

```

Clear[t];
Feed[0] = Null;
Feed[eqn_] := Module[{i, eqn1},
  i = Min[Cases[eqn, x[k_] => k, Infinity]];
  eqn1 = Expand[eqn / Coefficient[eqn, x[i], 1]];
  If[Head[t[i]] != t,
    (*then*) Feed[Simplify[t[i] - eqn1]],
    (*else*) t[i] = Simplify[eqn1]
  ];
];

n = 5;
MatrixForm[M = Table[RandomInteger[100], {n}, {n}]]

$$\begin{pmatrix} 5 & 50 & 16 & 95 & 79 \\ 48 & 56 & 59 & 39 & 31 \\ 57 & 11 & 73 & 23 & 28 \\ 98 & 63 & 92 & 9 & 70 \\ 81 & 28 & 23 & 99 & 36 \end{pmatrix}$$

eqns = (M - z IdentityMatrix[n]).Array[x, {n}]
{ (5 - z) x[1] + 50 x[2] + 16 x[3] + 95 x[4] + 79 x[5],
  48 x[1] + (56 - z) x[2] + 59 x[3] + 39 x[4] + 31 x[5],
  57 x[1] + 11 x[2] + (73 - z) x[3] + 23 x[4] + 28 x[5],
  98 x[1] + 63 x[2] + 92 x[3] + (9 - z) x[4] + 70 x[5],
  81 x[1] + 28 x[2] + 23 x[3] + 99 x[4] + (36 - z) x[5] }

```

(Feed[#]; Table[t[i], {i, n}]) & /@ eqns

$$\left\{ \left\{ \frac{(-5+z)x[1] - 50x[2] - 16x[3] - 95x[4] - 79x[5]}{-5+z}, t[2], t[3], t[4], t[5] \right\}, \right. \\ \left. \left\{ \frac{(-5+z)x[1] - 50x[2] - 16x[3] - 95x[4] - 79x[5]}{-5+z}, \right. \right. \\ \left. \left. - \left(\left((2120 + 61z - z^2)x[2] + (473 + 59z)x[3] + 4365x[4] + 39zx[4] + 3637x[5] + 31zx[5] \right) / \right. \right. \\ \left. \left. (-2120 - 61z + z^2) \right), t[3], t[4], t[5] \right\}, \right. \\ \left. \left\{ \frac{(-5+z)x[1] - 50x[2] - 16x[3] - 95x[4] - 79x[5]}{-5+z}, \right. \right. \\ \left. \left. - \left(\left((2120 + 61z - z^2)x[2] + (473 + 59z)x[3] + 4365x[4] + 39zx[4] + 3637x[5] + 31zx[5] \right) / \right. \right. \\ \left. \left. (-2120 - 61z + z^2) \right), \left((32479 + 772z - 134z^2 + z^3)x[3] + (192835 - 4441z - 23z^2)x[4] + \right. \right. \\ \left. \left. (183171 - 3136z - 28z^2)x[5] \right) / (32479 + 772z - 134z^2 + z^3), t[4], t[5] \right\}, \right. \\ \left. \left\{ \frac{(-5+z)x[1] - 50x[2] - 16x[3] - 95x[4] - 79x[5]}{-5+z}, \right. \right. \\ \left. \left. - \left(\left((2120 + 61z - z^2)x[2] + (473 + 59z)x[3] + 4365x[4] + 39zx[4] + 3637x[5] + 31zx[5] \right) / \right. \right. \\ \left. \left. (-2120 - 61z + z^2) \right), \left((32479 + 772z - 134z^2 + z^3)x[3] + (192835 - 4441z - 23z^2)x[4] + \right. \right. \\ \left. \left. (183171 - 3136z - 28z^2)x[5] \right) / (32479 + 772z - 134z^2 + z^3), \right. \\ \left. \left((-4418182 + 409660z - 11905z^2 - 143z^3 + z^4)x[4] - \right. \right. \\ \left. \left. (6193024 - 269724z + 2891z^2 + 70z^3)x[5] \right) / (-4418182 + 409660z - 11905z^2 - 143z^3 + z^4), \right. \\ \left. t[5] \right\}, \left\{ \frac{(-5+z)x[1] - 50x[2] - 16x[3] - 95x[4] - 79x[5]}{-5+z}, \right. \\ \left. - \left(\left((2120 + 61z - z^2)x[2] + (473 + 59z)x[3] + 4365x[4] + 39zx[4] + 3637x[5] + 31zx[5] \right) / \right. \right. \\ \left. \left. (-2120 - 61z + z^2) \right), \left((32479 + 772z - 134z^2 + z^3)x[3] + (192835 - 4441z - 23z^2)x[4] + \right. \right. \\ \left. \left. (183171 - 3136z - 28z^2)x[5] \right) / (32479 + 772z - 134z^2 + z^3), \right. \\ \left. \left((-4418182 + 409660z - 11905z^2 - 143z^3 + z^4)x[4] - (6193024 - 269724z + 2891z^2 + 70z^3) \right. \right. \\ \left. \left. x[5] \right) / (-4418182 + 409660z - 11905z^2 - 143z^3 + z^4), x[5] \right\} \}$$

Feed[eqns[[1]]]

Table[t[i], {i, 4}]

$$\left\{ \frac{(-5+z)x[1] - 50x[2] - 16x[3] - 95x[4] - 79x[5]}{-5+z}, \right. \\ \left. - \left(\left((2120 + 61z - z^2)x[2] + (473 + 59z)x[3] + 4365x[4] + 39zx[4] + 3637x[5] + 31zx[5] \right) / \right. \right. \\ \left. \left. (-2120 - 61z + z^2) \right), \left((32479 + 772z - 134z^2 + z^3)x[3] + (192835 - 4441z - 23z^2)x[4] + \right. \right. \\ \left. \left. (183171 - 3136z - 28z^2)x[5] \right) / (32479 + 772z - 134z^2 + z^3), \right. \\ \left. \left((-4418182 + 409660z - 11905z^2 - 143z^3 + z^4)x[4] - \right. \right. \\ \left. \left. (6193024 - 269724z + 2891z^2 + 70z^3)x[5] \right) / (-4418182 + 409660z - 11905z^2 - 143z^3 + z^4) \right\}$$

Feed[eqns[[2]]]

Table[t[i], {i, 4}]

$$\left\{ \frac{(-5+z)x[1] - 50x[2] - 16x[3] - 95x[4] - 79x[5]}{-5+z}, \right. \\ \left. - \left(\left((2120 + 61z - z^2)x[2] + (473 + 59z)x[3] + 4365x[4] + 39zx[4] + 3637x[5] + 31zx[5] \right) / \right. \right. \\ \left. \left. (-2120 - 61z + z^2) \right), \left((32479 + 772z - 134z^2 + z^3)x[3] + (192835 - 4441z - 23z^2)x[4] + \right. \right. \\ \left. \left. (183171 - 3136z - 28z^2)x[5] \right) / (32479 + 772z - 134z^2 + z^3), \right. \\ \left. \left((-4418182 + 409660z - 11905z^2 - 143z^3 + z^4)x[4] - \right. \right. \\ \left. \left. (6193024 - 269724z + 2891z^2 + 70z^3)x[5] \right) / (-4418182 + 409660z - 11905z^2 - 143z^3 + z^4) \right\}$$

```
Feed[eqns[[3]]];
```

```
Table[t[i], {i, 4}]
```

$$\left\{ \frac{(-5+z)x[1] - 50x[2] - 16x[3] - 95x[4] - 79x[5]}{-5+z}, \right. \\ \left. - \left(\left((2120 + 61z - z^2)x[2] + (473 + 59z)x[3] + 4365x[4] + 39zx[4] + 3637x[5] + 31zx[5] \right) / \right. \right. \\ \left. \left. (-2120 - 61z + z^2) \right), \left((32479 + 772z - 134z^2 + z^3)x[3] + (192835 - 4441z - 23z^2)x[4] + \right. \right. \\ \left. \left. (183171 - 3136z - 28z^2)x[5] \right) / (32479 + 772z - 134z^2 + z^3), \right. \\ \left. \left((-4418182 + 409660z - 11905z^2 - 143z^3 + z^4)x[4] - \right. \right. \\ \left. \left. (6193024 - 269724z + 2891z^2 + 70z^3)x[5] \right) / (-4418182 + 409660z - 11905z^2 - 143z^3 + z^4) \right\}$$

```
Feed[eqns[[4]]];
```

```
Table[t[i], {i, 4}]
```

$$\left\{ \frac{(-5+z)x[1] - 50x[2] - 16x[3] - 95x[4] - 79x[5]}{-5+z}, \right. \\ \left. - \left(\left((2120 + 61z - z^2)x[2] + (473 + 59z)x[3] + 4365x[4] + 39zx[4] + 3637x[5] + 31zx[5] \right) / \right. \right. \\ \left. \left. (-2120 - 61z + z^2) \right), \left((32479 + 772z - 134z^2 + z^3)x[3] + (192835 - 4441z - 23z^2)x[4] + \right. \right. \\ \left. \left. (183171 - 3136z - 28z^2)x[5] \right) / (32479 + 772z - 134z^2 + z^3), \right. \\ \left. \left((-4418182 + 409660z - 11905z^2 - 143z^3 + z^4)x[4] - \right. \right. \\ \left. \left. (6193024 - 269724z + 2891z^2 + 70z^3)x[5] \right) / (-4418182 + 409660z - 11905z^2 - 143z^3 + z^4) \right\}$$