D

-91- proof for zows A=(a) ep33 fie /1,2,3) tje /1,2,3) a= = > dut A=0 = a11 cl22 a33 + a12 a23 a21 + a13 a21 932 -- (1/3 azz az) - (1/2 az) azz - (1/1 azz azz fi=1 ! Ajef1,2,3 ay=av=0 => => def 0 = 0 anz azz + 0 azz azz + 0 azz azz -- 1 anz azi - O azi azz - 0 azz azz = 0 fi=2 1 jel1,2,3] dij=azj=0 => => def = 0,10 033 + 0,12 0 031 + 0,13 0 032 -- 9130 031 - 0120 033 - 011 0 033 = 0 71=3 je/1,2,33 ag= ag= 0=> => det A= an az 0+ a12 a20 + a3 az 0a13 anz 0 - a12 an 0 - a11 ans 0 = 0 A=(aq) ER313 |] Lefin33 4 je /112,33 aij=0 => det A

-91- proof for columns A=(aij)=R31?] = Jie/12/3] + ie/112/3] aij=0 => dut A=0 A=(04) =18313 det A = det (an anz anz) = = 411 972 933 + 912 a23 931 + a13 921 932 -- A13 922 931 - 912 921 033 - 411 923 032] = 1 Vie 112,39 ag = ac1 = 0 => => deff = 0 022 933 + 912 9230 + 913 0 932 -- de ano - ano ass - 0 ars asz = 0 31=2 Yie /12133 aij = aiz=0 => defA = 0110 azz + 0 923 azi + 013 azi 0 -- 930931-0921933- 9119230 = 0 => det A= a11 an2 0 + a12 0 as1 + 0 a21 a32 -- 0 ana31 - 912 9210 - 9110 a32 = 0 A=(ui) ER345] = lie/1,2,3} + ie/1,2,3} => det A = 0

-98- broad for nows A=(di) = R343 B=(Bij)=R343 LER 3 2e /1,2,33 (je /1,2,5) as = d (si) / (Vie /1,2,5) (Vie /1,2,5) 4 je /1,2,5) ai = (ij) > Stuby = 11 th C= $A = (u_{ij}) \in \mathbb{R}^{3\times3}$ B= (01) (61) (612 613)

det B = det (611 612 613) = 611 822 833 + 812 823 821 + 813 821 832
best 1832 1832 1832 - 613 822 831 - 812 803 827 - 811 823 832 = 1 12=1 (+ se(1,2,3) dej=db2j (>> aj=db1j) / det A = (db11) brz bz + (dbn) bez bz1 + (db13) bz1 bz2 -- (d Bis) 822 Bis = (d Biz) 621 B33 - (d Bis) 823 R32 = = H B11 Ron B3 + 6102 B3 R31 + B13 P21 B32 -- B13 bon B31 - B12 B21 B33 - B11 R73 R32 == = LdetB

(4)

```
1 7=2
        ( 4 je {1,2,3} azj = 2 bzj &> azj = 2 bzj) /
     1 (tie/1,2,3)/12] = /1,3} tje/1,2,3  ai = Bis) =>
     => delA = By (db23) B33 + B12 (db23) B31 + B13 (db21) B32 -
                                              - B13 (2802) B31 - B12 (2821) 823 - B11 (2825) B32 =
                                            = 2 det B
         J Z=3
       ( Yjef 1,2,3) azj=d82j => azj=d83j) 1
     1 (tied 1,2,3) (23 = 11/23 + 10 (1,2,3) aij = bij) =>
    => det A = 611 B22 (db33) + B12 B23 (dB31) + b13 B21 (dB32) -
                                         - 813 825 (7831) - BIS BSI (4 BSS) - BII BSS (4 BSS) =
                                          = 2 duB
        A=(ai)e/23x3 B=(Bi) = R3x3 JER
] 3 = (1) = (4) = (1) = (1) (4) = (1) (4) = (1) (2) 4) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1) = (1)
       => det A= L det B
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-92-proof for columns A=(aij) = 1R312 B=(bij)=1R312 JE(112,3) JER (tic {11233 dij = 2bij) 1 (tic {1123} tje {1123} \dij aij = bij) => NA A= A det B A = (ag) = R3x3 B = (bij) = R3x5 AER Ji=16/11233 (tiefyzis) (acj = 2 bij @ air = 2bij)) N(tie/1,23) tje/1,213}//ji] = {2,3} aij = 6ij) det 4: de (21 02 02) = = a,, areas + aras as, + a, sas, as, - a, a as, - ar as, as - a, as as - a, as as -= (261) Por 63 + Gr B23 (2651) + B13 (262) B32 - 413 P22 (2631) - 112 (2821) 633 - (2611) 823 82 = - 1 (by 872 833 + 812 823 831 + 813 821 832 - 813 822 831 - 812 823 833 - 811 823 832) = - A ded (B1 612 613) = 2 det B B31 632 833) = 2 det B

(B)

```
1=2e11723
(tie {112,3} (aij = 1 bij ( ) die = 26ig))
1 (tie 112,3) tie 112,3 1 fil = 11,3 au = bis)
 MAH = anazass + anzassası + anzassası + anzası ası - anzası - anzası - anazs ası =
     = B1(262) B33 + (2612) B23 B1 + B13 B21 (262) - B13 (262) B31-(1612) B21 B3 - B11 B23 (2632)=
      = 4(611 bz 633 + 612 823 831 + 613 821 832 - 813 622 631 - 612 621 633 - 611 823 852) =
Ji30 112,3)
(tie 1,2,3) (ay, =2 Rije ai3 = 1 613)) 1
1 ( tie (1,2,3) tje (1,2,3) ( j.g = {1,2} dij = Bij )
= 6/1 b2 (1633) + 6/2 (2623) b31 + (2613) b1 632 - (2613) b22 b31 - 612 b2 (2623) - 611 (2623) b32=
     = 1 ( by loo B33 + 612 623 B31 + 613 by B32 - 813 B22 B31 - 812 B21 B33 - B11 B23 B32 ) =
      = 1det B
```

-92- proof for rows A= (aij) e R3x3 B= (Bij) e R3x3 yellass JeR (4 je /112,3) aij = 2 Bij) N (tie/112,3} Hig tie/1123) aij = Bij) => det A = 1 det B A= (W)= R343 B= (B)=(R3x3 A=1R 4=10/1/2/33 (4 jed11233 (04) = 2 byj () (U=181)) / MA = det (an an an an) = = and azz azz + az azz azı + az azı azı - az azı az - az azı azı - az azı - azı azı - anaz azı = =(161) 622 833 + (162) 623 831 + (163) 621 832 - (1643) 622 631 - (1612) 621 831 - (1811) 823 831 = = 2 (biller Bz + b12 l23 b31 + b13 lei lsz - b18 lez l31 - P12 b21 l32 - b11 l25 lei) = = A det (B1 B12 43) = 2 det B B21 B22 B23) = 2 det B

(g)

```
1=20 1R3
     (4 je lings (ans = Abij = as = 1bi)) 1
           1 ( tick1,2,59) find= 1,13) tj = {1,12,3} aij = Bij)
          dut ) = anaza azz + a12 az azz azz + a13 az azz - a12 azz 421 - az a21 azz - a11 azz azz =
                                       = 611 (2622) BES + BR (2623) BSI + BB (2621) BEZ - AB (2621) BI - BIZ (2621) BEZ - BII (2623) BI =
                                      = A by box box + box box box + bis for for los for bis for bis
                                        = Adet B
           G=3€/123}
        ( t j et has ( aij = 1 bij = ) az j = 1 bz j ) 1
1 ( die f112/3) 1/213 - f121 Vjef12/3) di= Bij)
    = 6, 6, (163) + 6, 6, 6, (163) + b, 821 (162) - 6, 82 (163) - 6, 26, (163) - 6, 623 (163)
                                            = \( \bigg| \big| 
                                                = 1 det B
               A = (04) = 12343 13 = (81) = 12343
```

 $4 = \{09\} = 10$ $4 = \{1,2,3\}$ $4 = \{1,2,3\}$ $4 = \{1,2,3\}$ $4 = \{1,2,3\}$ $4 = \{1,2,3\}$ $4 = \{1,2,3\}$ $4 = \{1,2,3\}$ $4 = \{1,2,3\}$ $4 = \{1,2,3\}$ $4 = \{1,2,3\}$ $4 = \{1,2,3\}$ $4 = \{1,2,3\}$