



202109 Term Test 1
Math 122 A05
Instructor: Natasha Morrison

First name (please write as legibly as possible within the boxes)

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Last name

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Student ID number

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Please write your V number without the “V”
Do not open the booklet before you are told to

Date and Time: Friday, October 22, 2021 at 13.30pm.

Instructions: There are 10 pages and 8 questions. There are 24 marks available. The time limit is 45 minutes. Math and Stats standard calculators are allowed. Except when indicated, it is necessary to show clearly organized work in order to receive full or partial credit.

Please count your pages and report any discrepancy immediately to the invigilator.

True/False Instructions: Question 1 consists of 12 true/false questions labelled **TF 1** to **TF 12**. The last page of your test booklet is a bubble sheet for answering them. You can detach the back page from the rest of the test. Only fill in a bubble for questions 1-12 on the bubble sheet. When making your selection, **True is A** and **False is B**. Do not select C, D or E. Do not select more than one bubble.

Do not use the back of the bubble sheet for rough work.



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Nothing written on this page will be graded.



1. [6] Use the **bubble sheet** provided on the last page of the test booklet to indicate whether each statement is **True (A)** or **False (B)**.
- [1] p and $\neg(\neg p)$ can have different truth values.
 - [2] If $s_1 \rightarrow s_2$ is false, then s_1 is true.
 - [3] $a \vee (b \wedge c)$ is logically equivalent to $(a \wedge b) \vee c$.
 - [4] A valid argument has a counterexample.
 - [5] The statements “ $\forall y \in \mathbb{Z}, \exists x \in \mathbb{R}, x = 2y$ ” and “ $\exists x \in \mathbb{R}, \forall y \in \mathbb{Z}, x = 2y$ ” have the same truth value.
 - [6] The statement “*every integer is even*” can be written in symbols as “ $\exists n \in \mathbb{Z}, \forall k \in \mathbb{Z}, n = 2k$ ”.
 - [7] $\exists x \in \mathbb{R}, (x > 1) \rightarrow (x < 1)$.
 - [8] The statements “ $\forall x \in \{1, 2, 3\}, x > 2$ ” and “ $(1 > 2) \wedge (2 > 2) \wedge (3 > 2)$ ” are logically equivalent.
 - [9] $b \in \{a, \{b\}, \{a, b, c\}\}$.
 - [10] If $A \cap B = A \cup B$ then $A = \emptyset$.
 - [11] $(A \cup B) \setminus (A \cap B) = A \oplus B$.
 - [12] $\emptyset \in \mathcal{P}(\{1\})$.
2. [2] Is the statement $(q \rightarrow q) \rightarrow q$ a tautology, a contradiction, or neither? Explain.



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3. [4] Write the argument below in symbolic form, and then use known logical equivalences and inference rules to show it is valid. Remember to define the letters you use to represent statements.

The statement that I am wearing socks or I play with my puppy is false

I either play with my puppy or watch Jeopardy

If I don't go running, then I don't watch Jeopardy

\therefore I go running



4. [3] Write the statement

$$\neg[\exists x \in \mathbb{Z}, \forall y \in \mathbb{Z}, (x = 0) \rightarrow (xy \neq 1)]$$

in symbols without using any negated quantifiers or negated mathematical symbols and determine its truth value.



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5. Let k be an integer.

(a) [2] Prove that if k is even, then k^2 is even.

(b) [1] Write the converse of the statement in (a). Is the converse logically equivalent to the statement in (a)?



6. [3] There are 41 MATH 122 students. 25 own cats. 15 own dogs. 8 own hamsters. No student has a cat and a dog and a hamster. 11 have a cat and a dog. 2 have a cat and a hamster. Exactly one student with a dog does not have another pet. Draw a Venn diagram to represent the situation and determine how many students have no pets.



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7. [3] Let A and B be sets such that $A \cup B = B$. Prove that $A \cap B = A$. Determine whether the converse is a contradiction.



Name: _____

Student ID Number: _____

Instructions:

Please completely fill in the rectangle associated with your response. Example:

- | A | B | C | D | E | A | B | C | D | E | A | B | C | D | E | A | B | C | D | E | | | | |
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| 24 | <input type="checkbox"/> | 49 | <input type="checkbox"/> | 74 | <input type="checkbox"/> | 99 | <input type="checkbox"/> |
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