

# SOLUTION

## MTH210 – SUBMISSION\_EXTRA

TIME: 10 minutes

MARKS: 5

No consultation – open notes – books and internet not allowed.

Consider the statement A:

The equation  $x^n + y^n = z^n$  has a solution in which  $x, y, z$  are positive integers, and  $n$  is a positive integer  $> 2$ .

- Express A as a statement S in predicate logic, i.e. using a propositional function P with suitable variables and quantifiers. You must explicitly specify P and the variables required, along with the domain of discourse for each variable. (3 marks)
- Is S a proposition (YES/NO)? Justify. (1 mark)
- If YES, is it TRUE or FALSE? Justify in **exactly one** sentence. (1 mark)

ID:

Wednesday, November 30, 2022

NAME:

GROUP:

a. Consider the propositional function (predicate)  $P: x^n + y^n = z^n$

Remark: This is a 4-ary predicate with four variables  $x, y, z, n$

Then:  $S = \exists n \exists x \exists y \exists z (P)$   
with domains of discourse as:

For  $x, y, z$  :  $\mathbb{Z}^+$

For  $n$  :  $N = \{n \in \mathbb{N} : n > 2\}$

Note: Since all the quantifiers are of the same type, order is immaterial, and there is no need to have more brackets.

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b. YES - S is a proposition

Justification: All the variables in S are bound.

c. S is FALSE.

Either of the two following sentences (or equivalent) is acceptable :-

1. TS, known as Fermat's Last Theorem (FLT), was proved by Andrew Wiles in the 1990's. (\*)

2. I have discovered a truly marvellous proof of this, which this margin is too narrow to contain.

(\*\*) \* The sentence in the answer need not contain the name of the mathematician or the approximate date.

\*\* By the underlined this refers to the statement TS.