**Запишем матрицу в виде:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **A =** |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |  |
| --- | --- | --- | --- |
| **8** | **-4** | **12** | **-3** |
| **3** | **3** | **4** | **-5** |
| **4** | **5** | **-7** | **-3** |
| **7** | **8** | **3** | **4** |

 |  |

 |  |

 **Найдем определитель, использовав разложение по 1-му столбцу:
Минор для (1,1):
Вычеркиваем из матрицы 1-ю строку и 1-й столбец.**

|  |  |  |  |
| --- | --- | --- | --- |
| **8** | **-4** | **12** | **-3** |
| **3** | **3** | **4** | **-5** |
| **4** | **5** | **-7** | **-3** |
| **7** | **8** | **3** | **4** |

 **Получаем:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ1,1 =** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |
| --- | --- | --- |
| **3** | **4** | **-5** |
| **5** | **-7** | **-3** |
| **8** | **3** | **4** |

 |  |

 |  |

 **Найдем определитель для этого минора.
Минор для (1,1):
Вычеркиваем из матрицы 1-ю строку и 1-й столбец.**

|  |  |  |
| --- | --- | --- |
| **3** | **4** | **-5** |
| **5** | **-7** | **-3** |
| **8** | **3** | **4** |

 **Получаем:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ1,1 =** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| **-7** | **-3** |
| **3** | **4** |

 |  |

 |  |

 **Найдем определитель для этого минора.
∆1,1 = ((-7)\*4-3\*(-3)) = -19
Минор для (2,1):
Вычеркиваем из матрицы 2-ю строку и 1-й столбец.**

|  |  |  |
| --- | --- | --- |
| **3** | **4** | **-5** |
| **5** | **-7** | **-3** |
| **8** | **3** | **4** |

 **Получаем:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ2,1 =** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| **4** | **-5** |
| **3** | **4** |

 |  |

 |  |

 **Найдем определитель для этого минора.
∆2,1 = (4\*4-3\*(-5)) = 31
Минор для (3,1):
Вычеркиваем из матрицы 3-ю строку и 1-й столбец.**

|  |  |  |
| --- | --- | --- |
| **3** | **4** | **-5** |
| **5** | **-7** | **-3** |
| **8** | **3** | **4** |

 **Получаем:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ3,1 =** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| **4** | **-5** |
| **-7** | **-3** |

 |  |

 |  |

 **Найдем определитель для этого минора.
∆3,1 = (4\*(-3)-(-7)\*(-5)) = -47
Определитель минора:
∆1,1 = (-1)1+13\*(-19)+(-1)2+15\*31+(-1)3+18\*(-47) = 3\*(-19)-5\*31+8\*(-47) = -588
Минор для (2,1):
Вычеркиваем из матрицы 2-ю строку и 1-й столбец.**

|  |  |  |  |
| --- | --- | --- | --- |
| **8** | **-4** | **12** | **-3** |
| **3** | **3** | **4** | **-5** |
| **4** | **5** | **-7** | **-3** |
| **7** | **8** | **3** | **4** |

 **Получаем:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ2,1 =** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |
| --- | --- | --- |
| **-4** | **12** | **-3** |
| **5** | **-7** | **-3** |
| **8** | **3** | **4** |

 |  |

 |  |

 **Найдем определитель для этого минора.
Минор для (1,1):
Вычеркиваем из матрицы 1-ю строку и 1-й столбец.**

|  |  |  |
| --- | --- | --- |
| **-4** | **12** | **-3** |
| **5** | **-7** | **-3** |
| **8** | **3** | **4** |

 **Получаем:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ1,1 =** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| **-7** | **-3** |
| **3** | **4** |

 |  |

 |  |

 **Найдем определитель для этого минора.
∆1,1 = ((-7)\*4-3\*(-3)) = -19
Минор для (2,1):
Вычеркиваем из матрицы 2-ю строку и 1-й столбец.**

|  |  |  |
| --- | --- | --- |
| **-4** | **12** | **-3** |
| **5** | **-7** | **-3** |
| **8** | **3** | **4** |

 **Получаем:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ2,1 =** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| **12** | **-3** |
| **3** | **4** |

 |  |

 |  |

 **Найдем определитель для этого минора.
∆2,1 = (12\*4-3\*(-3)) = 57
Минор для (3,1):
Вычеркиваем из матрицы 3-ю строку и 1-й столбец.**

|  |  |  |
| --- | --- | --- |
| **-4** | **12** | **-3** |
| **5** | **-7** | **-3** |
| **8** | **3** | **4** |

 **Получаем:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ3,1 =** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| **12** | **-3** |
| **-7** | **-3** |

 |  |

 |  |

 **Найдем определитель для этого минора.
∆3,1 = (12\*(-3)-(-7)\*(-3)) = -57
Определитель минора:
∆2,1 = (-1)1+1(-4)\*(-19)+(-1)2+15\*57+(-1)3+18\*(-57) = (-4)\*(-19)-5\*57+8\*(-57) = -665
Минор для (3,1):
Вычеркиваем из матрицы 3-ю строку и 1-й столбец.**

|  |  |  |  |
| --- | --- | --- | --- |
| **8** | **-4** | **12** | **-3** |
| **3** | **3** | **4** | **-5** |
| **4** | **5** | **-7** | **-3** |
| **7** | **8** | **3** | **4** |

 **Получаем:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ3,1 =** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |
| --- | --- | --- |
| **-4** | **12** | **-3** |
| **3** | **4** | **-5** |
| **8** | **3** | **4** |

 |  |

 |  |

 **Найдем определитель для этого минора.
Минор для (1,1):
Вычеркиваем из матрицы 1-ю строку и 1-й столбец.**

|  |  |  |
| --- | --- | --- |
| **-4** | **12** | **-3** |
| **3** | **4** | **-5** |
| **8** | **3** | **4** |

 **Получаем:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ1,1 =** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| **4** | **-5** |
| **3** | **4** |

 |  |

 |  |

 **Найдем определитель для этого минора.
∆1,1 = (4\*4-3\*(-5)) = 31
Минор для (2,1):
Вычеркиваем из матрицы 2-ю строку и 1-й столбец.**

|  |  |  |
| --- | --- | --- |
| **-4** | **12** | **-3** |
| **3** | **4** | **-5** |
| **8** | **3** | **4** |

 **Получаем:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ2,1 =** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| **12** | **-3** |
| **3** | **4** |

 |  |

 |  |

 **Найдем определитель для этого минора.
∆2,1 = (12\*4-3\*(-3)) = 57
Минор для (3,1):
Вычеркиваем из матрицы 3-ю строку и 1-й столбец.**

|  |  |  |
| --- | --- | --- |
| **-4** | **12** | **-3** |
| **3** | **4** | **-5** |
| **8** | **3** | **4** |

 **Получаем:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ3,1 =** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| **12** | **-3** |
| **4** | **-5** |

 |  |

 |  |

 **Найдем определитель для этого минора.
∆3,1 = (12\*(-5)-4\*(-3)) = -48
Определитель минора:
∆3,1 = (-1)1+1(-4)\*31+(-1)2+13\*57+(-1)3+18\*(-48) = (-4)\*31-3\*57+8\*(-48) = -679
Минор для (4,1):
Вычеркиваем из матрицы 4-ю строку и 1-й столбец.**

|  |  |  |  |
| --- | --- | --- | --- |
| **8** | **-4** | **12** | **-3** |
| **3** | **3** | **4** | **-5** |
| **4** | **5** | **-7** | **-3** |
| **7** | **8** | **3** | **4** |

 **Получаем:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ4,1 =** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |
| --- | --- | --- |
| **-4** | **12** | **-3** |
| **3** | **4** | **-5** |
| **5** | **-7** | **-3** |

 |  |

 |  |

 **Найдем определитель для этого минора.
Минор для (1,1):
Вычеркиваем из матрицы 1-ю строку и 1-й столбец.**

|  |  |  |
| --- | --- | --- |
| **-4** | **12** | **-3** |
| **3** | **4** | **-5** |
| **5** | **-7** | **-3** |

 **Получаем:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ1,1 =** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| **4** | **-5** |
| **-7** | **-3** |

 |  |

 |  |

 **Найдем определитель для этого минора.
∆1,1 = (4\*(-3)-(-7)\*(-5)) = -47
Минор для (2,1):
Вычеркиваем из матрицы 2-ю строку и 1-й столбец.**

|  |  |  |
| --- | --- | --- |
| **-4** | **12** | **-3** |
| **3** | **4** | **-5** |
| **5** | **-7** | **-3** |

 **Получаем:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ2,1 =** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| **12** | **-3** |
| **-7** | **-3** |

 |  |

 |  |

 **Найдем определитель для этого минора.
∆2,1 = (12\*(-3)-(-7)\*(-3)) = -57
Минор для (3,1):
Вычеркиваем из матрицы 3-ю строку и 1-й столбец.**

|  |  |  |
| --- | --- | --- |
| **-4** | **12** | **-3** |
| **3** | **4** | **-5** |
| **5** | **-7** | **-3** |

 **Получаем:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ3,1 =** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| **12** | **-3** |
| **4** | **-5** |

 |  |

 |  |

 **Найдем определитель для этого минора.
∆3,1 = (12\*(-5)-4\*(-3)) = -48
Определитель минора:
∆4,1 = (-1)1+1(-4)\*(-47)+(-1)2+13\*(-57)+(-1)3+15\*(-48) = (-4)\*(-47)-3\*(-57)+5\*(-48) = 119
Определитель:
∆ = (-1)1+18\*(-588)+(-1)2+13\*(-665)+(-1)3+14\*(-679)+(-1)4+17\*119 = 8\*(-588)-3\*(-665)+4\*(-679)-7\*119 = -6258**

**Запишем матрицу в виде:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **A =** |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |  |
| --- | --- | --- | --- |
| **1** | **1** | **3** | **-1** |
| **1** | **0** | **-1** | **1** |
| **3** | **7** | **-1** | **1** |
| **0** | **4** | **4** | **-1** |

 |  |

 |

 **Найдем определитель, использовав разложение по 1-му столбцу:
Минор для (1,1):
Вычеркиваем из матрицы 1-ю строку и 1-й столбец.**

|  |  |  |  |
| --- | --- | --- | --- |
| **1** | **1** | **3** | **-1** |
| **1** | **0** | **-1** | **1** |
| **3** | **7** | **-1** | **1** |
| **0** | **4** | **4** | **-1** |

 **Получаем:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ1,1 =** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |
| --- | --- | --- |
| **0** | **-1** | **1** |
| **7** | **-1** | **1** |
| **4** | **4** | **-1** |

 |  |

 |

 **Найдем определитель для этого минора.
Минор для (2,1):
Вычеркиваем из матрицы 2-ю строку и 1-й столбец.**

|  |  |  |
| --- | --- | --- |
| **0** | **-1** | **1** |
| **7** | **-1** | **1** |
| **4** | **4** | **-1** |

 **Получаем:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ2,1 =** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| **-1** | **1** |
| **4** | **-1** |

 |  |

 |

 **Найдем определитель для этого минора.
∆2,1 = ((-1)\*(-1)-4\*1) = -3
Минор для (3,1):
Вычеркиваем из матрицы 3-ю строку и 1-й столбец.**

|  |  |  |
| --- | --- | --- |
| **0** | **-1** | **1** |
| **7** | **-1** | **1** |
| **4** | **4** | **-1** |

 **Получаем:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ3,1 =** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| **-1** | **1** |
| **-1** | **1** |

 |  |

 |

 **Найдем определитель для этого минора.
∆3,1 = ((-1)\*1-(-1)\*1) = 0
Определитель минора:
∆1,1 = (-1)2+17\*(-3)+(-1)3+14\*0 = 0\*0-7\*(-3)+4\*0 = 21
Минор для (2,1):
Вычеркиваем из матрицы 2-ю строку и 1-й столбец.**

|  |  |  |  |
| --- | --- | --- | --- |
| **1** | **1** | **3** | **-1** |
| **1** | **0** | **-1** | **1** |
| **3** | **7** | **-1** | **1** |
| **0** | **4** | **4** | **-1** |

 **Получаем:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ2,1 =** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |
| --- | --- | --- |
| **1** | **3** | **-1** |
| **7** | **-1** | **1** |
| **4** | **4** | **-1** |

 |  |

 |

 **Найдем определитель для этого минора.
Минор для (1,1):
Вычеркиваем из матрицы 1-ю строку и 1-й столбец.**

|  |  |  |
| --- | --- | --- |
| **1** | **3** | **-1** |
| **7** | **-1** | **1** |
| **4** | **4** | **-1** |

 **Получаем:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ1,1 =** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| **-1** | **1** |
| **4** | **-1** |

 |  |

 |

 **Найдем определитель для этого минора.
∆1,1 = ((-1)\*(-1)-4\*1) = -3
Минор для (2,1):
Вычеркиваем из матрицы 2-ю строку и 1-й столбец.**

|  |  |  |
| --- | --- | --- |
| **1** | **3** | **-1** |
| **7** | **-1** | **1** |
| **4** | **4** | **-1** |

 **Получаем:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ2,1 =** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| **3** | **-1** |
| **4** | **-1** |

 |  |

 |

 **Найдем определитель для этого минора.
∆2,1 = (3\*(-1)-4\*(-1)) = 1
Минор для (3,1):
Вычеркиваем из матрицы 3-ю строку и 1-й столбец.**

|  |  |  |
| --- | --- | --- |
| **1** | **3** | **-1** |
| **7** | **-1** | **1** |
| **4** | **4** | **-1** |

 **Получаем:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ3,1 =** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| **3** | **-1** |
| **-1** | **1** |

 |  |

 |

 **Найдем определитель для этого минора.
∆3,1 = (3\*1-(-1)\*(-1)) = 2
Определитель минора:
∆2,1 = (-1)1+11\*(-3)+(-1)2+17\*1+(-1)3+14\*2 = 1\*(-3)-7\*1+4\*2 = -2
Минор для (3,1):
Вычеркиваем из матрицы 3-ю строку и 1-й столбец.**

|  |  |  |  |
| --- | --- | --- | --- |
| **1** | **1** | **3** | **-1** |
| **1** | **0** | **-1** | **1** |
| **3** | **7** | **-1** | **1** |
| **0** | **4** | **4** | **-1** |

 **Получаем:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ3,1 =** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |
| --- | --- | --- |
| **1** | **3** | **-1** |
| **0** | **-1** | **1** |
| **4** | **4** | **-1** |

 |  |

 |

 **Найдем определитель для этого минора.
Минор для (1,1):
Вычеркиваем из матрицы 1-ю строку и 1-й столбец.**

|  |  |  |
| --- | --- | --- |
| **1** | **3** | **-1** |
| **0** | **-1** | **1** |
| **4** | **4** | **-1** |

 **Получаем:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ1,1 =** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| **-1** | **1** |
| **4** | **-1** |

 |  |

 |

 **Найдем определитель для этого минора.
∆1,1 = ((-1)\*(-1)-4\*1) = -3
Минор для (3,1):
Вычеркиваем из матрицы 3-ю строку и 1-й столбец.**

|  |  |  |
| --- | --- | --- |
| **1** | **3** | **-1** |
| **0** | **-1** | **1** |
| **4** | **4** | **-1** |

 **Получаем:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Δ3,1 =** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| **3** | **-1** |
| **-1** | **1** |

 |  |

 |

 **Найдем определитель для этого минора.
∆3,1 = (3\*1-(-1)\*(-1)) = 2
Определитель минора:
∆3,1 = (-1)1+11\*(-3)+(-1)3+14\*2 = 1\*(-3)+4\*2 = 5
Определитель:
∆ = (-1)1+11\*21+(-1)2+11\*(-2)+(-1)3+13\*5 = 1\*21-1\*(-2)+3\*5 = 38**