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1. (1 point) Suppose this is true: All widgets are gadgets.

Which is the correct conditional form of the sentence?

- A. If it's a gadget, then it's a widget
- B. If it's a widget, then it's a gadget

What can be deduced from that and this additional fact?
It's a gadget

- A. It's a gadget
- B. It's a widget
- C. It is not a gadget
- D. It is not a widget
- E. Nothing

What can be deduced from that and this additional fact?
It's not a widget

- A. It's a gadget
- B. It's a widget
- C. It is not a gadget
- D. It is not a widget
- E. Nothing

What can be deduced from that and this additional fact?
It's not a gadget

- A. It's a gadget
- B. It is not a gadget
- C. It's a widget
- D. It is not a widget
- E. Nothing

Answer(s) submitted:

- B
- E
- E
- D

(correct)

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2. (1 point) Suppose this is true: If $x \leq 4$ then $y > 11$.

What can be deduced from that and this additional fact?
$y = 12$

- A. $x \leq 4$
- B. $x > 4$
- C. $y \leq 11$
- D. $y > 11$
- E. Nothing

What can be deduced from that and this additional fact?
$y = 9$

- A. $y \leq 11$
- B. $x > 4$
- C. $x \leq 4$
- D. $y > 11$
- E. Nothing

What can be deduced from that and this additional fact?
$x = 3$

- A. $y > 11$
- B. $x \leq 4$
- C. $y \leq 11$
- D. $x > 4$
- E. Nothing

What can be deduced from that and this additional fact?
$x = 6$

- A. $x \leq 4$
- B. $x > 4$
- C. $y \leq 11$
- D. $y > 11$
- E. Nothing

What can be deduced from that and this additional fact?
$x^2 = 4$

- A. $y > 11$
- B. $x \leq 4$
- C. $y \leq 11$
- D. $x > 4$
- E. Nothing

Answer(s) submitted:

- E
- B
- A
- E
- A

(correct)

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3. (1 point) Assign truth values to the propositions P, Q, and R so that the given proposition is false. Use T for true and F for false.

$$[P \implies (Q \wedge R)] \implies [(P \wedge Q) \vee R]$$

Answer: P: _____ Q: _____ R: _____

Answer(s) submitted:

- F
- F
- F

(correct)

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4. (1 point)

Which rule of inference is used in each of the following arguments? Check the correct answers.

1. If I go swimming, then I will stay in the sun too long. If I stay in the sun too long, then I will sunburn. Therefore, if I go swimming, then I will sunburn.

- A. Simplification.
- B. Conjunction.
- C. Modus ponens.
- D. Addition.
- E. Hypothetical syllogism.
- F. Disjunctive syllogism.
- G. Modus tollens.

2. Jerry is a mathematics major and a computer science major. Therefore, Jerry is a mathematics major.

- A. Hypothestical syllogism.
- B. Modus ponens.
- C. Modus tollens.
- D. Simplification.
- E. Disjunctive syllogism.
- F. Conjuntion.
- G. Addition.

3. Steve will work at a computer company this summer. Therefore, this summer Steve will work at a computer company or be a beach bum.

- A. Hypothestical syllogism.
- B. Modus ponens.
- C. Conjuction.
- D. Addition.
- E. Modus tollens.
- F. Disjunctive syllogism.
- G. Simplication.

4. It is either hotter than 100 degrees today or the pollution outside is dangerous. It is less than 100 degrees outside today. Therefore, the pollution is dangerous.

- A. Modus tollens.
- B. Hypothetical syllogism.
- C. Addition.
- D. Modus ponens.
- E. Disjunctive syllogism.
- F. Conjuction.
- G. Simplification.

Answer(s) submitted:

- E
- D
- D
- E

(correct)

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5. (1 point) Negate the following statement:

If Mary fails her classes, then she cannot graduate.

p: Mary fails her classes
q: Mary can graduate

Write the statement in formal logic:

- A. $\neg p \rightarrow q$
- B. $q \rightarrow p$
- C. $p \rightarrow \neg q$
- D. $p \rightarrow q$

Negate the logic:

- A. $\neg p \vee \neg q$
- B. $p \wedge q$
- C. $\neg p \wedge q$
- D. $\neg p \wedge \neg q$

Rewrite the negated logic in English

- A. Mary does not fail her classes or she cannot graduate
- B. Mary does not fail her classes and she cannot graduate
- C. Mary does not fail her classes and she can graduate
- D. Mary fails her classes and she can graduate

Answer(s) submitted:

- C
- B
- D

(correct)

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6. (1 point)

Let $C(x)$ be the statement "x has a cat", let $D(x)$ be the statement "x has a dog" and let $F(x)$ be the statement "$x$has a ferret". Express each of the following statements in terms of $C(x)$, $D(x)$, and $F(x)$, quantifiers, and logical connectives. Let the universe of discourse consist of all students in your class. Put the appropriate letter next to the corresponding symbolic form.

___1. $\neg\exists x(C(x) \wedge D(x) \wedge F(x))$
___2. $\exists x(C(x) \wedge F(x) \wedge \neg D(x))$
___3. $\exists x(C(x)) \wedge (\exists x D(x)) \wedge (\exists x F(x))$
___4. $\exists x(C(x) \wedge D(x) \wedge F(x))$
___5. $\forall x(C(x) \vee D(x) \vee F(x))$

a) A student in your class has a cat, a dog, and a ferret.
b) All students in your class have a cat, a dog, or a ferret.
c) Some student in your class has a cat and a ferret but not a dog.
d) No student in this class has a cat, a dog, and a ferret.
e) For each of the three animals, cats, dogs, and ferrets, there is a student in your class who has one of these animals.

Answer(s) submitted:

- D
- C
- E

- A
- B

(correct)

7. (1 point)

Let $Q(x,y)$ be the statement " $x+y=x-y$ ". If the universe of discourse for both variables consists of all integers, what are the truth values?

___1. $\forall x \exists y\ (x=y^2)$
___2. $\forall y\ Q(1,y)$
___3. $\exists x \exists y\ Q(x,y)$
___4. $\exists x \forall y\ Q(x,y)$
___5. $Q(2,0)$
___6. $\forall x \exists y\ Q(x,y)$
___7. $\exists y \forall x\ Q(x,y)$
___8. $\forall y \exists x\ Q(x,y)$

Answer(s) submitted:

- F
- F
- T
- F
- T
- T
- T
- F

(correct)

8. (1 point)

Let P(x) be the statement "x is a duck", let Q(x) be the statement "x is one of my poultry", let R(x) be the statement "x is an officer", and let S(x) be the statement "x is willing to waltz". Express each of the following statements in terms of P(x), Q(x), R(x) and S(x), quantifiers, and logical connectives. Let the universe of discourse consist of all living creatures. Put the appropriate letter next to the corresponding symbolic form.

___1. $\exists x(P(x) \wedge \neg S(x))$
___2. $\forall x(R(x) \rightarrow S(x))$
___3. $\forall x(P(x) \rightarrow \neg S(x))$
___4. $\forall x(Q(x) \rightarrow P(x))$
___5. $\forall x(Q(x) \rightarrow \neg R(x))$

a) Some ducks are not willing to waltz.
b) No ducks are willing to waltz.
c) No officers ever decline to waltz.
d) All my poultry are ducks.
e) My poultry are not officers.

Answer(s) submitted:

- A
- C
- B
- D
- E

(correct)

9. (1 point)

Let I(x) be the statement "x has an Internet connection", let C(x,y) be the statement "x and y have chatted over the internet". Express each of the following statements in terms of I(x) and C(x,y), quantifiers, and logical connectives. Let the universe of discourse for the variables x and y consist of all students in your class. Put the appropriate letter next to the corresponding symbolic form.

___1. $C(Jan, Sharon)$
___2. $\exists x \exists y(y \neq x \wedge \neg C(x,y)))$
___3. $\forall x(I(x)) \rightarrow \exists y(x \neq y \wedge C(x,y))$
___4. $\exists x \neg I(x)$
___5. $\exists x(I(x) \wedge \forall y(I(y) \rightarrow y=x))$
___6. $\exists x \exists y(y \neq x \wedge \forall z \neg(C(x,z) \wedge C(y,z))$
___7. $\neg(C(Rachel, Chelsea)$
___8. $\forall x \neg C(x, Bob)$

a) Rachel has not chatted over the internet with Chelsea.
b) Jan and Sharon have chatted over the internet.
c) No one in the class has chatted with Bob.
d) Someone in your class does not have internet connection.
e) There are two students in your class who have not chatted over the internet.
f) Exactly one student in your class has an internet connection.
g) Everyone in your class with an internet connection has chatted over the internet with at least one other student in your class.
h) There are at least two students in your class who have not chatted with the same person in your class.

Answer(s) submitted:

- B
- E
- G
- D
- F
- H
- A
- c

(correct)

10. (1 point) Determine whether the given proposition is true or false, for the universe of all real numbers. Use T for true and F for false.

$$(\forall x)(\exists y)(x^2+y=0)$$

Answer: ____

$$(\exists x)(\forall y)(x^2+y=0)$$

Answer: ____

$$(\exists x)(\exists y)(x^2+y=0)$$

Answer: ____

$$(\forall y)(\exists x)(y = x^2)$$

Answer: ____

$$(\forall y)[y \geq 0 \implies (\exists x)(y = x^2)]$$

Answer: ____

Answer(s) submitted:

- T
- F
- T
- F
- T

(correct)

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11. (1 point)

The notation
$\exists ! x P(x)$
denotes the proposition
" There exists a unique x such that P(x) is true. "
If the universe of discourse is the set of integers, what are the truth values of the following?

___1. $\exists ! x(x+3=2x)$
___2. $\exists ! x(x>1)$
___3. $\exists ! x(x^2=1)$
___4. $\exists ! x(x=x+1)$

Answer(s) submitted:

- T
- F
- F
- F

(correct)

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12. (1 point) Are the two sentences logically equivalent?

If John and Fred will go, Jess will go.
If John will go, Jess will go, and if Fred will go, Jess will go.

- A. Yes
- B. No

Are the two sentences logically equivalent?
If James will go, Jack and Melinda will go.
If James will go, Jack will go, and if James will go, Melinda will go.

- A. Yes
- B. No

Are the two sentences logically equivalent?
If Chris or Michael will go, Jess will go.
If Chris will go, Jess will go, and if Michael will go, Jess will go.

- A. Yes
- B. No

Are the two sentences logically equivalent?
If Sam or Bobby will go, Karen will go.
If Sam will go, Karen will go, or if Bobby will go, Karen will go.

- A. Yes
- B. No

Answer(s) submitted:

- B
- A
- A
- B

(correct)