

Name: _____

Section:

Midterm (closed book, closed notes)

A Term, 2011

If you are/were a WPI undergrad, what was your first math course at WPI?

Show all work needed to reach your answers. You may use any theorem we discussed in class, but cite by name any theorem you use.

1. (20 points) If A and B are sets, please show that $\mathcal{C}(\mathcal{A} \cup \mathcal{B}) \subset \mathcal{C}\mathcal{A} \cap \mathcal{C}\mathcal{B}$ (the other containment direction is also true, but not part of this question).
2. (20 points) If $x_1, x_2 \in \mathbb{Q}$, show in detail that their product is rational: $x_1 x_2 \in \mathbb{Q}$.

3. (25 points) For which $x \in \mathbb{R}$ is $x + 2 < \frac{1}{|x|}$? Please show all needed steps, and give your final answer as the union of intervals.

Solution: _____

4. (15 points) **Please fill in the blanks.**

Suppose $f : X \rightarrow Y$ is a function. Then $f(x)$ is defined _____ $x \in X$, and f maps X _____ $f(X)$. Also if $y \in \text{Range}(f)$, then there exists $x \in X$ such that _____. And if $A \subset X$, then $f^{-1}(f(A))$ _____ A . Finally f^{-1} is itself a function iff f is _____.

5. (10 points) Please show that if $a, b, x, y \in \mathbb{R}$, and $a < x < b$, $a < y < b$, then $|y - x| < b - a$.

6. (10 points) Suppose $S \subset \mathbb{R}$ is a nonempty set that is bounded above. Can S have more than one least upper bound? Please explain in detail why or why not.