Counterexamples and deductive reasoning worksheet – Grade 10

Grade 10 · Mixed level · 20 questions · **Version X1874**

Name: _____ Date: _____ Score: ___ / 20

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1. How many counterexamples are needed to prove a claim false?
   A. Two **B.** One for every case **C.** Ten **D.** One

2. Which is a counterexample to this claim? Every multiple of 3 is odd.
   A. 9 **B.** 21 **C.** 15 **D.** 12

3. Does checking 100 examples prove a claim true for all numbers?
   A. No **B.** Yes

4. Ethan checks a pattern for 5 cases and says it will always work. What kind of reasoning is this?
   A. Proof by contradiction **B.** Deductive **C.** Inductive **D.** Circular

5. Amara uses "all rhombuses have four equal sides" to say that a given rhombus has four equal sides. What kind of reasoning is this?
   A. Guessing **B.** Deductive **C.** Inductive **D.** Measurement

6. Hana uses "all rhombuses have four equal sides" to say that a given rhombus has four equal sides. What kind of reasoning is this?
   A. Guessing **B.** Deductive **C.** Measurement **D.** Inductive

7. Which is a counterexample to this claim? The square of a number is always bigger than the number.
   A. 1/2 **B.** 3 **C.** 2 **D.** 5

8. Fact 1: If the shape is a square, then the shape is a rectangle. Fact 2: The shape is a rectangle. What follows?
   A. Nothing certain follows **B.** The shape is a square **C.** The shape is not a rectangle **D.** The shape is not a square

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9. Fact 1: If the month is July, then the month has 31 days. Fact 2: The month has 31 days. What follows?

   A. The month is July **B.** Nothing certain follows **C.** The month is not July

   D. The month does not have 31 days

10. Fact 1: If the angle measures 30°, then the angle is acute. Fact 2: The angle is not acute. What follows?

    A. The angle is acute **B.** The angle measures 30° **C.** Nothing follows

    D. The angle does not measure 30°

11. Fact 1: If the number ends in 0, then the number is even. Fact 2: The number does not end in 0. What follows?

    A. The number is even **B.** The number is not even **C.** The number ends in 0

    D. Nothing certain follows

12. All members of the chess club are in Grade 4. Noah is in Grade 4. What follows?

    A. Noah is not in the chess club **B.** Nothing certain follows

    C. Noah is in the chess club **D.** Everyone in the grade plays chess

13. Fact 1: If $x = 3$, then $x^2 = 9$. Fact 2: $X = 3$. What follows?

    A. Nothing follows **B.** $X \neq 3$ **C.** $X^2 \neq 9$ **D.** $X^2 = 9$

14. Fact 1: If the number is even, then the number is divisible by 2. Fact 2: The number is not divisible by 2. What follows?

    A. The number is even **B.** Nothing follows **C.** The number is not even

    D. The number is divisible by 2

15. $n^2 + n + 41$ gives a prime for $n = 1, 2, 3$ and many more. Is it prime for every whole number n?

    A. No, $n = 41$ gives 41×43 **B.** Yes, the pattern always holds **C.** Yes, up to 1,000

    D. We cannot know

16. If a student is late, then a slip is written. If a slip is written, then the office is told. What follows?

    A. Nothing follows **B.** If the office is told, then a student is late.

    C. If a student is late, then the office is told. **D.** If a slip is written, then a student is late.

17. If the road is icy, then the bus runs slowly. If the bus runs slowly, then the students arrive late. What follows?

    A. If the bus runs slowly, then the road is icy.

    B. If the students arrive late, then the road is icy. **C.** Nothing follows

    D. If the road is icy, then the students arrive late.

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18. Which argument is valid?

    A. If p, then q. Not q. So not p. **B.** If p, then q. q. So p. **C.** p or q. p. So not q.

    D. If p, then q. Not p. So not q.

19. Why is "my last 7 coin flips were heads, so the next will be heads" weak reasoning?

    A. It needs a counterexample first

    B. It is inductive, and past flips do not control the next one **C.** It is a contrapositive

    D. It is deductive, so it is certain

20. A claim says that $2^n > n^2$ for all whole numbers $n \geq 1$. Starting from $n = 1$, what is the first value of n that is a counterexample?

    Answer: _____

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Answer key · Version X1874

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1. **D (One)**
2. **D (12)**
3. **A (No)**
4. **C (Inductive)**
5. **B (Deductive)**
6. **B (Deductive)**
7. **A (1/2)**
8. **A (Nothing certain follows)**
9. **B (Nothing certain follows)**
10. **D (The angle does not measure 30°)**
11. **D (Nothing certain follows)**
12. **B (Nothing certain follows)**
13. **D ($X^2 = 9$)**
14. **C (The number is not even)**
15. **A (No, n = 41 gives 41 × 43)**
16. **C (If a student is late, then the office is told.)**
17. **D (If the road is icy, then the students arrive late.)**
18. **A (If p, then q. Not q. So not p.)**
19. **B (It is inductive, and past flips do not control the next one)**
20. **2**

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