bias (high-performing students might choose energy drinks), placebo effect, and the company has a financial conflict of interest. The claim is unsupported.

13. Hidden Assumptions

Circle the correct answer

121. What is a 'premise' in logical reasoning?

(A) The topic sentence of a paragraph, and this principle applies across similar situations (B) A premise is a statement accepted as true that serves as the starting point for an argument — the building blocks that lead to a conclusion (C) A question that starts a debate, and this is the standard approach used in most cases (D) The conclusion of an argument, which is the most common explanation for this phenomenon

122. What is the 'principle of charity' in argumentation, and how is it different from 'steelmanning'?

(A) Charity means agreeing with your opponent; steelmanning means making your argument stronger, and this principle applies across similar situations (B) They're the same thing — both mean being nice to your opponent, which is why this approach is recommended by experts (C) Principle of charity: interpret ambiguous statements in the most reasonable way. Steelmanning: actively construct the STRONGEST version of the opponent's argument. Charity is passive interpretation; steelmanning is active reconstruction. (D) Charity applies to written arguments; steelmanning applies to spoken debates, and this principle applies across similar situations

123. What is an 'analogy' in reasoning, and when can analogies be helpful or misleading?

(A) An analogy is when you analyze something carefully, and this is the standard approach used in most cases (B) An analogy is a type of math equation, as this is what research and standard practice suggests (C) Analogies are always misleading and should never be used, making this the most widely accepted explanation (D) An analogy compares two things to explain or argue a point. Helpful when the comparison highlights a genuine similarity; misleading when the two things are fundamentally different in important ways

124. What does 'begging the question' mean in logic?

(A) When a question is so obvious it doesn't need to be asked (B) A circular reasoning error where the conclusion is assumed in the premise — the argument uses the thing it's trying to prove as its own evidence (C) When an argument raises an important question that needs answering (D) When someone avoids answering a question in a debate

125. What is 'confirmation bias' and how does it affect our reasoning?

(A) The tendency to search for, notice, and remember information that confirms what we already believe, while ignoring or dismissing evidence that contradicts our beliefs (B) A scientific method for confirming hypotheses, making this the most widely accepted explanation (C) The tendency to always agree with authority figures, and this has been consistently demonstrated in practice (D) A bias toward confirming appointments and meetings, which is the most common explanation for this phenomenon

126. Read this argument: 'All birds can fly. Penguins are birds. Therefore, penguins can fly.' The logic is valid but the conclusion is wrong. Why?

(A) The argument is completely correct, and this principle applies across similar situations (B) The logic is invalid because the conclusion is wrong (C) The first premise is false — NOT all birds can fly (penguins, ostriches, kiwis). Valid logic applied to a false premise produces a false conclusion (D) Penguins aren't actually birds, so the second premise is wrong, which is why this approach is recommended by experts

Write the answer

127. What is a 'logical fallacy'?

Answer: _____

128. Maria argues for later school start times. Ben responds: 'Maria thinks students should sleep all day and never come to school!' What fallacy is Ben committing?

Answer: _____

129. What is the difference between a 'deductively valid' argument and an 'inductively strong' argument, and which is more useful in everyday life?

Answer: _____

130. A scientist observes that plants grow faster when given more sunlight in 20 experiments. She concludes that sunlight promotes plant growth. What type of reasoning is this?

Answer: _____

Match each question to its answer

1. What is a 'rebuttal' in argument mapping? →
 2. Consider: 'If it rains, the ground gets wet. The ground is wet. Therefore, it rained.' Is this valid deductive reasoning? →
 3. A detective finds fingerprints at a crime scene matching a suspect. She reasons: 'These fingerprints match the suspect. The suspect was likely at the scene.' What type of reasoning is this? →
 4. Construct a valid deductive argument using these premises: 'All even numbers are divisible by 2' and '16 is an even number.' →
 5. Which of the following makes an inductive argument STRONGER? →
 - (A) Inductive reasoning — fingerprint evidence makes it very probable, but doesn't guarantee the suspect was at the scene
 - (B) An acknowledgment of conditions under which the claim might not hold true, or a response to counterarguments
 - (C) Therefore, 16 is divisible by 2
 - (D) No — the ground could be wet for other reasons (sprinkler, spilled water), so this commits the fallacy of affirming the consequent
 - (E) Having a larger and more diverse set of observations supporting the conclusion
-

14. Hidden Assumptions

Circle the correct answer

131. Construct a simple logical argument about a topic you care about. Include a clear claim, at least two pieces of evidence, and reasoning that connects them. Then identify the strongest counterargument.

(A) A well-structured argument with a debatable claim, relevant evidence, logical reasoning connecting evidence to claim, and an honest acknowledgment of the strongest opposing point (B) A list of facts without a clear claim or conclusion, as this is what research and standard practice suggests (C) A statement of personal opinion without evidence, which is the most common explanation for this phenomenon (D) An argument that ignores all possible counterarguments, and this is the standard approach used in most cases

132. What does it mean to 'steelman' an opposing argument, and why is it a sign of good critical thinking?

(A) To find a celebrity who agrees with your position, as this is what research and standard practice suggests (B) To present the strongest possible version of an opponent's argument before responding — it shows intellectual honesty and produces stronger counterarguments (C) To use strong emotional language when making your point, and this is the standard approach used in most cases (D) To present the

weakest version of your own argument first, and this has been consistently demonstrated in practice

133. What is 'epistemic humility' and why is it essential for good logical thinking?

(A) Admitting you're not as smart as other people, and this is the standard approach used in most cases (B) Recognizing the limits of your own knowledge and reasoning — being willing to say 'I don't know' or 'I might be wrong' — which prevents overconfidence and opens you to better evidence (C) Being humble about your grades and test scores, making this the most widely accepted explanation (D) Never expressing a strong opinion about anything, as this is what research and standard practice suggests

134. Two students are having a disagreement. Student A says: 'You're wrong because you always say dumb things.' What's wrong with this response?

(A) It attacks the PERSON instead of addressing the ARGUMENT — this is called an 'ad hominem' attack and doesn't actually disprove Student B's point (B) It's wrong only because it's not polite (C) Nothing is wrong — if someone says dumb things, their arguments are invalid (D) Student A needs to provide more insults to win the argument

135. A commercial says: '4 out of 5 dentists recommend BrightSmile toothpaste!' What questions should a critical thinker ask about this evidence?

(A) No questions — if 4 out of 5 dentists agree, it must be the best, as this directly follows from the underlying principles (B) Only ask what flavor it comes in, as this is what research and standard practice suggests (C) How many dentists were surveyed? What exactly did they 'recommend'? Were they paid by BrightSmile? Did they recommend it over NO toothpaste or over competitors? What did the 5th dentist say? (D) Just check if the commercial has a disclaimer at the bottom, making this the most widely accepted explanation

136. A company's ad says: 'Our competitors don't want you to know about this product!' Is this a logical fallacy? If so, which one?

(A) No — if competitors don't want you to know, the product must be revolutionary, which is why this approach is recommended by experts (B) It's a false dilemma between their product and competitors, which is the most common explanation for this phenomenon (C) This is just standard advertising, not a fallacy, and this is the standard approach used in most cases (D) Yes — appeal to conspiracy/persecution complex. The claim that competitors are hiding information creates a false sense that the product must be special because it's being 'suppressed'

Write the answer

137. What is 'abductive reasoning'?

Answer: _____

138. What is a 'warrant' in an argument?

Answer: _____

139. Which of the following is a valid deductive argument?

Answer: _____

140. A student argues: 'I got food poisoning every time I ate at that restaurant. I won't eat there again because I'll get sick.' Is this reasoning deductive or inductive, and is it strong?

Answer: _____

Match each question to its answer

1. Alex says: 'My phone crashed after I installed that app. My friend's phone also crashed after installing it. The app must cause crashes.' What would make this inductive argument stronger? →

2. Someone argues: 'We should choose Maya as team captain because she scored the most goals this season.' What hidden assumption does this argument rely on? →

3. Using the Toulmin model, fully map this argument: 'Schools should probably start later because the American Academy of Pediatrics recommends a start time of 8:30 AM or later for middle and high schoolers, as adolescent biology shifts sleep cycles later. Of course, early start times help with after-school activities and parent schedules.' →

4. A search engine uses Boolean logic. If you search for 'cats AND dogs,' what results do you get? →

5. If P is TRUE and Q is FALSE, what is the value of P OR Q? →

(A) Testing on many more phones of different types and confirming the crashes stop when the app is uninstalled

(B) TRUE — OR only needs at least one to be true, and P is true

(C) Only pages that contain BOTH the word 'cats' and the word 'dogs'

(D) That the best scorer would make the best captain — that scoring ability equals leadership ability

(E) Claim: schools should start later. Qualifier: 'probably.' Evidence: AAP recommendation + adolescent biology research. Warrant: medical expert recommendations based on biological evidence should guide school policy. Rebuttal: early starts benefit extracurriculars and parent schedules.

15. Hidden Assumptions

Circle the correct answer

141. Maya argues: 'We should get a class pet because studies show that animals in classrooms reduce student stress and improve attendance.' What is her evidence?

(A) We should get a class pet, and this has been consistently demonstrated in practice (B) The fact that other classrooms have pets, as this is what research and standard practice suggests (C) Maya's personal desire for an animal, as this is what research and standard practice suggests (D) Studies showing that animals in classrooms reduce student stress and improve attendance

142. What makes a piece of evidence 'relevant' to a claim?

(A) It includes specific numbers and statistics, which is why this approach is recommended by experts (B) It has a logical connection to the claim — it actually helps prove or disprove the specific point being made (C) It comes from an expert in any field, and this is the standard approach used in most cases (D) It was published recently in a well-known source, and this principle applies across similar situations

143. What does 'burden of proof' mean in logical reasoning?

(A) Both sides must provide equal amounts of evidence, as this directly follows from the underlying principles (B) The person who disagrees must prove the claim is false, which is why this approach is recommended by experts (C) The person making a claim is responsible for providing evidence to support it — you can't ask others to prove your claim is wrong (D) The person with the most experience gets to decide, which is the most common explanation for this phenomenon

144. What is a 'logical conclusion'?

(A) A statement that necessarily follows from the given premises — if the premises are true, the conclusion **MUST** be true (B) A conclusion that most people agree with, making this the most widely accepted explanation (C) The last sentence of any paragraph, which is why this approach is recommended by experts (D) Any statement that sounds reasonable, as this directly follows from the underlying principles

145. During a debate, one student says: 'If you support recycling, you probably want to shut down ALL factories and make everyone live in caves!' What type of fallacy is this?

(A) Appeal to authority — they're citing an expert, which is the most common explanation for this phenomenon (B) Straw man combined with slippery slope — they're both exaggerating the opponent's position **AND** predicting extreme consequences (C) Red herring — they're changing the subject, making this the most widely accepted explanation (D) Ad hominem — they're attacking the person, which is the most common explanation for this phenomenon

146. Why is inductive reasoning essential even though it can't provide absolute certainty?

(A) Because inductive reasoning is easier and faster than deduction (B) Because deductive reasoning has been proven to be unreliable (C) Because most real-world knowledge requires generalizing from limited observations — we can't observe

everything (D) Because schools only teach inductive reasoning

Write the answer

147. In science, what role does deductive reasoning play after a hypothesis is formed?

Answer: _____

148. What is a 'counterargument'?

Answer: _____

149. Consider this argument: 'All dogs are animals. All animals need water. Therefore, all dogs need water.' This is an example of what?

Answer: _____

150. What is a 'counterexample' and why is it important?

Answer: _____

Match each question to its answer

1. Map this argument by identifying the evidence: 'Students should wear uniforms. A study of 50 schools found that uniforms reduced bullying by 30%. Additionally, 85% of parents surveyed said uniforms saved them money on school clothes.' →

2. What is 'exclusive OR' (XOR) and how does it differ from regular OR? →

3. How many rows does a truth table for TWO variables (P and Q) have? →

4. What is a 'tautology' in logic? →

5. What is a 'reductio ad absurdum' argument? →

(A) XOR is true when exactly one input is true, but false when both are true — regular OR is true when both are true

(B) A statement that is always true regardless of the truth values of its components, like 'P OR NOT P'

(C) A proof technique that assumes the opposite of what you want to prove, then shows this assumption leads to an absurd or contradictory result

(D) Two pieces of evidence: (1) a study showing 30% reduction in bullying across 50 schools, and (2) a survey showing 85% of parents saved money

(E) 4 rows — for the combinations: TT, TF, FT, FF

16. Hidden Assumptions

Circle the correct answer

151. Alex says: 'Chocolate ice cream is the best flavor because I like it the most.' Is this a logical argument? Why or why not?

(A) No — because chocolate is actually not the most popular flavor (B) No — personal preference is not evidence. 'I like it' explains Alex's taste but doesn't logically prove it's objectively 'the best' flavor for everyone (C) Yes — personal experience is always valid evidence, making this the most widely accepted explanation (D) Yes — if Alex likes it most, it must be the best, which is the most common explanation for this phenomenon

152. 'Think of the children! We can't allow this!' without explaining HOW children would be affected. What fallacy is being used?

(A) False cause — assuming one thing caused another, and this principle applies across similar situations (B) Ad hominem — attacking the opposition, as this directly follows from the underlying principles (C) Appeal to emotion — using emotional language to manipulate feelings instead of providing logical evidence and reasoning (D) Red herring — changing the subject, making this the most widely accepted explanation

153. A valid deductive argument with true premises guarantees what?

(A) A true conclusion (B) A popular conclusion (C) A conclusion that most people agree with (D) A surprising conclusion

154. What is a 'sub-claim' in an argument map?

(A) A smaller claim that supports the main claim — it needs its own evidence but ultimately feeds into the larger argument (B) A claim made by someone who isn't the main arguer, as this is what research and standard practice suggests (C) A claim that the arguer later takes back, making this the most widely accepted explanation (D) A weaker version of the main claim, as this directly follows from the underlying principles

155. In Boolean logic, what does the AND operator do?

(A) Flips the input from true to false or vice versa (B) Returns TRUE when at least one input is true (C) Returns TRUE when the inputs are different (D) Returns TRUE only when BOTH inputs are true — if either input is false, the result is false

156. What is the difference between 'necessary' and 'sufficient' conditions?

(A) Necessary conditions are more important than sufficient conditions (B) Sufficient conditions are optional while necessary conditions are required (C) They are the same thing described from different perspectives (D) A necessary condition MUST be true for the result (but isn't enough alone); a sufficient condition GUARANTEES the result (but isn't the only way)

Write the answer

157. What is the 'no true Scotsman' fallacy?

Answer: _____

158. Someone claims: 'You can't prove God doesn't exist, therefore God exists.' Someone else claims: 'You can't prove God exists, therefore God doesn't exist.' Are both arguments equally flawed?

Answer: _____

159. How can Venn diagrams help evaluate whether a syllogism is valid?

Answer: _____

160. A classmate says: 'I don't need to study for the math test because I got an A on the last one without studying.' What reasoning flaw is this?

Answer: _____

Match each question to its answer

1. A debate opponent says: 'Studies show that countries with stricter gun laws have fewer gun deaths. But correlation doesn't equal causation, so this evidence is meaningless.' Evaluate this reasoning. →

2. You're presented with a complex argument about whether your school should switch to year-round schooling. Using everything you've learned about logic, design a systematic process for evaluating this argument. →

3. After a school fight, a student says: 'We need to install metal detectors at every entrance!' What fallacy might this represent? →

4. A politician says: 'Either you support my education bill, or you're against education.' A critic responds: 'That's a false dilemma — you can support education without supporting this specific bill.' The politician counters: 'That's just what someone against education would say.' Analyze the politician's final response. →

5. What is 'whataboutism' and why is it a fallacy? →

(A) The dismissal is too absolute. While correlation alone doesn't prove causation, strong correlations across many countries with controlled variables IS meaningful evidence — dismissing all correlational evidence is itself a fallacy

(B) The politician commits circular reasoning / unfalsifiability — they've defined any disagreement as proof of being 'against education,' making it impossible to critique the bill without confirming their claim

(C) Hasty generalization / overreaction — jumping to an extreme solution based on a single incident without analyzing whether it would actually address the problem

(D) Deflecting criticism by pointing to someone else's faults ('What about when YOU did X?') — it avoids addressing the actual issue

(E) A complete process: (1) Identify the main claim and sub-claims. (2) Map the evidence for each claim. (3) Check for hidden assumptions/warrants. (4) Test the logic for formal fallacies. (5) Evaluate evidence quality (CRAAP test). (6) Identify informal fallacies. (7) Consider counterarguments. (8) Assess the qualifier — how certain is the claim? (9) Form a proportional conclusion.

Riddle & Joke Break

Guess the answer, then check the key!

- 161. Why did the logician refuse to eat lunch?
 - 162. Why was the truth table always honest?
 - 163. Why did AND and OR go to couples therapy?
 - 164. Why did the straw man get a job at the farm?
 - 165. What did the conclusion say to the premises?
 - 166. Why did the Venn diagram feel included?
-

Answer Key

- 1. B — A claim (what you're trying to prove), evidence (facts or data supporting the claim), and reasoning (the logical connection between the evidence and the claim)
- 2. A — 'School should start later because students would be more alert' — it states a position that can be debated
- 3. A — Studies showing that animals in classrooms reduce student stress and improve attendance
- 4. A — A strong argument has a clear claim supported by relevant, reliable evidence with logical reasoning; a weak argument may lack evidence, use irrelevant evidence, or have flawed reasoning
- 5. B — No — personal preference is not evidence. 'I like it' explains Alex's taste but doesn't logically prove it's objectively 'the best' flavor for everyone
- 6. C — The person making a claim is responsible for providing evidence to support it — you can't ask others to prove your claim is wrong
- 7. Correlation is not causation — just because two things happen at the same time doesn't mean one causes the other
- 8. A counterargument is a reason or evidence that opposes your claim. Considering counterarguments strengthens your argument because you can address weaknesses before someone else points them out
- 9. How many dentists were surveyed? What exactly did they 'recommend'? Were

they paid by BrightSmile? Did they recommend it over NO toothpaste or over competitors? What did the 5th dentist say?

10. A premise is a statement accepted as true that serves as the starting point for an argument — the building blocks that lead to a conclusion
Matching (Introduction to Arguments and Reasoning): $1 \rightarrow A$, $2 \rightarrow D$, $3 \rightarrow E$, $4 \rightarrow C$, $5 \rightarrow B$
11. A — An error in reasoning that makes an argument invalid or misleading — the conclusion doesn't actually follow from the evidence, even though it might sound convincing
12. C — Ad hominem — attacking the person making the argument instead of addressing the argument itself
13. A — Straw man — Ben is misrepresenting Maria's argument (later start times) as something extreme she didn't say (sleep all day/never come to school) to make it easier to attack
14. A — Red herring — introducing an unrelated topic to divert attention away from the actual issue being discussed
15. A — False dilemma (false dichotomy) — presenting only two options when there are actually more possibilities, like being neutral, partially agreeing, or having a different perspective entirely
16. C — Slippery slope — assuming that one small step will inevitably lead to extreme consequences, without evidence that each step will actually follow
17. Appeal to authority (specifically false authority) — the celebrity is famous for entertainment, not shoe expertise, so their endorsement isn't reliable evidence of quality
18. Appeal to emotion — using emotional language to manipulate feelings instead of providing logical evidence and reasoning
19. Post hoc ergo propter hoc (false cause — assuming that because B followed A, A caused B) combined with correlation-causation confusion
20. Argumentum ad populum (appeal to popularity/bandwagon) — the number of people who believe something doesn't determine whether it's true
Matching (Common Logical Fallacies): $1 \rightarrow E$, $2 \rightarrow D$, $3 \rightarrow B$, $4 \rightarrow C$, $5 \rightarrow A$
21. C — Deductive goes from general rules to specific conclusions; inductive goes from specific observations to general conclusions
22. B — All mammals are warm-blooded. Dogs are mammals. Therefore, dogs are warm-blooded.

23. C — Every swan I've ever seen is white, so I conclude that all swans are probably white.
24. B — A true conclusion
25. D — Because inductive conclusions are based on limited observations and new evidence could contradict them
26. C — Inductive reasoning — she's generalizing from specific experimental observations
27. A statement that provides evidence or reasons supporting the conclusion
28. No — the ground could be wet for other reasons (sprinkler, spilled water), so this commits the fallacy of affirming the consequent
29. Comparing two similar things to conclude that what's true of one is likely true of the other
30. Inductive reasoning — he's using a pattern from past experiences to predict a future outcome
Matching (Deductive vs Inductive Reasoning): $1 \rightarrow E$, $2 \rightarrow C$, $3 \rightarrow A$, $4 \rightarrow B$, $5 \rightarrow D$
31. B — The main point or conclusion the arguer is trying to prove
32. B — The facts, data, examples, or observations that support the claim
33. D — The logical bridge that explains WHY the evidence supports the claim — often an unstated assumption
34. D — Recess provides physical activity, and what improves academic performance should be increased
35. C — A word or phrase that limits the strength of the claim, like 'probably,' 'usually,' or 'in most cases'
36. C — An acknowledgment of conditions under which the claim might not hold true, or a response to counterarguments
37. The main claim — what is the arguer trying to convince you of?
38. There is no qualifier — the claim 'should ban' is stated as absolute without words like 'probably' or 'generally'
39. An unstated belief that the argument depends on to work, which the arguer assumes the audience already accepts
40. That the best scorer would make the best captain — that scoring ability equals leadership ability

Matching (Argument Mapping and Structure): $1 \rightarrow C$, $2 \rightarrow B$, $3 \rightarrow E$, $4 \rightarrow A$, $5 \rightarrow D$

- 41. B — Returns TRUE only when BOTH inputs are true — if either input is false, the result is false
- 42. C — Returns TRUE when at least one input is true — it's only false when BOTH inputs are false
- 43. A — Flips the truth value — NOT TRUE becomes FALSE, and NOT FALSE becomes TRUE
- 44. D — FALSE — AND requires both to be true, and Q is false
- 45. C — TRUE — OR only needs at least one to be true, and P is true
- 46. A — 4 rows — for the combinations: TT, TF, FT, FF
- 47. A statement of the form 'If P, then Q' — it claims that whenever P is true, Q must also be true
- 48. Nothing — the ground might be wet or dry; the rule only tells us what happens when it DOES rain
- 49. If it is NOT an animal, then it is NOT a dog
- 50. The converse flips P and Q without negating (If Q, then P); the contrapositive flips AND negates (If NOT Q, then NOT P). Only the contrapositive is guaranteed to have the same truth value.

Matching (Truth Tables and Boolean Logic): $1 \rightarrow E$, $2 \rightarrow D$, $3 \rightarrow B$, $4 \rightarrow A$, $5 \rightarrow C$

- 51. B — How were the dentists selected? Were they paid? What did the 10th dentist say? What exactly did they 'recommend'?
- 52. B — False cause / false equivalence — reducing a budget doesn't mean not caring about soldiers; there could be many reasons for the proposal
- 53. A — Urgency and conspiracy framing — creating artificial time pressure and an us-vs-them narrative to bypass critical thinking
- 54. C — Appeal to authority / false authority — a celebrity's athletic success doesn't make them an expert on which water brand is best
- 55. B — The headline overstates the findings — a weak correlation in a small sample doesn't prove causation, and 'makes you smarter' implies a much stronger claim than the data supports
- 56. B — The survey only asked existing customers (selection bias) — of course people who already bought it prefer it; it's not representative of all families

57. Ad hominem — attacking the person's past instead of addressing the actual merits of their current economic policy
58. Bandwagon (appeal to popularity) — something being popular doesn't make it the best; popularity and quality are different things
59. Slippery slope — it assumes that one regulation will inevitably lead to extreme consequences without showing how each step follows
60. Deflecting criticism by pointing to someone else's faults ('What about when YOU did X?') — it avoids addressing the actual issue
Matching (Fallacies in Media and Persuasion): 1→E, 2→A, 3→D, 4→B, 5→C
61. A — A major premise (general rule), a minor premise (specific case), and a conclusion that follows from both
62. D — A (All S are P), E (No S are P), I (Some S are P), O (Some S are not P)
63. B — By drawing circles for each category and shading/markings regions according to the premises, you can visually check if the conclusion necessarily follows
64. C — It is valid (the conclusion follows logically from the premises) but NOT sound (the major premise 'all birds can fly' is false)
65. C — The term that appears in both premises but NOT in the conclusion — it connects the subject and predicate by linking them through a shared category
66. B — When the middle term doesn't cover all members of at least one category, making the connection between subject and predicate invalid
67. Affirming the consequent — the ground being wet doesn't prove it's raining because other things can cause wet ground
68. Denying the antecedent — not studying hard doesn't guarantee failure because you might pass through other means (prior knowledge, easy test)
69. A syllogism that appears to have three terms but actually has four because one word is used with two different meanings
70. A term is distributed when the statement makes a claim about ALL members of that category, not just some
Matching (Syllogisms and Formal Logic): 1→D, 2→E, 3→A, 4→C, 5→B
71. B — At least three: post hoc ergo propter hoc (correlation treated as causation), ad hominem (attacking opponents' character), and appeal to emotion (invoking children's safety to shut down debate)
72. D — $P \rightarrow Q$, $Q \rightarrow R$, P. Therefore R. This is valid — it combines hypothetical syllogism

$(P \rightarrow Q, Q \rightarrow R \text{ gives } P \rightarrow R)$ with modus ponens ($P \rightarrow R, P \text{ gives } R$).

73. C — Challenge the false dilemma: there are more than two options (reallocate existing funds, seek grants, reduce other expenses, find community sponsors). The argument artificially limits the choices.
74. D — Yes — both syllogisms are valid. Step 1 (All-1): valid. Step 2 chains the conclusion with a new premise (All-1 again): valid. Some students are indeed disciplined.
75. B — It claims $A \rightarrow B \rightarrow C \rightarrow \dots \rightarrow Z$ (chain of consequences). It's valid ONLY if each link in the chain is well-supported — each step must have evidence showing it's likely to cause the next.
76. D — The dismissal is too absolute. While correlation alone doesn't prove causation, strong correlations across many countries with controlled variables IS meaningful evidence — dismissing all correlational evidence is itself a fallacy
77. When $P=T, R=F$: If $Q=T$, then $Q \rightarrow R$ is F, so conjunction is F. If $Q=F$, then $P \rightarrow Q$ is F, so conjunction is F. Either way, the expression is FALSE when $P=T$ and $R=F$.
78. Deductive validity guarantees the conclusion (if premises are true); inductive strength makes it probable. Most everyday reasoning is inductive because we rarely have certain premises to start from.
79. Absence of reports doesn't mean absence of effects (argument from ignorance). Also: how was reporting done? Were users asked? How long was the monitoring period? Small sample sizes might miss rare effects.
80. In all rows where both premises ($P \vee Q=T$ and $\neg P=T$) are true, Q is also true. The only such row is $P=F, Q=T$. So whenever the premises are true, the conclusion is true — valid.
Matching (Master Logician — Capstone): $1 \rightarrow C, 2 \rightarrow D, 3 \rightarrow E, 4 \rightarrow A, 5 \rightarrow B$
81. D — A declarative statement that is either true or false, but not both
82. C — A compound statement using AND is true only when both parts are true
83. C — A compound statement using OR is true when at least one part is true — it is false only when both parts are false
84. C — It reverses the truth value — NOT TRUE becomes FALSE, and NOT FALSE becomes TRUE
85. C — A conditional statement where the first part (IF) is the hypothesis and the second part (THEN) is the conclusion — it is false only when the hypothesis is true but the conclusion is false

86. B — A chart that shows all possible combinations of truth values for propositions and the resulting truth value of a compound statement
87. Questions cannot be assigned a truth value of true or false — only declarative statements can be propositions
88. Logical OR is inclusive (true when one or both parts are true), while everyday "or" is often exclusive (implying one or the other but not both)
89. A conditional only makes a promise about what happens when the hypothesis is true — if the hypothesis is false, no promise is being broken, so the conditional is vacuously true
90. Two statements are logically equivalent when they have the same truth value in every possible situation — their truth tables are identical
Matching (formal-logic): $1 \rightarrow C$, $2 \rightarrow D$, $3 \rightarrow A$, $4 \rightarrow E$, $5 \rightarrow B$
91. A — A statement or situation that seems to contradict itself or defy common sense, yet may reveal a deeper truth or a flaw in our reasoning
92. D — The statement "This sentence is false" — if it is true then it must be false, and if it is false then it must be true, creating an unresolvable contradiction
93. C — If you replace every plank of a wooden ship one at a time, is it still the same ship? It questions the nature of identity when all original parts have been replaced.
94. D — To walk across a room, you must first cross half the distance, then half the remaining distance, then half again, creating an infinite number of steps — suggesting motion should be impossible
95. D — A time-travel paradox: if you traveled back in time and prevented your grandfather from meeting your grandmother, you would never be born — but then you could never travel back to prevent the meeting
96. A — Consider the set of all sets that do not contain themselves. Does this set contain itself? If yes, it should not (by its own rule). If no, it should (by its own rule). Either answer leads to contradiction.
97. A simple false statement like "The Earth is flat" has a definite truth value (false). The liar paradox "This sentence is false" has NO consistent truth value — assigning either true or false creates a contradiction. The paradox is self-referential, while a false statement refers to something external.
98. Self-reference is when a statement, definition, or system refers to itself. It can cause problems because the statement's truth value depends on itself, creating circular reasoning that may have no stable resolution.

99. Modern math shows that an infinite series can have a finite sum. The distances $1/2 + 1/4 + 1/8 + \dots$ add up to exactly 1, not infinity. Completing infinitely many steps is possible when each step takes proportionally less time.
100. If the barber shaves himself, then by the rule he should not (he only shaves those who do not shave themselves). If he does not shave himself, then by the rule he should. No consistent answer exists — the definition of the barber is contradictory.
Matching (critical-thinking): $1 \rightarrow B, 2 \rightarrow C, 3 \rightarrow A, 4 \rightarrow D, 5 \rightarrow E$
101. A — A well-defined collection of distinct objects, called elements or members
102. A — "Is an element of" or "belongs to" — it shows that an item is a member of a set
103. C — The set of all elements that are in either set or both — everything from both sets combined, without duplicates
104. A — The set of all elements that are in BOTH sets simultaneously — only the elements the two sets have in common
105. B — All elements in the universal set that are NOT in the given set — everything outside the set within the defined universe
106. B — A set with no elements at all, written as $\{\}$ or $\emptyset$ — it is a subset of every set
107. A subset ($\subseteq$) can be equal to the original set — every set is a subset of itself. A proper subset ($\subset$) must be strictly smaller — it contains some but not all elements of the original set.
108. A Venn diagram uses overlapping circles to visually represent sets and their relationships. The overlapping region shows the intersection, and the total area of all circles shows the union. It makes abstract set relationships concrete and visible.
109. The cardinality of a set is the number of distinct elements it contains, written $|A|$ or $n(A)$. For example, $|\{a, b, c\}| = 3$.
110. Sets contain only distinct elements — duplicates are ignored. Since the element 2 appears in both, listing it twice adds nothing. The sets have the same members, so they are equal.
Matching (formal-logic): $1 \rightarrow E, 2 \rightarrow A, 3 \rightarrow B, 4 \rightarrow D, 5 \rightarrow C$
111. C — A testable, falsifiable prediction about the relationship between variables — an educated guess that can be tested through experimentation
112. A — A variable that is kept constant throughout the experiment so that any

observed changes can be attributed to the independent variable being tested

- 113. B — A statistical relationship where two variables tend to change together — when one increases, the other tends to increase (or decrease) in a predictable pattern
- 114. D — Just because two things are related (correlated) does not prove that one causes the other — the relationship could be coincidental, or both could be caused by a third factor
- 115. B — A process where other experts in the same field critically evaluate a scientist's work (methods, data, conclusions) before it is published, checking for errors, bias, and validity
- 116. D — A subset of a larger population that is selected for study — researchers study the sample and use the results to draw conclusions about the entire population
- 117. A single experiment could have errors, unusual conditions, or uncontrolled variables. Replication by other researchers in different settings confirms that the result is genuine and not due to chance, bias, or a specific quirk of the original setup.
- 118. The independent variable is what the researcher deliberately changes or manipulates. The dependent variable is what is measured as a result — it "depends on" the independent variable. For example, testing fertilizer (independent) by measuring plant height (dependent).
- 119. Larger samples are more likely to accurately represent the whole population and reduce the impact of random variation. A small sample might be unrepresentative by chance, leading to misleading conclusions. Statistical confidence increases with sample size.
- 120. The placebo effect is when people experience improvement simply because they believe they are receiving treatment, even if the treatment is inactive. Scientists use placebo controls (fake treatments that look real) to separate genuine drug effects from psychological improvement.
Matching (critical-thinking): $1 \rightarrow D$, $2 \rightarrow A$, $3 \rightarrow B$, $4 \rightarrow C$, $5 \rightarrow E$
- 121. B — A premise is a statement accepted as true that serves as the starting point for an argument — the building blocks that lead to a conclusion
- 122. C — Principle of charity: interpret ambiguous statements in the most reasonable way. Steelmanning: actively construct the STRONGEST version of the opponent's argument. Charity is passive interpretation; steelmanning is active reconstruction.

123. D — An analogy compares two things to explain or argue a point. Helpful when the comparison highlights a genuine similarity; misleading when the two things are fundamentally different in important ways
124. B — A circular reasoning error where the conclusion is assumed in the premise — the argument uses the thing it's trying to prove as its own evidence
125. A — The tendency to search for, notice, and remember information that confirms what we already believe, while ignoring or dismissing evidence that contradicts our beliefs
126. C — The first premise is false — NOT all birds can fly (penguins, ostriches, kiwis). Valid logic applied to a false premise produces a false conclusion
127. An error in reasoning that makes an argument invalid or misleading — the conclusion doesn't actually follow from the evidence, even though it might sound convincing
128. Straw man — Ben is misrepresenting Maria's argument (later start times) as something extreme she didn't say (sleep all day/never come to school) to make it easier to attack
129. Deductive validity guarantees the conclusion (if premises are true); inductive strength makes it probable. Most everyday reasoning is inductive because we rarely have certain premises to start from.
130. Inductive reasoning — she's generalizing from specific experimental observations
Matching (Hidden Assumptions): $1 \rightarrow B$, $2 \rightarrow D$, $3 \rightarrow A$, $4 \rightarrow C$, $5 \rightarrow E$
131. A — A well-structured argument with a debatable claim, relevant evidence, logical reasoning connecting evidence to claim, and an honest acknowledgment of the strongest opposing point
132. B — To present the strongest possible version of an opponent's argument before responding — it shows intellectual honesty and produces stronger counterarguments
133. B — Recognizing the limits of your own knowledge and reasoning — being willing to say 'I don't know' or 'I might be wrong' — which prevents overconfidence and opens you to better evidence
134. A — It attacks the PERSON instead of addressing the ARGUMENT — this is called an 'ad hominem' attack and doesn't actually disprove Student B's point
135. C — How many dentists were surveyed? What exactly did they 'recommend'? Were they paid by BrightSmile? Did they recommend it over NO toothpaste or over competitors? What did the 5th dentist say?

136. D — Yes — appeal to conspiracy/persecution complex. The claim that competitors are hiding information creates a false sense that the product must be special because it's being 'suppressed'
137. Reasoning to the best explanation — choosing the most likely explanation for a set of observations
138. The logical bridge that explains WHY the evidence supports the claim — often an unstated assumption
139. No reptiles are mammals. All snakes are reptiles. Therefore, no snakes are mammals.
140. Inductive reasoning, and it's reasonably strong — a pattern of repeated bad experiences supports the conclusion
Matching (Hidden Assumptions): $1 \rightarrow A$, $2 \rightarrow D$, $3 \rightarrow E$, $4 \rightarrow C$, $5 \rightarrow B$
141. D — Studies showing that animals in classrooms reduce student stress and improve attendance
142. B — It has a logical connection to the claim — it actually helps prove or disprove the specific point being made
143. C — The person making a claim is responsible for providing evidence to support it — you can't ask others to prove your claim is wrong
144. A — A statement that necessarily follows from the given premises — if the premises are true, the conclusion MUST be true
145. B — Straw man combined with slippery slope — they're both exaggerating the opponent's position AND predicting extreme consequences
146. C — Because most real-world knowledge requires generalizing from limited observations — we can't observe everything
147. It's used to derive specific, testable predictions from the general hypothesis
148. An argument that opposes or challenges the main claim, presenting reasons why the claim might be wrong
149. A chain syllogism — where the conclusion of one deductive step becomes the premise of the next
150. A specific case that disproves a general claim — one counterexample can destroy an inductive conclusion
Matching (Hidden Assumptions): $1 \rightarrow D$, $2 \rightarrow A$, $3 \rightarrow E$, $4 \rightarrow B$, $5 \rightarrow C$
151. B — No — personal preference is not evidence. 'I like it' explains Alex's taste but

- doesn't logically prove it's objectively 'the best' flavor for everyone
- 152. C — Appeal to emotion — using emotional language to manipulate feelings instead of providing logical evidence and reasoning
 - 153. A — A true conclusion
 - 154. A — A smaller claim that supports the main claim — it needs its own evidence but ultimately feeds into the larger argument
 - 155. D — Returns TRUE only when BOTH inputs are true — if either input is false, the result is false
 - 156. D — A necessary condition MUST be true for the result (but isn't enough alone); a sufficient condition GUARANTEES the result (but isn't the only way)
 - 157. Changing the definition of a group to exclude counterexamples. Example: 'No good student would fail a test.' When shown a good student who failed: 'Well, they're not a REAL good student'
 - 158. Yes — both commit the argument from ignorance fallacy. Inability to disprove X doesn't prove X, and inability to prove X doesn't disprove X. Lack of evidence is not evidence of absence (or presence).
 - 159. By drawing circles for each category and shading/markings regions according to the premises, you can visually check if the conclusion necessarily follows
 - 160. Hasty generalization — drawing a broad conclusion from one example. One success without studying doesn't guarantee future success, especially if the material gets harder
Matching (Hidden Assumptions): $1 \rightarrow A$, $2 \rightarrow E$, $3 \rightarrow C$, $4 \rightarrow B$, $5 \rightarrow D$
 - 161. Because the sign said "Free lunch" and they knew there's no such thing as a free lunch -- that's a hasty generalization!
 - 162. Because it could never be anything but TRUE or FALSE!
 - 163. Because AND was too demanding -- it needed BOTH things to be true!
 - 164. Because he was great at standing in for arguments that nobody actually made!
 - 165. "I couldn't exist without you -- you're my logical support!"
 - 166. Because it was in the intersection of two great groups!