College of Science.
Department of Mathematics

كلية العلوم
قسم الرياضيات

First Midterm Exam
Academic Year 1445-1446 Hijri- Second Semester

Exam Information معلومات الامتحان			
Course name	**Discrete Mathematics**		اسم المقرر
Course Code	**Math 151**		رمز المقرر
Exam Date	**2025-02-19**	**1446-08-20**	تاريخ الامتحان
Exam Time	**12: 00 PM**		وقت الامتحان
Exam Duration	**2 hours**	ساعتان	مدة الامتحان
Classroom No.			رقم قاعة الاختبار
Instructor Name	د. جواهر المفرج		اسم استاذ المقرر

Student Information معلومات الطالب		
Student's Name		اسم الطالب
ID number		الرقم الجامعي
Section No.		رقم الشعبة
Serial Number		الرقم التسلسلي

General Instructions:

- Your Exam consists of 6 PAGES (except this paper)
- Keep your mobile and smart watch out of the classroom.
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تعليمات عامة:

- عدد صفحات الامتحان 6 صفحة. (بإستثناء هذه الورقة)
- يجب إبقاء الهواتف و الساعات الذكية خارج قاعة الامتحان.
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هذا الجزء خاص بأستاذ المادة

This section is ONLY for instructor

#	Course Learning Outcomes (CLOs)	Related Question (s)	Points	Final Score
1	C.LO.1.1	Q1-Q2	5.5+8	
2	C.L.O 2.1	Q3-Q4-Q5	5+3.5+3	
3	.			
4				
5				25
6				
7				
8				

EXAM COVER PAGE

Questions	Q1	Q2	Q3	Q4	Q5	Total
Marks						

Question 1: (8 points)

Question Number	1	2	3	4	5	6	7	8
Answer								

Choose the correct answer, then fill it in the above table:

1) The truth value of "$\forall x \in \mathbb{R}$, if $x^2 \geq 1$, then $x > 0$" is:
   (a) True.
   (b) False.

2) The proposition $\neg(p \vee q) \leftrightarrow (\neg p \wedge \neg q)$ for any prpositions p and q is a:
   (a) Tautology.
   (b) Contradiction.
   (c) Contingency

3) The proposition $(p \rightarrow q) \wedge (p \wedge \neg q)$ is logically equivalent to:
   (a) **T** (b) **F** (c) p (d) q

4) The statement $p \rightarrow q$ is equivalent to:
   (a) $\neg p \rightarrow q$
   (b) $p \rightarrow \neg q$
   (c) $\neg q \rightarrow \neg p$
   (d) $\neg q \rightarrow p$

5) The negation of the statement $[\exists x(x^2 > x)]$ and $[\forall x(x^2 \neq 1)]$ is
(a) $[\forall x(x^2 \geq x)]$ or $[\exists x(x^2 = 1)]$
(b) $[\exists x(x^2 > x)]$ or $[\forall x(x^2 = 1)]$
(c) $[\forall x(x^2 \leq x)]$ or $[\exists x(x^2 = 1)]$
(d) $[\exists x(x^2 \leq x)]$ or $[\forall x(x^2 = 1)]$

6) The statement "$x - 3 < 0$" is true when the domain is the set of:
(a) All positive real numbers.
(b) All negative real numbers.
(c) All real numbers.
(d) All real numbers except $x = 3$.

7) Let $P(x, y)$ be the statement: "$y - 1 = x$". Then
(a) $P(2,3)$ is false.
(b) $P(3,2)$ is true.
(c) $P(5,4)$ is false
(d) $P(4,5)$ is false

8) Let $p(x)$ be the statement "$x^2 > 11$" and the universe of discourse consists of the positive integers not exceeding 4, then the truth value of $\exists x P(x)$ is equal to
(a) $\big(P(1) \vee P(2)\big) \wedge (P(3) \wedge P(4))$.
(b) $P(1) \vee P(2) \vee P(3) \vee P(4)$.
(c) $P(1) \wedge P(2) \wedge P(3) \wedge P(4)$.
(d) $\big(P(1) \vee P(2)\big) \vee (P(3) \wedge P(4))$.

Question 2: (3+2.5 points)

(A) Consider the proposition: "If $2 + 6 = 3$ then $\sqrt{2}\ is$ irrational ". Find the following:

(1) The truth value of the proposition.

(2) The convers and its truth value.

(3) The inverse and its truth value.

(4) The contraposition and its truth value.

(B) Without using truth tables show that $(p \wedge q) \to r \equiv (p \to r) \vee (q \to r)$.

<u>Question 3:</u> (2.5+2.5 points)

(A) **<u>By contradiction:</u>** Prove that if x is rational and y is irrational then $x + y$ is irrational.

(B) Prove that for all integer n, if $n + 1$ is even, then n^2 is odd.

Question 4: (2.5+1 points)

(A) Prove that for all integer n, if $n^2 + n$ is odd, then n is odd.

(B) Show that that statement "For every positive integer n, $n^2 + 1 > 2n$" is false.

<u>Question 5:</u> (3 points)

The sequence $\{a_n\}$ is defined recursively by

$$a_1 = 1, a_2 = 4, a_n = 2a_{n-1} - a_{n-2}, n \geq 3$$

Use the Principal of Strong Mathematical induction to prove that $a_n = 3n - 2\ \forall n \geq 1$.

دعواتي لكن بالتوفيق