

Hcampus

be reasonable, to be successful

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Mathematics Mid Exam for Natural Science *August 09, 2021*

JIMMA UNIVERSITY

COLLEGE OF NATURAL SCIENCES

DEPARTMENT OF MATHEMATICS

Mark=30%

time allowed=2:30 hrs

Name:_____ **ID No:** _____ **Section:** _____

PART I: Multiple Choice Items: Choose the best answer from the given alternatives (7pts)

1. If $n(U)=50$, $n(A)=26$, $n(A\cap B)=12$, $n(A'\cap B')=10$, then $n(B-A)=$ ____

   A) 14 *B)* 26 *C)* 12 *D)* 22

2. Let $A=\left\{\frac{2}{3^n}+\frac{(-1)^n}{2^{n-1}} \mid n\in N\right\}$. What is the least upper bound of A?

   A) $\frac{17}{36}$ *B)* $\frac{-1}{3}$ *C)* $\frac{13}{18}$ *D)* 0 *E)* $\frac{7}{6}$

3. Suppose $p\Rightarrow(r\vee\neg q)$ is false, then which one of the following is **true**?

   A) $p\Rightarrow r$ *B)* $q\Leftrightarrow r$ *C)* $\neg p\vee r$ *D)* $r\Rightarrow q$

4. Let $U=\{1,2,3\}$ be the universal set. Which one of the following is **not true**?

   A) $(\exists x)(\forall y)(x^2+2y<10)$
   B) $(\exists x)(\exists y)(x^2+2y<10)$
   C) $(\exists x)(\exists y)(x^2+y^2<2xy)$
   D) $(\forall x)(\exists y)(x^2+2y<10)$

5. Let $U=\{3,5,11\}$ be the universal set. Which one of the following is **true**?

   A) $\neg(\exists x)(\exists y)(xy-2$ *is composite*$)$
   B) $\neg(\forall x)(\forall y)(xy-2$ *is prime*$)$
   C) $(\forall x)(\exists y)(\frac{x}{y}<1)$
   D) $(\exists x)(\forall y)(\frac{x}{y}>1)$

6. What are the solution set of $z^2+(2i-3)z+5-i=0$?

   A) $\{1+i,-2+3i\}$ *B)* $\{1+i,2+3i\}$ *C)* $\{-1+i,2-3i\}$ *D)* $\{1+i,2-3i\}$

7. Let $A=\{\phi,\{\{\ \}\}\}$. Which one of the following is **not true**?

   A) $\phi\subseteq A$ *B)* $\{\{\{\ \}\}\}\subseteq P(A)$ *C)* $\phi\in A$ *D)* $\phi\in P(A)$ *E)* $\phi\subseteq P(A)$

*Good Luck!!!

PART II: Short Answer Items: Write the most simplified answer on the space provided (7pts)

8. Let $z=\left(\frac{1-\sqrt{3}i}{\sqrt{2}+\sqrt{-6}}\right)^{28}$

(a) $Re(z)=$ _____ (b) $Im(z)=$ _____ (c) $Arg(z)=$ _____ (d) $|z|=$ _____

9. Suppose $GCF(x,120,300)=12$ & $LCM(x,120,300)=1200$, $x=$ _____

10. If $A\cup C=\{x|x\in\mathbb{R}, x^3-x^2-x+1=0\}$ & $A\cup C=\{x|x\in\mathbb{R}, |2x-3|<5\}$, the

$(A\cap B)\cup C=$ _____

11. Suppose $A=\{x|x\in\mathbb{R}, \sqrt{2x^2-1}\neq x\Rightarrow\sqrt{x+3}=3-x\}$,

$P(A)=$ _____

PART III: Workout Items: Show all the necessary steps clearly and neatly! (16pts)

12. Prove whether the following argument is valid or invalid by using formal proof (Without truth table). $q\Rightarrow r, \neg s\Rightarrow(w\Rightarrow p), s\vee(q\vee w), \neg s\vdash\neg r\wedge\neg p$

13. Using logical equivalence (Without truth table), Prove that

$[(\neg p\Rightarrow q)\wedge((p\Rightarrow\neg r)\wedge r)]\Rightarrow q$ is **tautology**.

14. Prove that $10^n+3x4^{n+2}+5$, $n\geq 0$ is divisible by 9 by using Mathematical induction.

15. Find all roots of: $z^6+3iz^3+10=0$

*Good Luck!!!