HW2 MTH300 Fall 2024

Sunday, September 8, 2024 3:31 PM

§1.5 #3 $A=\{0,1\}$, $B=\{1,2\}$

(a) $(A\times B)\cap(B\times B)=\{(1,1),(1,2)\}$

$A\times B=\{(0,1),(0,2),(1,1),(1,2)\}$

$B\times B=\{(1,1),(1,2),(2,1),(2,2)\}$

(e) $(A\times B)\cap B=\emptyset$

B has no ordered pairs, so there is nothing in common!

(f) $\mathcal{P}(A)\cap\mathcal{P}(B)=\{\emptyset,\{1\}\}$

$\mathcal{P}(A)=\{\emptyset,\{0\},\{1\},\{0,1\}\}$

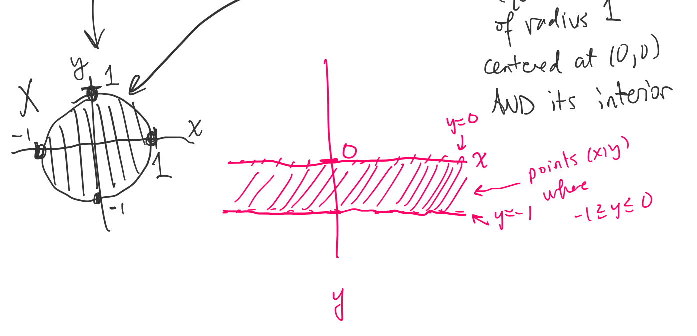
$\mathcal{P}(B)=\{\emptyset,\{1\},\{2\},\{1,2\}\}$

(h) $\mathcal{P}(A\cap B)=\mathcal{P}(\{1\})=\{\emptyset,\{1\}\}$

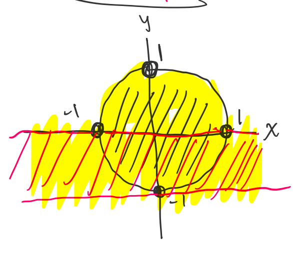
#7 $X=\{(x,y)\in\mathbb{R}^2 : x^2+y^2\le 1\}$ $X\cup Y$, $X\cap Y$, $X-Y$, $Y-X$

$Y=\{(x,y)\in\mathbb{R}^2 : -1\le y\le 0\}$

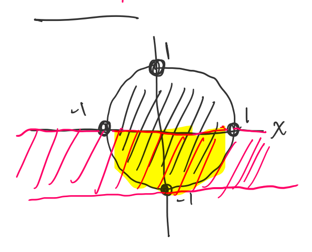
eqt of circle of radius 1 centered at (0,0) AND its interior



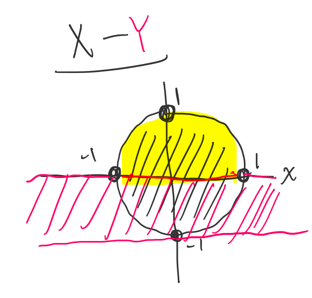
$X\cup Y$



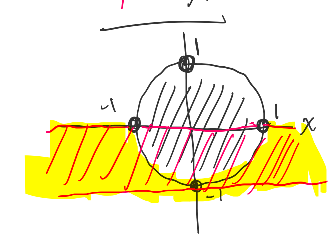
$X\cap Y$



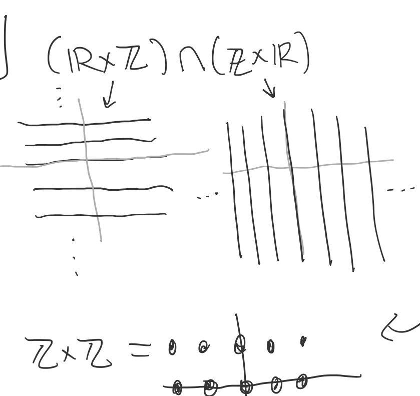
$X-Y$

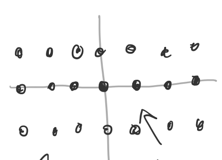


$Y-X$



#9 $(\mathbb{R}\times\mathbb{Z})\cap(\mathbb{Z}\times\mathbb{R})$ =

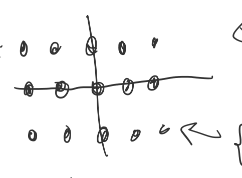




$\{(n,m : n,m\in\mathbb{Z}\}$

same set!

$\mathbb{Z}\times\mathbb{Z}=$

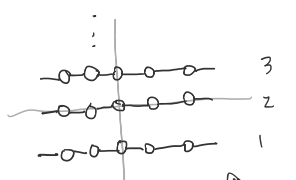


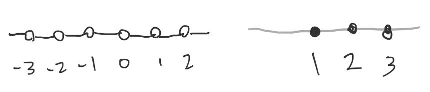
$\{(n,m): n,m\in\mathbb{Z}\}$

So the statement

$(\mathbb{R}\times\mathbb{Z})\cap(\mathbb{Z}\times\mathbb{R})=\mathbb{Z}\times\mathbb{Z}$ is true

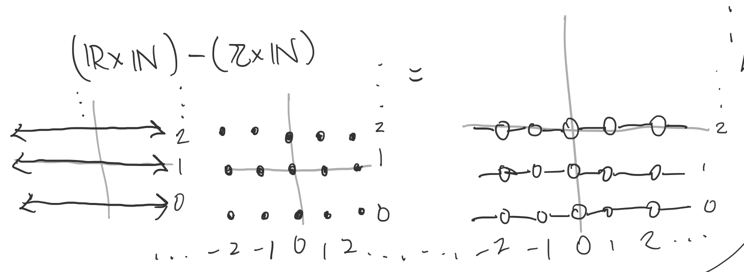
#10 $(\mathbb{R}-\mathbb{Z})\times\mathbb{N}$ =





same

$(\mathbb{R}\times\mathbb{N})-(\mathbb{Z}\times\mathbb{N})$ =



True that

$(\mathbb{R}-\mathbb{Z})\times\mathbb{N}=(\mathbb{R}\times\mathbb{N})-(\mathbb{Z}\times\mathbb{N})$

seems true!

§1.6

#2 $A=\{0,2,4,6,8\}$, $B=\{1,3,5,7\}$, $U=\{0,1,2,3,4,5,6,7,8\}$

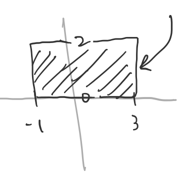
(f) $\overline{A\cup B}=\overline{\{0,1,2,\ldots,8\}}=\emptyset$

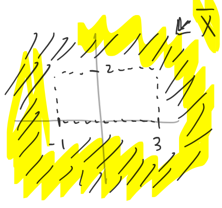
(g) $\bar{A}\cap\bar{B}=\{1,3,5,7\}\cap\{0,2,4,6,8\}=\emptyset$

(h) $\overline{A\cap B}=\bar{\emptyset}=\{0,1,2,\ldots,8\}$

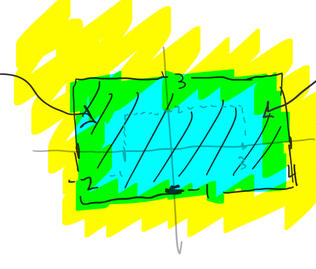
complement of empty set is the universal set!

#4

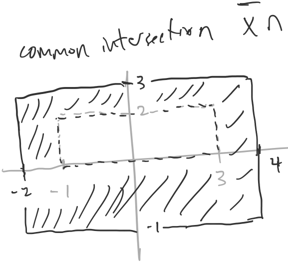




$[-2,4]\times[-1,3]$

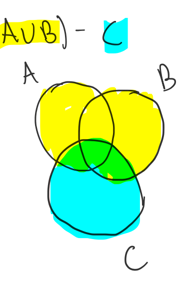


common intersection $\bar{X}\cap([-2,4]\times[-1,3])$

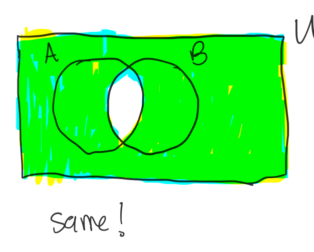


§1.7

#4 $(A\cup B)-C$

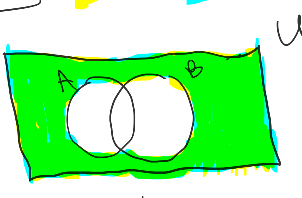


#7 $\overline{A\cap B}\overset{?}{=}\bar{A}\cup\bar{B}$



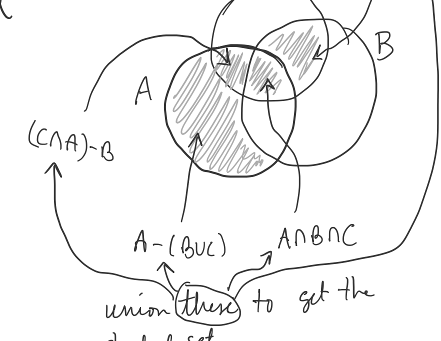
same!

#8 $\overline{A\cup B}\overset{?}{=}\bar{A}\cap\bar{B}$



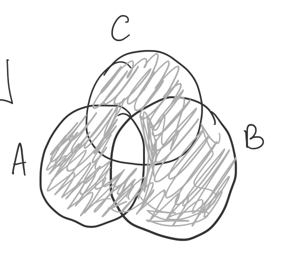
same!

#12



union these to get the shaded set

#13



$(A\cup B\cup C)-(A\cap B\cap C)$

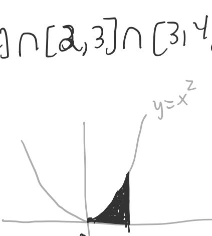
§1.8 1 5 6 10 11

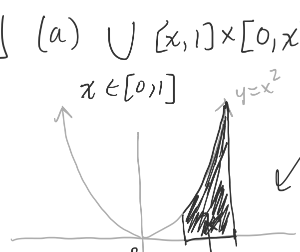
#5 (a) $\bigcup_{i\in\mathbb{N}}[i,i+1]=[1,2]\cup[2,3]\cup[3,4]\cup\ldots$

$=[1,\infty)$

(b) $\bigcap_{i\in\mathbb{N}}[i,i+1]=[1,2]\cap[2,3]\cap[3,4]\cap\ldots=\emptyset$

#10 (a) $\bigcup_{x\in[0,1]}[x,1]\times[0,x^2]$ =



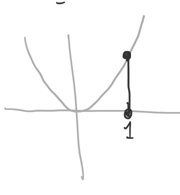


union of these for all $x\in[0,1]$

$[x,1]\cup[0,x^2]$

only what's in common to all of these for $x\in[0,1]$

(b) $\bigcap_{x\in[0,1]}[x,1]\times[0,x^2]$ =



§2.1 1,2,3,4,5,6,7,8,9,10,14

#1 false statement

#2 true statement

#5 true statement

#7 false statement

#8 false statement

#9 neither true or false statement (truth value depends on x)

#14 not a statement (it's a command!)