

# Math 142

## Test #1

### Spring 2024

Name: \_\_\_\_\_

Multiple Choice: Choose the answer that best fits as the solution to the question.

1. Let  $T$  be the set of teachers. Let  $S(x)$  be the predicate “ $x$  are teachers who are required to have a student teaching class.” What is the negation of statement below?

**“All teachers are required to take a student teaching class.”**

- A)  $\exists x \in T, \neg S(x)$
- B)  $\neg \forall x \in T, \neg S(x)$
- C)  $\forall x \in T, S(x)$
- D)  $\exists x \in T, S(x)$
- E) None of these

2. Given:  $t = x$  is a prime number.  
 $g = x$  is an even number.

Use symbolic logic to represent the sentence:

**“ $x$  is neither a prime number nor an even number, but not both.”**

- A)  $(t \vee g) \wedge (t \vee g)$
- B)  $\neg(t \wedge g) \wedge \neg(t \vee g)$
- C)  $(t \wedge g) \wedge \neg(t \wedge g)$
- D)  $\neg(t \vee g) \wedge \neg(t \wedge g)$

3. Use the variable  $G$  to represent Casey's GPA and use  $A$  to represent Casey's ACT score. It is required for students to have higher than a 3.5 GPA *and* a score of at least a 25 on the ACT to be considered for a scholarship. Use the variables to write the statement:

**“Casey was eligible for the scholarship.”**

- A)  $(G \geq 3.5) \wedge (A > 25)$
- B)  $(G > 3.5) \vee (A > 25)$ ,
- C)  $(G > 3.5) \wedge (A \geq 25)$
- D)  $(G > 3.5) \vee (A \geq 25)$
- E) None of these

**For questions 4 and 5, use the following:**

$r$  = Katie is rich.  
 $h$  = Katie is happy.  
 $s$  = Katie is successful.

4. The symbolic statement:  $(r \vee h \vee s) \wedge \neg(r \wedge h \wedge s)$  written as a sentence:

- A) Katie is either rich, happy, or successful, but not all three.
- B) Katie is rich, and happy, and successful, but not all three.
- C) Katie is neither rich, happy, nor successful.
- D) Katie is rich, happy, successful and not rich, or happy or successful.

5. The symbolic statement:  $(r \wedge \neg s) \rightarrow \neg h$  is written as:

- A) If Katie is not rich and happy, then she is not successful.
- B) If Katie is rich and successful, then she is not happy.
- C) If Katie is rich or not successful, then she is not happy.
- D) If Katie is rich but not successful, then she is not happy.
- E) None of these

6. Negate the statement: All prime numbers are odd.

- A) No prime numbers are even.
- B) Some prime numbers are not odd.
- C) Some prime numbers are odd.
- D) No prime numbers are odd.
- E) None of these

7.  $\neg(p \wedge \neg q \vee \neg r)$  is logically equivalent to:

- A)  $(\neg p \vee q \vee r)$
- B)  $\neg(\neg p \wedge q \vee r)$
- C)  $(\neg p \wedge q \wedge r)$
- D)  $(\neg p \vee q \wedge r)$
- E) None of these

**For questions 8 and 9, use the following implication:**

**Given: *If a triangle is not isosceles, then the triangle is not equilateral.***

8. The inverse of the given statement is:

- A) If a triangle is isosceles, then the triangle is equilateral.
- B) If a triangle is equilateral, then the triangle is isosceles.
- C) If a triangle is not equilateral, then the triangle is not isosceles.
- D) If a triangle is a scalene triangle, then the triangle is equilateral.
- E) None of these

9. The contrapositive of the given statement is:

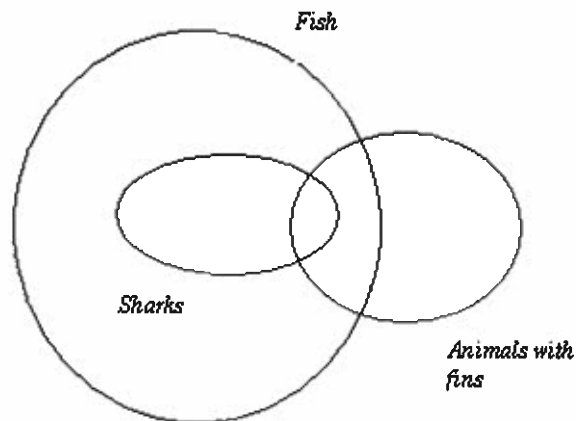
- A) If a triangle is isosceles, then the triangle is equilateral.
- B) If a triangle is equilateral, then the triangle is isosceles.
- C) If a triangle is not equilateral, then the triangle is not isosceles.
- D) If a triangle is a scalene triangle, then the triangle is equilateral.
- E) None of these

10. Write the given implication as a universally quantified statement.

If the figure is an equilateral triangle, then it has three congruent sides.

- A) Some equilateral triangles have three congruent sides.
- B) All triangles are equilateral triangles.
- C) All equilateral triangles do not have three congruent sides.
- D) All equilateral triangles have three congruent sides.
- E) None of these

11. Given the Venn diagram below, which of the following statements are true?



- A) Some sharks do not have fins.
- B) There are some animals with fins that are not fish.
- C) All sharks are fish.
- D) Choices A, B, and C are true statements from the diagram
- E) Only choices A and C are true statements from the given diagram.

12. Use De Morgan's Law to negate the following sentence and thus creating a logically equivalent statement.

$$(x < 0) \vee (x \geq 6)$$

- A)  $(x < 0) \vee (x > 6)$
- B)  $(x > 0) \wedge (x < 6)$
- C)  $(x \geq 0) \wedge (x < 6)$
- D)  $(x \geq 0) \wedge (x \leq 6)$
- E) None of these

13. Knowing that p is false, q is true, and r is true, what is the truth value for the statement below?

$$(\neg p \wedge \neg r) \rightarrow (q \wedge r)$$

- A) The statement is false.
- B) The statement is true.
- C) There is not enough information to determine whether the statement is true or false

14. Is the argument below valid or invalid?

If I quit smoking, then my health will improve.  
My health did improve.  
Therefore, I did quit smoking.

- A) The argument is valid by modus ponens.
- B) The argument is invalid by inverse fallacy.
- C) The argument is valid by modus tollens.
- D) The argument is invalid by converse fallacy.
- E) All of the above

15. Is the argument below valid or invalid?

If  $x > 10$ , then x must be an integer.  
 $x > 10$ .  
Therefore, x must be an integer.

- A) The argument is valid by modus ponens.
- B) The argument is invalid by inverse fallacy.
- C) The argument is valid by modus tollens.
- D) The argument is invalid by converse fallacy.
- E) None of these

16. Bob purchased red roses for Cindy. Bob purchased red roses for Katie. Bob purchased red roses for Samantha. All of the girls were happy with Bob. Bob concluded that all girls like red roses. What logic did Bob use when purchasing red roses for his new girlfriend, Beth, in hopes of making her happy as well?

- A) Bob used Inductive Reasoning.
- B) Bob used Modus Ponens Reasoning.
- C) Bob used Deductive Reasoning.
- D) Bob used "I am a Playa" Reasoning.

17. Which of the following statements is logically equivalent to the following?

**“If you ride your bike home, then you cannot use the bike path as a route.”**

- A) If you can use the bike path as a route, then you can ride your bike home.
- B) If you cannot use the bike path as a route, then you cannot ride your bike home.
- C) If you cannot use the bike path as a route, then you can ride your bike home.
- D) None of these are logically equivalent.

18. Using truth tables, is the following argument valid or invalid?

John will attend either Stanford or Yale.  
John did not attend Yale.  
Therefore, John did not attend Stanford.

- A) The argument is invalid.
- B) The argument is valid.
- C) The argument is neither valid nor invalid. There is not enough information given.

19. Given  $B = \{5, 10, 15, 20, 25, 30\}$ , which of the following is true?

- i. If  $x < 30$ , then  $x$  is odd.
- ii. If  $x > 10$ , then  $x$  is even.
- iii. If  $x \leq 30$ , then  $x$  is a multiple of 5.
- iv. If  $x \leq 30$ , then  $x$  is a multiple of 10.

- A) All of the statements are true.
- B) Only statements iii and iv are true.
- C) Only statements i, ii, and iii are true.
- D) Only statements ii and iii are true.
- E) Only statement iii is true.

20. Using truth tables, which choice is logically equivalent to:

$$p \vee (q \wedge \neg p)$$

- A)  $(p \vee q)$
- B)  $(p \wedge q)$
- C)  $\neg(p \rightarrow q)$
- D) All of these are logically equivalent to the given statement.
- E) None of these are logically equivalent to the given statement.

21. Which of the following statements are true?

- i. If Radford is the capital of Virginia, then Richmond is the capital of Nevada.
- ii.  $7 \neq 3$  or 9 is a prime number.
- iii. If 10 is a prime number, then 7 is a prime number.
- iv.  $8 > 4$  and  $8 > 7$ .

- A) All of the statements are false.
- B) All of the statements are true.
- C) Only statements i and iii are true.
- D) Only statements i, iii, and iv are true.
- E) Only statements i, ii, and iv are true.

22. Let  $T = \{1, 3, 5, 7, 9, 11\}$ . Decide whether the following statements are true for the elements of  $x \in T$ .

- i.  $x$  is odd and  $x > 1$ .
- ii.  $x$  is not odd or  $x < 11$ .
- iii.  $x$  is even or  $x > 1$ .
- iv.  $x$  is odd and  $x \geq 1$ .

- A) All of the statements are true.
- B) Only statements i, ii, and iii are true.
- C) Only statement iv is true.
- D) None of the statements are true.
- E) Only statements iii and iv are true.

23. Using a Venn Diagram, determine which conclusion is valid from the given argument:

No psychologist can juggle.  
All clowns can juggle  
Therefore.....

- A) All psychologists are clowns.
- B) Some psychologists are clowns.
- C) No psychologists are clowns.
- D) Some psychologists can dance.
- E) None of these are valid conclusions.

24. Given  $(p \wedge \sim q) \rightarrow (\sim r \vee p)$ . What can be said about  $(p \wedge \sim q) \rightarrow (\sim r \vee p)$ ?

- A) The statement  $(p \wedge \sim q) \rightarrow (\sim r \vee p)$  is a tautology.
- B) The statement  $(p \wedge \sim q) \rightarrow (\sim r \vee p)$  is a contradiction.
- C) The statement  $(p \wedge \sim q) \rightarrow (\sim r \vee p)$  is neither a tautology nor a contradiction.

25. What is  $(\sim p \vee c)$  logically equivalent to given that  $c$  is a contradiction?

- A) A tautology
- B)  $Q$
- C)  $P$
- D) A contradiction
- E)  $\sim P$