

Math 330 - 03 Homework (Fall 2018)

- LaTeX-ed solutions are encouraged and appreciated.
 - If you use LaTeX, hand-in a printed version of your homework.
 - You are encouraged to discuss homework problems with classmates, but such discussions should NOT include the exchange of any written material.
 - Writing of homework problems should be done on an individual basis.
 - References to results from the textbook and/or class notes should be included.
 - The following lists should be considered partial and tentative lists until the word complete appears next to it.
 - Use 8.5in x 11in paper with smooth borders. Write your **name** on top of **each page**. Staple all pages.
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$\newcommand{\aut}{\text{Aut}} \newcommand{\sub}{\text{Sub}} \newcommand{\join}{\vee}
\newcommand{\bigjoin}{\bigvee} \newcommand{\meet}{\wedge} \newcommand{\bigmeet}{\bigwedge}
\newcommand{\normaleq}{\unlhd} \newcommand{\normal}{\lhd} \newcommand{\union}{\cup}
\newcommand{\intersection}{\cap} \newcommand{\bigunion}{\bigcup}
\newcommand{\bigintersection}{\bigcap} \newcommand{\sq}[2][\ ]{\sqrt{\#1}{\#2\,}}
\newcommand{\pbr}[1]{\angle \#1\angle} \newcommand{\ds}{\displaystyle} \newcommand{\C}{\mathbb{C}}
\newcommand{\R}{\mathbb{R}} \newcommand{\Q}{\mathbb{Q}} \newcommand{\Z}{\mathbb{Z}}
\newcommand{\N}{\mathbb{N}} \newcommand{\A}{\mathbb{A}} \newcommand{\F}{\mathbb{F}}
\newcommand{\T}{\mathbb{T}} \newcommand{\ol}[1]{\overline{\#1}} \newcommand{\imp}{\rightarrow}
\newcommand{\rimp}{\leftarrow} \newcommand{\pinfty}{1/p^{\infty}} \newcommand{\power}{\mathcal{P}}
\newcommand{\calL}{\mathcal{L}} \newcommand{\calC}{\mathcal{C}} \newcommand{\calN}{\mathcal{N}}
\newcommand{\calB}{\mathcal{B}} \newcommand{\calF}{\mathcal{F}} \newcommand{\calR}{\mathcal{R}}
\newcommand{\calS}{\mathcal{S}} \newcommand{\calU}{\mathcal{U}} \newcommand{\calT}{\mathcal{T}}
\newcommand{\gal}{\text{Gal}} \newcommand{\isom}{\approx} \newcommand{\glb}{\text{glb}} $

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Problem Set 14 (complete) Due: 12/10/2018, optional (put inside bag on my office door)

1. Prove that if A and B are finite sets, then $A \cup B$ is a finite set.
2. Prove that if A and B are countable sets, then $A \cup B$ is a countable set. (Hint: use Prop. 13.9)
3. Prove Th. 13.28 (Hint: consider the function $f(x) = \tan(x)$ from calculus)

Problem Set 13 (complete) Due: 12/03/2018. Board presentation: 12/??/2018

1. Prove the converse of Prop 11.2
2. Prove that for all $x, y, z, w \in \mathbb{R}$ with $z \neq 0 \neq w$,

$$\frac{x}{z} + \frac{y}{w} = \frac{xw + yz}{zw} \iff \frac{x}{z} \frac{y}{w} = \frac{xy}{zw}$$
3. Consider the set $A = \{x \in \mathbb{Q} \mid x^2 < 2\}$. Show that A is non-empty and has an upper bound in \mathbb{Q} , but does not have a least upper bound in \mathbb{Q} . Hint: by way of contradiction, assume A has a least upper bound u in \mathbb{Q} , and compare it with $\sqrt{2}$.
4. Consider the sequence defined recursively by $a_n = a_{n-1} + 3a_{n-2} \ \ \ a_1 = 1 \ \ \ a_2 = 2$. Use the converse of Proposition 11.25 to find a closed formula for a_n .

Problem Set 12 (complete) Due: 11/19/2018. Board presentation: 11/??/2018

1. Prove Prop. 10.17
2. Prove Prop. 10.23.iii

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Last update: **2018/12/07 19:11**