King Saud University
College of Science
Department of Mathematics

Course Title:	Mathematical logic
Course Code:	132 Math
Course Instructor:	Reem Almahmud
Exam:	1^{st} MIDTERM
Semester:	1^{st} term 1445/1446
Date:	04-10-2023
Duration:	2 Hrs
Marks:	25

Privileges: Calculator is not Permitted

Student Name:	
Student ID:	
Section No:	54945
Serial No:	

Instructions:

- Cell Phones should be switched off or on silent mode during the exam.
- Write your answers directly on the question sheet.
- There are 4 questions in 5 pages.

Official Use Only		
Question	**Students Marks**	**Question Marks**
1		6
2		7
3		7
4		5
Total		25

(1)	(2)	(3)	(4)	(5)	(6)

Q1

Q1: **Choose** the correct answer and **write** it in the top table:

1- The truth value of the statement "For all positive integers x, if $x^2 < 0$, then $x + 1 > 2$"

a) True
b) False
c) Undetermined
d) None

2- Let $P(x, y)$ be the statement "$x - 3y - 6 = 0$". Then,

a) $P(1,6)$ is true
b) $P(9,1)$ is true
c) $P(1,9)$ is true
d) $P(6,1)$ is true

3- $\neg[\forall x(1 + 2x \geq 2 - x \ \vee x > 0)]$ is equivalent to

a) $\exists x(1 + 2x < 2 - x \ \wedge x \leq 0)$
b) $\forall x(1 + 2x < 2 - x \ \wedge x \leq 0)$
c) $\exists x(1 + 2x < 2 - x \ \vee x \leq 0)$
d) $\exists x(1 + 2x \geq 2 - x \ \vee x > 0]$

4- Let $Q(x)$ be the statement "$x + 4 > 3x$", with the domain tb the set of integers. Which of the following statements is true:

a) $\forall x \, Q(x)$
b) $\exists x \, Q(x)$
c) $Q(5)$
d) $Q(10)$

5- The inverse of the conditional statement "If n is odd, then n^2 is odd" is

a) If n^2 is even, then n is even
b) If n^2 is odd, then n is odd
c) If n is even, then n^2 is even
d) None

6- The proposition $(p \vee \neg p) \rightarrow p$ is a

a) Tautology
b) Contradiction
c) Contingency
d) None

Q2

Q2: I - **Prove** the following statement:

I - $n^2 + 1 \geq 2^n$ where n is a positive integer with $1 \leq n \leq 4$.

II - Prove that $[\neg p \wedge (p \vee q)] \rightarrow q$ is a tautology, (**Use two different ways**).

Q3

Q3: **Prove** the following statements:

I- If n is integer and $3n + 2$ is even, then n is even. (Use two different methods)

II - If $m + n$ and $n + p$ are even integers, where m, n and p are integers, then $m + p$ is even. (Use direct method)

Q4

Q4: Prove that

$$1^2 + 2^2 + \cdots + n^2 = \frac{n(n+1)(2n+1)}{n}, \text{ for a positive integer } n.$$

End of the Exam