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1. **(2 points)** `Library/NAU/setFoundations/MAT320_0101.pg`

Determine which of the following is a proposition.

A. $x > 3$
B. $2 > 3$
C. $2x + 11 = 23$

Answer: ___

Determine which of the following is not a proposition.
A. All real numbers are positive.
B. $x + y = 2$
C. All cows eat grass.

Answer: ___

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2. **(2 points)** `Library/Westmont/EoDM3/Exercises_1_1/exer1_1_5.pg`

Let *s* be the following statement.
If it is raining, then the ground is wet.

Which is the converse of *s*?

- ?
- If it is not raining, then the ground is not wet.
- If it is raining, then the ground is not wet.
- If the ground is wet, then it is raining.
- If the ground is not wet, then it is raining.
- If the ground is not wet, then it is not raining.

Which is the contrapositive of *s*?

- ?
- If it is not raining, then the ground is not wet.
- If it is raining, then the ground is not wet.
- If the ground is wet, then it is raining.
- If the ground is not wet, then it is raining.
- If the ground is not wet, then it is not raining.

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3. **(5 points)** `Library/MontanaState/Misc.Logic/1.4A1Logic1.pg`

True or False?
If a conditional sentence is true, its converse is false.

- A. True
- B. False

True or False?
If a conditional sentence is true, its contrapositive is true.

- A. True
- B. False

True or False?
If a conditional sentence is false, its converse is false.

- A. True
- B. False

True or False?
The contrapositive of the contrapositive of a conditional is the original conditional.

- A. True
- B. False

True or False?
The converse of the converse of a conditional is the original conditional.

- A. True
- B. False

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4. **(2 points)** `Library/Westmont/EoDM3/Inquiry_1_1/iprob1_2.pg`

Buttercup knows whether or not Westley is lying. She promises that if Westley is lying, she will give you a cookie. Buttercup always keeps her promises.

Suppose she does not give you a cookie; what can you conclude?

- ?
- Westley is lying.
- Westley is not lying.
- Not enough information to determine.

Suppose she gives you a cookie; what can you conclude?

- ?
- Westley is lying.
- Westley is not lying.
- Not enough information to determine.

5. (**2 points**) `Library/SDSU/Discrete/Logic/formallogicB7.pg`
Convert the following statement using an "if-then" structure.

John doesn't own a dog, or he owns a cat.

Choose the correct statement:

- A. If John owns a cat, then he owns a dog
- B. If John doesn't own a dog, then he owns a cat
- C. If John owns a dog, then he owns a cat
- D. If John doesn't own a cat, then he owns a dog

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6. (**7 points**) `Library/SUNYSB/implication.pg`

What is the negation of the following: "If I vote in the election then I feel enfranchised."

- A. If I feel disenfranchised then I don't vote.
- B. I vote in the election and I feel enfranchised.
- C. If I don't vote then I feel enfranchised.
- D. I don't vote or I feel enfranchised.
- E. I vote in the election or I feel enfranchised.
- F. I vote in the election or I feel disenfranchised.
- G. I vote in the election and I feel disenfranchised.
- H. If I feel enfranchised then I vote in the election.
- I. If I don't vote then I feel disenfranchised.
- J. If I vote in the election then I feel enfranchised.
- K. I don't vote and I feel enfranchised.

What is the negation of the following: "If this triangle has two 45 degree angles then it is a right triangle."

- A. this triangle has two 45 degree angles or it is not a right triangle.
- B. If this triangle has two 45 degree angles then it is a right triangle.
- C. If it is a right triangle then this triangle has two 45 degree angles.
- D. this triangle has two 45 degree angles and it is a right triangle.
- E. If it is not a right triangle then this triangle does not have two 45 degree angles.
- F. If this triangle does not have two 45 degree angles then it is a right triangle.
- G. this triangle has two 45 degree angles or it is a right triangle.
- H. this triangle has two 45 degree angles and it is not a right triangle.
- I. If this triangle does not have two 45 degree angles then it is not a right triangle.
- J. this triangle does not have two 45 degree angles and it is a right triangle.
- K. this triangle does not have two 45 degree angles or it is a right triangle.

What is the negation of the following statement: "n is prime and n is odd or n is 2."

- A. n is composite or n is odd or n is 2.
- B. n is composite and n is even but not 2.
- C. n is prime or n is even but not 2.
- D. n is prime or n is odd or n is 2.
- E. n is prime and n is odd or n is 2.
- F. n is composite and n is odd or n is 2.
- G. n is composite or n is even but not 2.
- H. n is prime and n is even but not 2.

What is the negation of the following statement: "this triangle has two 45 degree angles or it is a right triangle."

- A. this triangle does not have two 45 degree angles or it is not a right triangle.
- B. this triangle has two 45 degree angles and it is not a right triangle.
- C. this triangle does not have two 45 degree angles and it is not a right triangle.
- D. this triangle does not have two 45 degree angles or it is a right triangle.
- E. this triangle does not have two 45 degree angles and it is a right triangle.
- F. this triangle has two 45 degree angles and it is a right triangle.
- G. this triangle has two 45 degree angles or it is not a right triangle.
- H. this triangle has two 45 degree angles or it is a right triangle.

What is the converse of the following: "If I am hungry then I eat an apple."

- A. If I eat an apple then I am hungry.
- B. If I am hungry then I eat an apple.
- C. If I'm hungry then I eat an apple.
- D. If I eat an apple then I am not hungry.
- E. If I don't eat an apple then I'm not hungry.
- F. If I'm not hungry then I don't eat an apple.

What is the inverse of the following: "If r is rational then the decimal expansion of r is repeating."

- A. If r is irrational then the decimal expansion of r does not repeat.
- B. If the decimal expansion of r does not repeat then r is irrational.
- C. If r is rational then the decimal expansion of r is repeating.
- D. If the decimal expansion of r is repeating then r is irrational.
- E. If the decimal expansion of r is repeating then r is rational.
- F. If r is rational then the decimal expansion of r does not repeat.

What is the contrapositive of the following: "If n is divisible by 6 then n is divisible by both 2 and 3."

- A. If n is divisible by both 2 and 3 then n is divisible by 6.
- B. If n is divisible by 6 then n is not divisible by both 2 and 3.
- C. If n is not divisible by 6 then n is not divisible by both 2 and 3.
- D. If n is divisible by both 2 and 3 then n is not divisible by 6.
- E. If n is not divisible by both 2 and 3 then n is not divisible by 6.
- F. If n is divisible by 6 then n is divisible by both 2 and 3.

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7. **(6 points)** `Library/SUNYSB/necsuff.pg`

Which proposition is a necessary condition for the following statement to be true: "I don't exercise and I feel tired."

- A. I exercise if and only if I feel tired.
- B. I feel envigorated
- C. I feel tired
- D. I exercise
- E. I exercise and I feel tired.

Which proposition is a necessary condition for the following statement to be true: "I form a study group and I lower my grades."

- A. I form a study group if and only if I raise my grades.
- B. I form a study group
- C. I form a study group and I raise my grades.
- D. I work alone
- E. I raise my grades

Which proposition is a sufficient condition for the following statement to be true: "If I vote in the election then I feel enfranchised."

- A. I don't vote or I feel disenfranchised.
- B. I don't vote
- C. I vote in the election or I feel enfranchised.
- D. I vote in the election
- E. I feel disenfranchised
- F. I vote in the election and I feel disenfranchised.
- G. If I feel enfranchised then I vote in the election.

Rewrite the following as an equivalent if then statement: "'I am on time for work' is a necessary condition for 'I catch the 8:05 bus'."

- A. If I am on time for work then I miss the 8:05 bus.
- B. If I catch the 8:05 bus then I am on time for work.
- C. If I am late for work then I miss the 8:05 bus.
- D. If I catch the 8:05 bus then I am late for work.
- E. If I miss the 8:05 bus then I am late for work.
- F. If I miss the 8:05 bus then I am on time for work.
- G. If I am on time for work then I catch the 8:05 bus.
- H. If I am late for work then I catch the 8:05 bus.

Rewrite the following as an equivalent if then statement: "'n is divisible by both 2 and 3' is a necessary condition for 'n is divisible by 6'."

- A. If n is not divisible by 6 then n is divisible by both 2 and 3.
- B. If n is not divisible by both 2 and 3 then n is divisible by 6.
- C. If n is not divisible by 6 then n is not divisible by both 2 and 3.
- D. If n is divisible by both 2 and 3 then n is not divisible by 6.
- E. If n is divisible by 6 then n is not divisible by both 2 and 3.
- F. If n is divisible by 6 then n is divisible by both 2 and 3.
- G. If n is not divisible by both 2 and 3 then n is not divisible by 6.
- H. If n is divisible by both 2 and 3 then n is divisible by 6.

Rewrite the following as an equivalent if then statement: "'I raise my grades' is a sufficient condition for 'I form a study group'."

- A. If I work alone then I lower my grades.
- B. If I raise my grades then I work alone.
- C. If I raise my grades then I form a study group.
- D. If I lower my grades then I work alone.
- E. If I lower my grades then I form a study group.
- F. If I work alone then I raise my grades.
- G. If I form a study group then I lower my grades.
- H. If I form a study group then I raise my grades.

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8. **(7 points)** `Library/Utah/Calculus_I/set1_Preliminaries/1210s1p27.pg`

The next few problems are simple exercises in logic. Section 1.1 of the textbook discusses the concept of the *converse* , the *contrapositive,* and the *negation* of a statement. For example, consider the statement *all natural numbers are real numbers.* (This is a true statement, but this is actually not important for this discussion.) This statement can be put as an implication: *if x is a natural number, then x is a real number.* The **converse** of this statement is *all real numbers are natural numbers* , or *if x is a real number then it is a natural number* , (which is a false statement), the **contrapositive** is *if x is not a real number then it isn't a natural number* (which is a true statement), and the **negation** of the statement is *some natural numbers are not real numbers* (which is a false statement).

The purpose this particular problem is to illustrate the pattern of the next couple of problems. You already know the answers, so it is just a matter of entering them. In this problem, WeBWorK will tell you separately for each answer whether it is correct or not, but in the next two you will have to enter everything correctly to get credit.

Let S be the statement: *All natural numbers are real numbers.*

Complete the sentences below, filling in A-G from the following list, and T or F for true or false, as appropriate.

A. Numbers aren't natural.

B. All real numbers are natural.

C. Some natural numbers aren't real numbers.

D. Some real numbers aren't natural numbers.

E. No real number is natural.

F. A number can't be natural if it isn't real.

G. A number can't be real if it isn't natural.

S is ___ (true or false).

The converse of S is ___ (enter a letter from A-G) and that statement is ___.
The contrapositive of S is ___ and that statement is ___.
The negation of S is ___ and that statement is ___ (true or false).

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9. **(7 points)** `Library/Utah/Calculus_I/set1_Preliminaries/1210s 1p28.pg`
Let S be the statement: *All men are humans.*

Complete the sentences below, filling in A-G from the following list, and T or F for true or false, as appropriate.

A. Some men aren't humans.

B. Some men are humans.

C. Some humans aren't men.

D. No men are humans.

E. If you aren't a human you aren't a man.

F. Women aren't human.

G. All humans are men.

S is ___ (true or false).

The converse of S is ___ (enter a letter from A-G) and that statement is ___ (true or false).
The contrapositive of S is ___ and that statement is ___.
The negation of S is ___ and that statement is ___.

There are two versions of this problem with the roles of "men" versus "women" randomly interchanged.

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10. **(7 points)** `Library/Utah/Calculus_I/set1_Preliminaries/1210 s1p29.pg`
Let the following statement:

For any x, if $x > 0$ then $x^3 > 0$.

Complete the sentences below, filling in A-G from the following list.

A. Real numbers are all zero.

B. For any x, if $x^3 > 0$, then $x > 0$.

C. There is some $x > 0$ such that $x^3 \leq 0$

D. For any x, if $x \geq 0$ then $x^3 \leq 0$.

E. For any x, if $x > 0$ then $x^3 > x$.

F. For any x, $x^3 > x$.

G. For any x, if $x^3 \leq 0$ then $x \leq 0$.

S is ?

The converse of S is ___ (enter a letter from A-G) and that statement is ? .

The contrapositive of *S* is ___ and that statement is ⌐?⌐.
The negation of *S* is ___ and that statement is ⌐?⌐.

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11. **(10 points)** `Library/SDSU/Discrete/Logic/ttlogicequivA7.pg`
Complete the truth table for the following statement:

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

p	q	$\sim p$	$\sim q$	$p \wedge \sim q$	$\sim p \vee q$	$(p \wedge \sim q) \wedge (\sim p \vee q)$
T	T	___	___	___	___	___
T	F	___	___	___	___	___
F	T	___	___	___	___	___
F	F	___	___	___	___	___