
MATH 10771: Exam #1 (Fall 2016)

1. Short answer.

- (a) If $A = \{1, 6\}$ and $B = \{3, 4, 5\}$, find $B \times A$.
- (b) Suppose $Y \cap X = Y$. If $X \neq Y$, draw a Venn Diagram to illustrate the relationship between X and Y . Be sure to label your Venn Diagram.
- (c) Suppose that $q \rightarrow p$ is known to be false. Determine the truth value for $\sim p \wedge q$.
- (d) How many subsets does $A = \{1, 2, 3, 4\}$ have? (Note: you do not need to list them.)
- (e) List the **proper subsets** of $B = \{5, 7, 9\}$.

2. State the **contrapositive** of the following statement:

If a figure is a square, then the figure is not a trapezoid.

3. State the **negation** of the following statement:

Valerie is enrolled in statistics and Robert does not play the trumpet.

4. State the **inverse** of the following statement:

If it is not raining, then I will go for a bike ride.

5. State the **converse** of the following statement:

If today is Monday, then yesterday was Sunday.

10. Write the following arguments in symbolic form using $p, r, s, \sim, \wedge, \vee, \longrightarrow, \longleftrightarrow$ and parentheses where necessary, when $p, r,$ and s are the given statements.

p is “Penny likes Petunias”

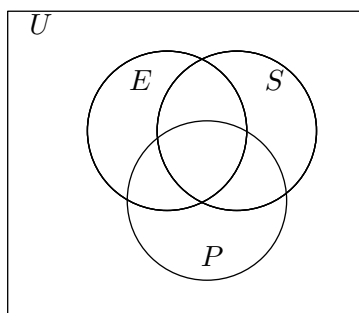
r is “Robert likes roses”

s is “Sam likes sunflowers”

- (a) If Robert does not like roses and Sam does not like sunflowers, then Penny likes Petunias.
- (b) Sam likes sunflowers if and only if it is not the case that both Penny likes Petunias and Sam does not like sunflowers.
- (c) If Penny doesn't like Petunias, then either Robert does not like roses or Sam likes sunflowers.
11. A total of 146 students at Kent State Tuscarawas were surveyed regarding the classes that they are enrolled in during Fall 2016. The results are as follows:

85 enrolled in English (E)
 64 enrolled in Statistics (S)
 56 enrolled in Psychology (P)
 39 enrolled in English and Statistics
 29 enrolled in English and Psychology
 31 enrolled in Statistics and Psychology
 18 enrolled in English, Statistics, and Psychology

- (a) Fill in the Venn Diagram COMPLETELY using the above information.



- (b) How many students are enrolled in Psychology and Statistics, but not English?
- (c) How many students are enrolled in Statistics or English?
- (d) How many students are enrolled in English, but not Statistics?
- (e) How many students are enrolled in only one of these courses?

12. Use a truth table to determine whether

$$(p \wedge q) \longrightarrow \sim p \quad \text{and} \quad p \longleftrightarrow \sim q$$

are logically equivalent. If not logically equivalent, state why. An answer without supporting work will receive no credit.

13. Using a truth table, determine whether the following argument is valid or invalid. You must show all work.

Circle one: Valid Invalid

$$\frac{\sim p \vee q \quad \sim q \longrightarrow p}{p}$$

ANSWERS

1. (a) $B \times A = \{(3, 1), (4, 1), (5, 1), (3, 6), (4, 6), (5, 6)\}$
(b) Set Y would be inside of set X
(c) true
(d) 16 subsets
(e) $\emptyset, \{5\}, \{7\}, \{9\}, \{5, 7\}, \{5, 9\}, \{7, 9\}$
2. If the figure is a trapezoid, then the figure is not a square.
3. Valerie is not enrolled in statistics or Robert plays the trumpet.
4. If it is raining, then I will not go for a bike ride.
5. If yesterday was Sunday, then today is Monday.
6. See instructor for answer.
7. (a) false (b) false
8. (a) $\{1, 2, 6\}$ (b) $\{1, 4, 6\}$ (c) $\{5, 6, 8\}$ (d) $\{7\}$
9. (a) true (b) true (c) false (d) false
10. (a) $(\sim r \wedge \sim s) \longrightarrow p$
(b) $s \longleftrightarrow \sim (p \wedge \sim s)$
(c) $\sim p \longrightarrow (\sim r \vee s)$
11. (a) See instructor for answer
(b) 13
(c) 110
(d) 46
(e) 61
12. not logically equivalent
13. invalid