

```
> restart: with(linalg):
```

```
print('EMLEKEZTETO_ALT_INV_FROBENIUS_FELBONTASSAL');  
A:=F0_*F1;  
A:=matrix([[2, 4, 8, 16], [1, 2, 7, 15], [0, 0, 6, 14]]):  
F0:=matrix([[2, 8], [1, 7], [0, 6]]):  
F1:=matrix([[1, 2, 0, -4/3], [0, 0, 1, 7/3]]):  
evalm(A)=evalm(F0)*evalm(F1);  
print('ELMELET___',Ainv:=Flinv_*F0inv);
```

*EMLEKEZTETO\_ALT\_INV\_FROBENIUS\_FELBONTASSAL*

*A\_ = F0\_F1\_*

$$\begin{bmatrix} 2 & 4 & 8 & 16 \\ 1 & 2 & 7 & 15 \\ 0 & 0 & 6 & 14 \end{bmatrix} = \begin{bmatrix} 2 & 8 \\ 1 & 7 \\ 0 & 6 \end{bmatrix} \&* \begin{bmatrix} 1 & 2 & 0 & -\frac{4}{3} \\ 0 & 0 & 1 & \frac{7}{3} \end{bmatrix}$$

*ELMELET\_\_\_, Ainv\_ = Flinv\_ F0inv*

(1)

```
> print(F1,'SVD_FELBONTASA');  
print('CELSZERUBB___',F1trp,'__SVD_MAJD_ENNEK_TRANSZPONALTJA');  
F1trp:=evalm(transpose(F1));  
B:=evalm(F1*&transpose(F1));  
print(B_=F1*&F1trp,'___',B_=evalm(F1)*evalm(F1trp),'___',  
evalm(B));  
lambda:=array(1..2): R:=matrix(2,2):  
print(B_,'_FOTENGELY_ALAKJA___',B_=R_*lambda_*Rtrp);  
lambda:=diag(lambda[1],lambda[2]):  
print(evalm(B)=[r1,r2]*evalm(lambda)*matrix(2,1,[r1trp,r2trp]),  
'___',r1_,r2_,'OSZL_VEKT');  
print(lambda[1],lambda[2],'__',B_,'KARAKT_POL_GYOKEI');  
det_(evalm(B-diag(lambda[1],lambda[2])))=charpoly(B,lambda);  
solve(lambda^2-(119/9)*lambda+34=0,lambda);  
print(lambda[1]=119/18+(1/18)*sqrt(3145),'___',lambda[2]=  
119/18-(1/18)*sqrt(3145));  
print(r1_,'SAJAT_EGYSEG_VEKTORA_',B_,'NEK_',lambda[1],  
'_SAJATERTEKKEL');  
r1:=array(1..2):  
print(evalm(B)*matrix(2,1,[r[1],r[2]])=(119/18+(1/18)*sqrt(  
3145))*matrix(2,1,[r[1],r[2]]),'___',r1[1]^2+r1[2]^2=1);  
evalm(B*&matrix(2,1,[r[1],r[2]]))=evalm((119/18+(1/18)*sqrt(  
3145))*matrix(2,1,[r[1],r[2]]));  
print((61/9)*r1[1]-(28/9)*r1[2]=(119/18+(1/18)*sqrt(3145))*r1  
[1],'___',r1[1]^2+r1[2]^2=1);  
solve({(61/9)*r1[1]-(28/9)*r1[2]=(119/18+(1/18)*sqrt(3145))*r  
[1],r1[1]^2+r1[2]^2=1},{r1[1],r1[2]});  
r1[2]=solve((61/9)*r1[1]-(28/9)*r1[2]=(119/18+(1/18)*sqrt(3145))  
*r1[1],r1[2]);  
r1[1]^2+( (3/56)*r1[1]-(1/56)*r1[1]*sqrt(3145) )^2=1;  
solve(r1[1]^2+( (3/56)*r1[1]-(1/56)*r1[1]*sqrt(3145) )^2=1,r1[1]  
);  
print('VALASZTAS___',r1[1]=28*sqrt(6290-6*sqrt(3145))/  
(-3145+3*sqrt(3145)));  
print(r1[2]^2=1-r1[1]^2,'___',r[2]=sqrt(1-(28*sqrt(6290-6*sqrt(  
3145)))/(-3145+3*sqrt(3145))^2));
```

$$\begin{bmatrix} 1 & 2 & 0 & -\frac{4}{3} \\ 0 & 0 & 1 & \frac{7}{3} \end{bmatrix}, SVD\_FELBONTASA$$

CELSZERUBB\_, F1trp, \_SVD\_MAJD\_ENNEK\_TRANSZPONALTJA

$$F1trp := \begin{bmatrix} 1 & 0 \\ 2 & 0 \\ 0 & 1 \\ -\frac{4}{3} & \frac{7}{3} \end{bmatrix}$$

$$B\_ = F1 \&* F1trp, \_, B\_ = \begin{bmatrix} 1 & 2 & 0 & -\frac{4}{3} \\ 0 & 0 & 1 & \frac{7}{3} \end{bmatrix} \&* \begin{bmatrix} 1 & 0 \\ 2 & 0 \\ 0 & 1 \\ -\frac{4}{3} & \frac{7}{3} \end{bmatrix}, \_, \begin{bmatrix} \frac{61}{9} & -\frac{28}{9} \\ -\frac{28}{9} & \frac{58}{9} \end{bmatrix}$$

B\_, \_FOTENGELY\_ALAKJA\_, B\_ = R\_Lambda\_Rtrp\_

$$\begin{bmatrix} \frac{61}{9} & -\frac{28}{9} \\ -\frac{28}{9} & \frac{58}{9} \end{bmatrix} = [r1, r2] \begin{bmatrix} \lambda_1 & 0 \\ 0 & \lambda_2 \end{bmatrix} \begin{bmatrix} r1trp \\ r2trp \end{bmatrix}, \_, r1_, r2_, OSZL\_VEKT$$

$\lambda_1, \lambda_2, \_, B_, KARAKT\_POL\_GYOKEI$

$$\det_ \left( \begin{bmatrix} \frac{61}{9} - \lambda_1 & -\frac{28}{9} \\ -\frac{28}{9} & \frac{58}{9} - \lambda_2 \end{bmatrix} \right) = \lambda^2 - \frac{119}{9} \lambda + 34$$

$$\frac{119}{18} + \frac{1}{18} \sqrt{3145}, \frac{119}{18} - \frac{1}{18} \sqrt{3145}$$

$$\lambda_1 = \frac{119}{18} + \frac{1}{18} \sqrt{3145}, \_, \lambda_2 = \frac{119}{18} - \frac{1}{18} \sqrt{3145}$$

r1\_, SAJAT\_EGYSEG\_VEKTORA\_, B\_, NEK\_,  $\lambda_1$ , \_SAJATERTEKKEL

$$\begin{bmatrix} \frac{61}{9} & -\frac{28}{9} \\ -\frac{28}{9} & \frac{58}{9} \end{bmatrix} \&* \begin{bmatrix} r_1 \\ r_2 \end{bmatrix} = \left( \frac{119}{18} + \frac{1}{18} \sqrt{3145} \right) \begin{bmatrix} r_1 \\ r_2 \end{bmatrix}, \_, r_1^2 + r_2^2 = 1$$

$$\begin{bmatrix} \frac{61}{9} r_1 - \frac{28}{9} r_2 \\ -\frac{28}{9} r_1 + \frac{58}{9} r_2 \end{bmatrix} = \begin{bmatrix} \left( \frac{119}{18} + \frac{1}{18} \sqrt{3145} \right) r_1 \\ \left( \frac{119}{18} + \frac{1}{18} \sqrt{3145} \right) r_2 \end{bmatrix}$$

$$\frac{61}{9} r_1 - \frac{28}{9} r_2 = \left( \frac{119}{18} + \frac{1}{18} \sqrt{3145} \right) r_1, \quad r_1^2 + r_2^2 = 1$$

$$\left\{ r_1 = \text{RootOf} \left( - (2293045 - 31535 \sqrt{3145}) \_Z^2 - (19764 r_1 \sqrt{3145} - 2351916 r_1) \_Z - 892296 r_1^2 + 399056 - 5488 \sqrt{3145} \right), r_2 = \frac{61}{28} \text{RootOf} \left( (-2293045 + 31535 \sqrt{3145}) \_Z^2 + (-19764 r_1 \sqrt{3145} + 2351916 r_1) \_Z - 892296 r_1^2 + 399056 - 5488 \sqrt{3145} \right) - \frac{17}{8} r_1 - \frac{1}{56} r_1 \sqrt{3145} \right\}$$

$$r_2 = \frac{3}{56} r_1 - \frac{1}{56} r_1 \sqrt{3145}$$

$$r_1^2 + \left( \frac{3}{56} r_1 - \frac{1}{56} r_1 \sqrt{3145} \right)^2 = 1$$

$$\frac{28 \sqrt{6290 - 6 \sqrt{3145}}}{-3145 + 3 \sqrt{3145}}, \quad -\frac{28 \sqrt{6290 - 6 \sqrt{3145}}}{-3145 + 3 \sqrt{3145}}$$

$$\text{VALASZTAS} \quad \_, r_1 = \frac{28 \sqrt{6290 - 6 \sqrt{3145}}}{-3145 + 3 \sqrt{3145}}$$

$$r_2^2 = 1 - r_1^2, \quad \_, r_2 = \sqrt{1 - \frac{28 \sqrt{6290 - 6 \sqrt{3145}}}{(-3145 + 3 \sqrt{3145})^2}}$$

(2)

```
> print('HORROR ___ KEZI_SOT_SZIMBOLIKUS_SZAMITASSAL');
print
('TANULSAG ___ SVD_ES_FOTENGELY ___ CSAK_GEPI_NUM_MODSZEREKKEL');
print('___');
print('DE_EZ_NEM_IS_KELL_', Flinv, '_HEZ');
print('ELEG_ANNYI___', B=F1*Fltrp, '_INVERTALHATO_MERT_',
lambda[1], lambda[2]<>0);
print('EHHEZ_NEM_IS_KELL_SZAMOLNI_HISZEN_', rank(F1)=2, '___',
Matrix(2, 4, {(1, 1) = 1, (1, 2) = 2, (1, 3) = 0, (1, 4) = -4/3,
(2, 1) = 0, (2, 2) = 0, (2, 3) = 1, (2, 4) = 7/3}),
'_BEN_VAN_A_KET_EGYSEGV');
print('___');
print('AZ_SVD_PUSZTA_LETEZESENEK_FELHASZNALASA');
Fltrp = Q * Lambda * Rtrp;
F1 * Fltrp = R * Lambda * Qtrp * (Qtrp * Lambda * Rtrp);
F1 * Fltrp = R * Lambda * Qtrp * Q * Lambda * Rtrp;
F1 * Fltrp = R * Lambda * Lambda * Rtrp;
F1 * Fltrp = R * diag(lambda[1]^2, lambda[2]^2) * Rtrp;
print('EZ_INVERTALHATO_MERT_', lambda[1], lambda[2]<>0);
print('ESZREVETEL');
```

```

inv(F1 *F1trp_)=R_*diag(1/lambda[1]^2,1/lambda[2]^2)*Rtrp_;
print(F1_=R_*Lambda_trp*Qtrp,'_____',F1trp=Q_*Lambda_trp_*Rtrp)
;
print(F1trp_*inv(F1_*F1trp_)=
Q_*diag(1/lambda[1],1/lambda[2])*Rtrp_,'____EZ_EPPEN____',F1inv)
;
print('____');
F1inv_=F1trp_*inv(Matrix([[61/9,-28/9],[-28/9,58/9]]));
F1inv_=evalm(transpose(F1))*evalm(inverse(Matrix([[61/9,-28/9],
[-28/9,58/9]])));
F1inv:=evalm(transpose(F1)&*inverse(Matrix([[61/9,-28/9],[-28/9,
58/9]])));

```

*HORROR\_\_\_\_KEZI\_SOT\_SZIMBOLIKUS\_SZAMITASSAL  
TANULSAG\_\_\_\_SVD\_ES\_FOTENGELY\_\_\_\_CSAK\_GEPI\_NUM\_MODSZEREKKEL*

*DE\_EZ\_NEM\_IS\_KELL\_, F1inv\_,\_HEZ  
ELEG\_ANNYI\_\_\_\_, B=F1\_F1trp\_,\_INVERTALHATO\_MERT\_,  $\lambda_1, \lambda_2 \neq 0$*

*EHHEZ\_NEM\_IS\_KELL\_SZAMOLNI\_HISZEN\_, 2=2, \_\_\_\_\_,* 
$$\begin{bmatrix} 1 & 2 & 0 & -\frac{4}{3} \\ 0 & 0 & 1 & \frac{7}{3} \end{bmatrix},$$

*\_BEN\_VAN\_A\_KET\_EGYSEGV*

*AZ\_SVD\_PUSZTA\_LETEZESENEK\_FELHASZNALASA  
F1trp\_=Q\_Lambda\_Rtrp\_  
F1\_F1trp\_=R\_Lambda\_Qtrp\_Qtrprp\_Lambda\_trp\_Rtrp  
F1\_F1trp\_=R\_Lambda\_Qtrp\_Q\_Lambda\_trp\_Rtrp  
F1\_F1trp\_=R\_Lambda\_Lambda\_trp\_Rtrp\_*

$$F1_F1trp_=R_ \begin{bmatrix} \lambda_1^2 & 0 \\ 0 & \lambda_2^2 \end{bmatrix} Rtrp_$$

*EZ\_INVERTALHATO\_MERT\_,  $\lambda_1, \lambda_2 \neq 0$*

*ESZREVETEL*

$$inv(F1_F1trp_)=R_ \begin{bmatrix} \frac{1}{\lambda_1^2} & 0 \\ 0 & \frac{1}{\lambda_2^2} \end{bmatrix} Rtrp_$$

*F1\_=R\_Lambda\_trp\_Qtrp, \_\_\_\_\_, F1trp=Q\_Lambda\_trp\_Rtrp*

$$F1trp\_inv(F1\_F1trp\_)=Q\_ \begin{bmatrix} \frac{1}{\lambda_1} & 0 \\ 0 & \frac{1}{\lambda_2} \end{bmatrix} Rtrp\_ \text{---} \text{EZ\_EPPEN\_}, Flinv$$

$$Flinv\_ = F1trp\_inv \left( \begin{bmatrix} \frac{61}{9} & -\frac{28}{9} \\ -\frac{28}{9} & \frac{58}{9} \end{bmatrix} \right)$$

$$Flinv\_ = \begin{bmatrix} 1 & 0 \\ 2 & 0 \\ 0 & 1 \\ -\frac{4}{3} & \frac{7}{3} \end{bmatrix} \begin{bmatrix} \frac{29}{153} & \frac{14}{153} \\ \frac{14}{153} & \frac{61}{306} \end{bmatrix}$$

$$Flinv := \begin{bmatrix} \frac{29}{153} & \frac{14}{153} \\ \frac{58}{153} & \frac{28}{153} \\ \frac{14}{153} & \frac{61}{306} \\ -\frac{2}{51} & \frac{35}{102} \end{bmatrix}$$

(3)

>

```
F0:=Matrix(3, 2, {(1, 1) = 2, (1, 2) = 8, (2, 1) = 1, (2, 2) =
7, (3, 1) = 0, (3, 2) = 6});
print(A =evalm(A), 'ALT_INV_HEZ_KELL_MEG', F0inv);
print('HAZI_FELADAT', F0inv = F0trp_*inv(F0_*F0trp_), ' ',
evalm(inverse(transpose(F0)*F0))*transpose(F0), ' ',
evalm(inverse(transpose(F0)*F0))*transpose(F0)));
print('ELMELET_ALAPJAN', Ainv = Flinv_*F0inv);
print(Ainv = evalm(Flinv)*Matrix(2, 3, {(1, 1) = 19/36, (1, 2) =
-1/18, (1, 3) =
-23/36, (2, 1) = -1/36, (2, 2) = 1/18, (2, 3) = 5/36}), ' ',
evalm(Flinv*Matrix(2, 3, {(1, 1) = 19/36, (1, 2) = -1/18, (1,
3) =
-23/36, (2, 1) = -1/36, (2, 2) = 1/18, (2, 3) = 5/36})));
```

$$F0 := \begin{bmatrix} 2 & 8 \\ 1 & 7 \\ 0 & 6 \end{bmatrix}$$

$$A_ = \begin{bmatrix} 2 & 4 & 8 & 16 \\ 1 & 2 & 7 & 15 \\ 0 & 0 & 6 & 14 \end{bmatrix}, \text{---ALT\_INV\_HEZ\_KELL\_MEG---}, F0inv_$$

HAZI\_FELADAT\_\_\_, F0inv\_ = F0trp\_inv(F0\_F0trp\_), \_\_\_,

$$\begin{bmatrix} \frac{149}{216} & -\frac{23}{216} \\ -\frac{23}{216} & \frac{5}{216} \end{bmatrix} \&* \begin{bmatrix} 2 & 1 & 0 \\ 8 & 7 & 6 \end{bmatrix}, \text{---}, \begin{bmatrix} \frac{19}{36} & -\frac{1}{18} & -\frac{23}{36} \\ -\frac{1}{36} & \frac{1}{18} & \frac{5}{36} \end{bmatrix}$$

ELMELET\_ALAPJAN\_\_\_, Ainv\_ = Flinv\_F0inv

$$Ainv = \begin{bmatrix} \frac{29}{153} & \frac{14}{153} \\ \frac{58}{153} & \frac{28}{153} \\ \frac{14}{153} & \frac{61}{306} \\ -\frac{2}{51} & \frac{35}{102} \end{bmatrix} \&* \begin{bmatrix} \frac{19}{36} & -\frac{1}{18} & -\frac{23}{36} \\ -\frac{1}{36} & \frac{1}{18} & \frac{5}{36} \end{bmatrix}, \text{---}, \begin{bmatrix} \frac{179}{1836} & -\frac{5}{918} & -\frac{199}{1836} \\ \frac{179}{918} & -\frac{5}{459} & -\frac{199}{918} \\ \frac{157}{3672} & \frac{11}{1836} & -\frac{113}{3672} \\ -\frac{37}{1224} & \frac{13}{612} & \frac{89}{1224} \end{bmatrix}$$

(4)

>

```

print
('_____');
);
print('ALTALANOS_EGYENLETMEGOLDAS_GAUSS_JORDAN_ELIMINACIOVAL');
print
('_____');
);
X:=matrix(4,1,[x,y,z,u]); b:=matrix(3,1,[p,q,r]);
A_x =b ;
evalm(A&x=b);
print(1,'SOR_MINUS_2x ',3,'SOR');
L1:=matrix(3,3,[1,-2,0,0,1,0,0,0,1]);
print(L1*A=L1*b,'_____',A1=evalm(A1));
A1:=evalm(L1&A); b1:=evalm(L1&b);
evalm(A1&X)=evalm(b1);
print(1,2,'SORCSERE');
L2:=matrix(3,3,[0,1,0,1,0,0,0,0,1]);
A2:=evalm(L2&A1); b2:=evalm(L2&b1);
evalm(A2&X=evalm(b2));
print(3,'SOR_PLUS',2,'SOR');
L3:=matrix(3,3,[1,0,0,0,1,0,0,1,1]);
A3:=evalm(L3&A2); b3:=evalm(L3&b2);
evalm(A3&X=evalm(b3));
print('PONTOS_MEGOLDAS_FELTETELE _____',p-2*q+r=0);

```

```

print(2, 'SOR PER', -6);
L4:=matrix(3,3, [1,0,0,0, (-1/6), 0,0,0,1]);
A4:=evalm(L4*A3); b4:=evalm(L4*b3);
evalm(A4*X=evalm(b4));
print(1, 'SOR MINUS 7x', 2, 'SOR');
L5:=matrix(3,3, [1,-7,0,0,1,0,0,0,1]);
A5:=evalm(L5*A4); b5:=evalm(L5*b4);
evalm(A5*X=evalm(b5));
print('EGYSEGVEKTOROK JO_SORREND BEN', 1, 3, '_OSZLOP');
print('TELJES MEGOLDAS');
print(1, 3, 'VALTOZORA', 2, 4, 'VALT_TETTSZ');
print(p-2*q+r=0, 'ESETEN');
x=(7/6)*p-(4/3)*q-2*y+(4/3)*u;
z=(-1/6)*p+(1/3)*q-(7/3)*u;

```

---

*ALTALANOS\_EGYENLETMEGOLDAS\_GAUSS\_JORDAN\_ELIMINACIOVAL*

---

$$b := \begin{bmatrix} p \\ q \\ r \end{bmatrix}$$

$$A \cdot x = b$$

$$\begin{bmatrix} 2x_{1,1} + 4x_{2,1} + 8x_{3,1} + 16x_{4,1} \\ x_{1,1} + 2x_{2,1} + 7x_{3,1} + 15x_{4,1} \\ 6x_{3,1} + 14x_{4,1} \end{bmatrix} = \begin{bmatrix} p \\ q \\ r \end{bmatrix}$$

1, SOR\_MINUS\_2x, 3, SOR

$$L1 := \begin{bmatrix} 1 & -2 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$L1 \cdot A = L1 \cdot b, \text{---}, A1 = \begin{bmatrix} 0 & 0 & -6 & -14 \\ 1 & 2 & 7 & 15 \\ 0 & 0 & 6 & 14 \end{bmatrix}$$

$$\begin{bmatrix} -6z - 14u \\ x + 2y + 7z + 15u \\ 6z + 14u \end{bmatrix} = \begin{bmatrix} p - 2q \\ q \\ r \end{bmatrix}$$

1, 2, SORCSERE

$$L2 := \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$A2 := \begin{bmatrix} 1 & 2 & 7 & 15 \\ 0 & 0 & -6 & -14 \\ 0 & 0 & 6 & 14 \end{bmatrix}$$

$$\begin{bmatrix} x + 2y + 7z + 15u \\ -6z - 14u \\ 6z + 14u \end{bmatrix} = \begin{bmatrix} q \\ p - 2q \\ r \end{bmatrix}$$

3, *SOR\_PLUS*, 2, *SOR*

$$L3 := \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix}$$

$$A3 := \begin{bmatrix} 1 & 2 & 7 & 15 \\ 0 & 0 & -6 & -14 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} x + 2y + 7z + 15u \\ -6z - 14u \\ 0 \end{bmatrix} = \begin{bmatrix} q \\ p - 2q \\ p - 2q + r \end{bmatrix}$$

*PONTOS\_MEGOLDAS\_FELTETELE* \_\_\_\_\_,  $p - 2q + r = 0$

2, *SOR\_PER*, -6

$$L4 := \begin{bmatrix} 1 & 0 & 0 \\ 0 & -\frac{1}{6} & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$A4 := \begin{bmatrix} 1 & 2 & 7 & 15 \\ 0 & 0 & 1 & \frac{7}{3} \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} x + 2y + 7z + 15u \\ z + \frac{7}{3}u \\ 0 \end{bmatrix} = \begin{bmatrix} q \\ -\frac{1}{6}p + \frac{1}{3}q \\ p - 2q + r \end{bmatrix}$$

1, *SOR\_MINUS\_7x*, 2, *SOR*



$$L5 := \begin{bmatrix} 1 & -7 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$A5 := \begin{bmatrix} 1 & 2 & 0 & -\frac{4}{3} \\ 0 & 0 & 1 & \frac{7}{3} \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} x + 2y - \frac{4}{3}u \\ z + \frac{7}{3}u \\ 0 \end{bmatrix} = \begin{bmatrix} -\frac{4}{3}q + \frac{7}{6}p \\ -\frac{1}{6}p + \frac{1}{3}q \\ p - 2q + r \end{bmatrix}$$

EGYSEGVEKTOROK\_JO\_SORREND BEN\_1, 3, \_OSZLOP

TELJES\_MEGOLDAS

1, 3, VALTOZORA\_, 2, 4, VALT\_TETSZ

$p - 2q + r = 0$ , \_ESETEN

$$x = \frac{7}{6}p - \frac{4}{3}q - 2y + \frac{4}{3}u$$

$$z = -\frac{1}{6}p + \frac{1}{3}q - \frac{7}{3}u$$

(5)

