

# Math 351

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Name: .....

Student ID (last 6 digits): XXX- .....

## MIDTERM 1

You have 50 minutes to complete the exam. Do all work on this exam, i.e., on the page of the respective assignment. Indicate clearly, when you continue your solution on the back of the page or another part of the exam.

Write your name and the last six digits of your student ID number on the top of this page. Check that no pages of your exam are missing. This exam has 5 questions and 7 printed pages (including this one and a page for scratch work in the end).

No books or notes are allowed on this exam, but you can use your own index cards!

**Show all work!** (Unless I say otherwise.) Correct answers without work will receive **zero**. Also, **points will be taken from messy solutions**.

**Good luck!**

Question	Max. Points	Score
1	20	
2	20	
3	20	
4	20	
5	20	
Total	100	

1) [20 points] Use the *Extended Euclidean Algorithm* to write the GCD of 83 and 61 as a linear combination of themselves. *Show work!*

[**Hint:** You should get 1 for the GCD!]

2) [20 points] Express 2023 in base 5, i.e., write

$$2023 = \boxed{?} + \boxed{?} \cdot 5 + \boxed{?} \cdot 5^2 + \boxed{?} \cdot 5^3 + \dots$$

with the blanks in  $\{0, 1, 2, 3, 4\}$ . *Show work!*

[**Note:** Trial and error is not acceptable here! You have to use some algorithm that always works, like the one I showed you in class.]

**3)** Prove that for all positive integers  $n$ , we have  $\gcd(n, n + 2)$  is either 1 or 2.

4) [20 points] Let  $a, b \in \mathbb{Z}$ . Prove that if  $\gcd(a, b) = 1$ , then  $\gcd(a, b^2) = 1$ .

5) [20 points] Prove that if  $\gcd(a, b) = 1$ ,  $a \mid c$ , and  $b \mid c$ , then  $ab \mid c$ .

[**Hint:** This was a HW problem. *Carefully state any previous result you use!*]

**Scratch:**