Math 3385

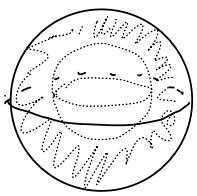
Homework #4

3.2 #16, 19

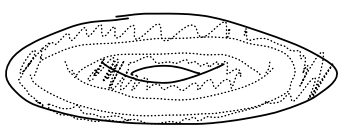
3.3 #23, 33ac

3.2 #16

$S^2 \times I$ is a sphere with some thickness

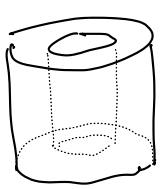


$T \times I$ is a torus with some thickness

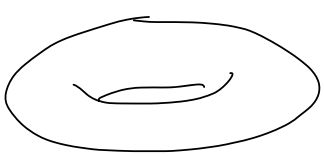


For $S^1 \times I \times I$: $S^1 \times I$ is an annulus:

Then $S^1 \times I \times I$ makes a thick cylinder



$S^1 \times D$ is like $S^1 \times S^1$ which is the torus, but filled in



(including the solid volume)

#19 Let A be closed in X & B closed in Y.

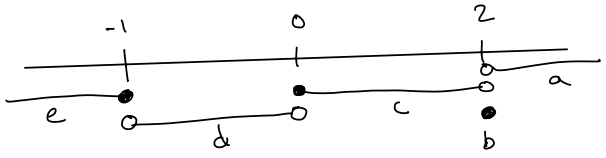
To show $A \times B$ is closed, will show the complement is open. Take $(x,y) \in (X \times Y) - (A \times B)$ so $x \notin A$ and $y \notin B$.

Since $X - A$ & $Y - B$ are open, $\exists$ a nbhd $\mathcal{U}$ of x with $\mathcal{U} \subset X - A$ and a nbhd $\mathcal{V}$ of y with $\mathcal{V} \subset Y - B$.

Then $\mathcal{U} \times \mathcal{V}$ is a nbhd of (x,y) with $\mathcal{U} \times \mathcal{V} \subset X \times Y - A \times B$,

so $X \times Y - A \times B$ is open as desired.

#23a



What are all the ways p^{-1} can give an open set?

$p^{-1}(\{e\}) = (-\infty, -1]$ which is not open, so $\{e\}$ is not open in quot. top.

$p^{-1}(\{d\}) = (-1, 0)$ which is open, so $\{d\}$ is open in quot. top.

etc.

Open sets are: $\{e,d\}, \{e,d,c\}, \{e,d,c,b,a\}, \{e,d,a\}, \{e,d,c,a\}$

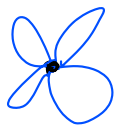
$\{d\}, \{d,c\}, \{d,c,b,a\}, \{d,a\}, \{d,c,a\}$

$\{a\}$, and of course $\emptyset$

I think that's all!

#33 a c Disk with boundary identified to a point

a.  →  like a sphere

c. →  4 loops joined at a point