

Howard University Math Department

Instructions:

PLEASE PROVIDE STEP BY STEP EXPLANATIONS

WRITING ONLY ANSWERS WILL NOT GET FULL CREDIT

Time Limit 30 minutes

Please read the questions carefully before answering

EXTRA CREDIT 10 POINTS

1. (10 points) Prove by cases: $m^3 + n^2 = 40$ has no solutions in positive integers.

2. (10 points) Prove by cases: For any two real numbers x, y ,

$$\max\{x, y\} = \frac{x + y + |x - y|}{2}.$$

3. (10 points) Prove **using induction** : If $n \in \mathbb{Z}$ then $n^3 + n$ is always even.

In the proof you can assume that $n^2 + n$ is always even, as we proved in class, if necessary.

4. (10 points) Prove **using induction** :

$$1 + 4 + 7 + \dots + (3n - 5) + (3n - 2) = n(3n - 1)/2.$$