

Due Wednesday, November 24, 2021. Write all complex numbers and polynomials in standard form. Do not copy. Do not write anything you do not understand.

Definition 1. Let A and B be sets. The *union* of A and B , denoted $A \cup B$, is the set consisting of all the elements that are in either A or in B . That is,

$$A \cup B = \{x \mid x \in A \text{ or } x \in B\}.$$

Example 1. The set of all real numbers except 0 is the set of all negative numbers, union with all the positive numbers. The set of negative numbers is $(-\infty, 0)$. The set of positive numbers is $(0, \infty)$. Therefore, the set of all real numbers except 0 can be written in these three ways:

$$\{x \in \mathbb{R} \mid x \neq 0\} = \{x \in \mathbb{R} \mid x < 0 \text{ or } x > 0\} = (-\infty, 0) \cup (0, \infty).$$

Problem 1. Write the following subsets of \mathbb{R} using correct set notation.

- (a) The set of positive integers less than or equal to 7.
- (b) The set of real numbers greater than 3.14.
- (c) The set of real numbers except 3.
- (d) The set of real numbers whose square is less than 25.
- (e) The set of real numbers whose square is greater than 9.
- (f) The set of real numbers x such that $x^3 - x > 0$.

Problem 2. Let $f(x) = x^3 - 2x^2 - 9x + 18$.

(a) Find the zeros of f . You may use “factor by grouping”.

(b) Draw a sign chart for f .

(c) Solve the inequality $x^3 + 18 \geq 2x^2 + 9x$.

Problem 3. Let $f(x) = x^3 - 9x^2 + 33x - 65$.

(a) Use synthetic division to show that $f(5) = 0$.

(b) Let $q(x)$ be the quotient when $f(x)$ is divided by $x - 5$, so that $f(x) = (x - 5)q(x)$. Write $q(x)$ in standard form.

(c) Use the quadratic formula to solve $q(x) = 0$. Simplify.

(d) Solve $f(x) = 0$. Write the solution set.