

Always justify your answers, even if the question does not explicitly say so. Write your own solutions, independently of anyone else.

Core Problems: When a problems says “Find all ring homomorphisms . . .”, I want a list with no repeats (and of course, none missing).

I. Sec. 4.2 # 2, 3 abcef (Remember, to prove $R/I \cong S$, you want to find a surjective ring homomorphism $\phi: R \rightarrow S$ with $\ker \phi = I$. Also remember that $\mathbb{Z}_{12} = \mathbb{Z}/\langle 12 \rangle$.)

II. Sec. 4.2 # 5 (Before doing (a), first prove that R is a commutative subring of the (non-commutative!) ring $M_2(\mathbb{R})$. #4.1.11 might give an idea for (b).)

III. Sec. 4.2 # 9 abc (Assume $f(x) \in \mathbb{Q}[x]$).

IV. Sec. 4.2 # 11 ab (If any of the rings *are* isomorphic, prove it using Theorem 2.2 if you can.)

V. Sec. 4.2 # 20, 23 ab (Hint: A homomorphism defined on any of the direct products in this problem is completely determined by $\phi((1, 0))$ and $\phi((0, 1))$. Why? What is the resulting formula for $\phi((a, b))$?)

Advanced Problem: Due **Fri. Nov. 20**. Students registered for 6000 must turn these problems in. They count for extra credit for 4000 students, but anyone hoping to get an ‘A’ in 4000 should do a reasonable number of advanced problems. Please hand in Advanced Problems separately from Core Problems.

VI. Sec. 4.2 # 27.