	Top / Diff Geo Prelim Exam Sanuary 2014
1).	Let $U^2$ $p(Q_1)$ $V^2$ $p(Q_2)$ (Note: $p^2$ $p(Q_3)$ $= Q_1$ so these are open sets) and $U \cap V^2$ $p(Q_1 \cap Q_2)$ . Thun by $SVL$ . we can compute the fundamental grap.
	are open sefs) and UNV= p(a, na). Then by SVk.
	ue can compute the fundamental goup.
	7 (Q) <
	$\rho(\alpha, \alpha\alpha_1)$
	$\rho(\alpha, \alpha\alpha_1)$
	$\rho(\alpha_1, \alpha_2)$
The second secon	- 2 γ ο 2 γ
	TP, (p(0, no2)) = <0, B   aba'b'=17.
	7/6(a,1) = (a) 7/((2)) = (b).
1	$L_{1*}(\alpha) = \alpha \qquad L_{1*}(\alpha) = 1$ $L_{1*}(\beta) = 1$ $L_{1*}(\beta) = 5$
-  -	(b) = 1
-	So
-   0	20 ~ 1 G-00 Th.
-	THE AUTO
1	$\pi_{i}(x) = \pi_{i}(\rho(a_{i})) + \pi_{i}(\rho(a_{i})) = \frac{\langle a \rangle \times \langle b \rangle}{\langle a = 1 \ b \cdot i \rangle} = 1$
1	R. (p(e, naz))
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2)	(a) Suppose that there is some homesmorphism between  It and Rigina by f. Then this will induce a homeomorphish from Right to Right Biggs is not path-	
	I and Rigines by f. Then this will induce a homeomorphi	كامر
	from RISX to R2 13fox13. But R13x3 is not onthe	
	connected while R2 Itas is I. So R and R2 annot	
	be homeomorphic.	-
	(b) Rec is not home which to P because P.	
	(b) Rst is not homeomorphic to R FC because Rst is Housdorff but RfC is not.	-
	Transmitted to the total	-
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3)	(a) We only need to show that for any there is some $r \ge 0$ such that $B_r(x) \times B_r(y) \stackrel{\checkmark}{=} d^{-}(a,b)$ .  Define $r_r : \stackrel{?}{=} (d\alpha_r y) - a)$ and $r_r : \stackrel{?}{=} (b - d\alpha_r y))$ . We have that for any $(\alpha_r v) \in B_r(x) \times B_r(y)$
	d(x,y)=d(x,n)+d(y,v) & r, +d(y)+r, = d(x,y)-a+d(u,v)
	So a < d(u,v),  Also for any (u,b) & B <sub>2</sub> (x) × B <sub>2</sub> (y)  d(u,v) = d(x,u) + d(x,y) + d(y,y) < b - d(xy) + d(x,y)
	So du, v) < b. If we then take reminer, row, we have that Br(x) × Br(y) = d'((a,b)), so every point in d'((a,b)) has a basic open set around it contained in d'((a,b)). Thus d'((a,b)) is open and d: M×M-> R is continuous.
	(b) First of all, since A and B are compact subsets of a Meetric Space, they are both closed (Metric Spaces are Hausdorff). Moreover, AxB is closed and compact in
	M×M so any confinuous function f: A×B-R affairs  both a minimum and a maximum on A×B. We showed  in part (a) that d: M×M-> R is confinuous so d A×B  is confinuous and affairs a minimum at some point (6+4).
	Suppose $d(A,B) = d(x_0y_0) = 0$ . Then $x = y$ and $A \cap B \neq \emptyset$ I. So $d(A,B) \neq 0$ and thus must be positive.
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7	a) we have that
	dμ=dωλω <sup>1</sup> + ωλdωλω <sup>1</sup> + ··· + ω <sup>1</sup> λdω = 0+0+··· + 0 = 0.
-	= 0+o+ ··· + 0 = 0.
	(b) We have that M is a nonvanishing 2n-form on
nd tunner?	(b) We have that $\mu$ is a nonvanishing $2n$ -form on a $2n$ -dimensional orientation
~	on M. This gives us that
	$\left \int_{\mathcal{M}} u\right  > 0$
	Signal and a second of the sec
	Suppose now that $\mu = d\beta$ for some $(2n-1)$ -form $\beta$ .  Then we have that by Stokes' Theorem
-	Men we mare mar by spokes weren
1	M= Jdp= B=0 2
1	$\int_{M} M = \int_{M} d\beta = \int_{M} \beta = 0  \frac{1}{2}.$
	(a) S. h / 1 / 1
	(c) Suppose that we do for some 1-form a. Then we have that
	No.W XIALL
1	$\mu = d\alpha \Lambda (d\alpha)^{n+1}$ $= d(\alpha \Lambda (d\alpha)^{n+1})$
110	= d(a 1(da) <sup>n-1</sup> )
-	so M = db for B = & 1(dx)n+ which confradicts part (b)
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5) Let f: P2 - P3: (u,v) + (u,v, u, u-v).
                                 (a) Suppose \omega = y dx + x dy + y dz. Well

X(u,v) = uv \qquad dx = du + dv
Y(u,v) = uv \qquad dy = v du + u dr
Z(u,v) = u - v \qquad dz = du - dv
So
                                                                                                    f * w = (Zuv + v2) dn + (u2 + uv) dv.
                         (b) No. If for = dB for some O-form B, we would
                                                           need \beta = u^2 v + v^2 u + F(v) = u^2 v + v^2 u + G(u)
                                               which is impossible since the coefficients on the V^2u term cannot agree. Alternatively, you can compute d(f^*\omega) = (2u-2v-1) du \, 1 dv \neq 0 So f^*\omega cannot be exact since if is not closed.
             (c) Let \gamma_{(t)}=(t,0) \gamma_{2}(t)=(1,t) \gamma_{3}(t)=(1-t), () \gamma_{4}(t)=(0,1-t) t\in[0,1]
                                  Then

\int f^* \omega = \int f^* \omega = \int f^* \omega + \int f^* \omega + \int f^* \omega

\partial I^2 \qquad \gamma_1 + \gamma_2 + \gamma_3 + \gamma_4 \qquad \gamma_1 \qquad \gamma_2 \qquad \gamma_3 \qquad \gamma_4 \qquad \gamma_5 \qquad \gamma_6 
                                                                                                                                                                                            = 0 + \int_{0}^{1} 1+\epsilon d\epsilon + \int_{0}^{1} 2(1-\epsilon)+1 d\epsilon + 0
= \int_{0}^{1} 4-\epsilon d\epsilon = \sqrt{3.5}
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(۵)	Let F: R3 - R2: (u,v,w) +> (w2-uv, v2+u2)
	Then we have that
	$DF = \begin{pmatrix} -V & -u & zw \\ zw & zv & o \end{pmatrix}$
	which has full rank except when utvzo, w=o; u-v=o, w=o; or u=v=o. So the critical points of eare the points of the form. (u,-u,o), (u,u,o), (o,o,w)
<u> </u>	1-V=0 w=v; or u=v=o. S. h. will with
-  f	= are the points of the form (u-u a) (u u) (a a 2)
11	Plugging these critical points in, we get that our set of
Co	ifical values of this given by
	S={(x,y):0≤x, y=2, }U{(xy):0≥x, y=-2,}U{(x,y):0≤x,
av	nd F ((a,b)) is a smooth one-dimensional submanifold whenever
(a,	b) & S.
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