

MATH 9: REVIEW 4

2021/05/09

1. PROBLEMS SECTION 1

1. Write down the definition for an injective function, and write the definition for a surjective function.
 - (a) Write down a function $f : \mathbb{N} \rightarrow \mathbb{N}$ that is injective but not surjective.
 - (b) Write down a function $f : \mathbb{N} \rightarrow \mathbb{N}$ that is injective but not injective.
 - (c) Write down a function $f : \mathbb{Z} \rightarrow \mathbb{N}$ that is injective.
2. Given a line l , a point O not on l , and a circle centered at O with radius r , let d be the length of the perpendicular line segment from O to l . Find the radius of the figure that results from inversion of l around the circle centered at O .
3.
 - (a) Given two ellipses with the same major axis, if one ellipse has a greater area than the other, then which ellipse has greater eccentricity, the one with greater area or the one with lesser area?
 - (b) Given two ellipses with the same minor axis, if one ellipse has greater area than the other, then which ellipse has greater eccentricity?
4. Prove that, given a positive integer n , the binomial coefficients $\binom{n}{k}$ are multiples of n if and only if $k \neq 0$ and $k \neq n$.

2. PROBLEMS SECTION 2

1. For each of the 3 weeks of October, pick 1 problem from the assigned homework problems, and write up solutions of those problems.
2. For each of the 4 weeks of November, pick 1 assigned problem and write up a solution to each of those problems.
3. For each of the 4 weeks of January, pick 1 assigned problem and write up a solution to each of those problems.
4. For each of the 4 weeks of March, pick 1 assigned problem and write up a solution to each of those problems.