

MATH8705 IN-CLASS WORKSHEET 1

ANAND DEOPURKAR

Exercise 2.3. The following expressions define sets. Turn words into symbols, using standard or Zermelo definitions. (Represent geometrical objects, e.g., planar curves, by their cartesian equations.)

1. *The set of negative odd integers.*
2. *The set of natural numbers with three decimal digits.*
3. *The set of rational numbers which are the ratio of consecutive integers.*
4. *The set of rational points in the closed unit cube.*
5. *The complement of the open unit disc in the complex plane.*
6. *The set of vectors of unit length in three-dimensional euclidean space.*
7. *The set of circles in the plane, passing through the origin.*
8. *The set of hyperbolae in the plane, whose asymptotes are the coordinate axes.*
9. *The set of lines tangent to the unit circle.*

Exercise 2.4. The following expressions define sets. Turn symbols into words. [✓]

1. $\{x \in \mathbb{Q} : 0 < x < 1\}$
2. $\{1/(2n+1) : n \in \mathbb{Z}\}$
3. $\{m2^{-k} : m \in 1+2\mathbb{Z}, k \in \mathbb{N}\}$
4. $\{x \in \mathbb{R} \setminus \mathbb{Z} : x^2 \in \mathbb{Z}\}$
5. $\{z \in \mathbb{C} \setminus \mathbb{R} : z^2 \in \mathbb{R}\}$

Exercise 2.5. Turn symbols into words. [✓]

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|---|---------------------------------------|
| 1. f^{-1} | 2. $f^{-1}(x)$ |
| 3. $f(x^{-1})$ | 4. $f(x)^{-1}$ |
| 5. $f(x)^2$ | 6. $f \circ f$ |
| 7. $f(\mathbb{R} \setminus \mathbb{Q})$ | 8. $f(A) \cap f(B)$ |
| 9. $f^{-1}(\{0\})$ | 10. $f(\mathbb{R}) \cap \mathbb{Q}$. |

1. Let's practice set-builder notation. Write out in plain English what the following sets are. For example, $\{x \in \mathbb{R} \mid x^2 > 3\}$ is "the set of real numbers whose square is bigger than 3."
 - (a) $\{n \in \mathbb{Z} \mid n^2 > 5\}$.
 - (b) $\{n \in \mathbb{Z} \mid n = 2k + 1 \text{ for some } k \in \mathbb{Z}\}$
 - (c) $\{(x, y) \mid x, y \in S\}$, where S is a set.¹⁰
 - (d) $\{(x, y) \in \mathbb{R}^2 \mid x^2 = y\}$.