***Числовая матрица — это прямоугольная таблица чисел.***

Матрица размером m\*n, где m - количество строк, n – количество столбцов

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| A = | |  |  |  |  | | --- | --- | --- | --- | | a11 | a12 | a1... | a1n | | a...1 | a...2 | a…... | a...n | | am1 | am2 | am... | amn | |

***Матрица называется квадратной, если число строк равно количеству столбцов. При этом число строк является порядком матрицы.***

Квадратная матрица 3-его порядка

|  |  |  |
| --- | --- | --- |
| a11 | a12 | a13 |
| a21 | a22 | a23 |
| a31 | a32 | a33 |

***Диагональ a11 – a22 – a33 называется главной диагональю. Если все элементы матрицы, кроме элементов лежащих на главной диагонали, равны 0, то такая матрица называется диагональной***. ***Диагональная матрица, у которой элементы главной диагонали равны 1, называется единичной. Если все элементы матрицы равны 0, то матрица называется нулевой.***

***Матрицы Amn и Bpq равны, если m = p и n = q, aij = bij при 1 <= i <= m и 1 <= j <= n.***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| A = | |  |  |  |  | | --- | --- | --- | --- | | 1 | 2 | 3 | 4 | | 5 | 6 | 7 | 8 | | 9 | 10 | 11 | 12 | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| B = | |  |  |  |  | | --- | --- | --- | --- | | 1 | 2 | 3 | 4 | | 5 | 6 | 7 | 8 | | 9 | 10 | 11 | 12 | |

***A = B***

***Сложение матриц***

***Сложение матрицы Amn и матрицы Bpq возможно если m = p и n = q. Amn + Bpq = Cmn, при этом:***

***(cij) = (aij) + (bij).***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| A = | |  |  |  | | --- | --- | --- | | 5 | 7 | -3 | | 0 | 6 | 1 | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| B = | |  |  |  | | --- | --- | --- | | -6 | 7 | 2 | | 8 | 12 | 4 | |

C = A + B

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| C = | |  |  |  | | --- | --- | --- | | 5 | 7 | -3 | | 0 | 6 | 1 | | + | |  |  |  | | --- | --- | --- | | -6 | 7 | 2 | | 8 | 12 | 4 | | = | |  |  |  | | --- | --- | --- | | 5 + (-6) | 7 + 7 | -3 + 2 | | 0 + 8 | 6 + 12 | 1 + 4 | | = | |  |  |  | | --- | --- | --- | | -1 | 14 | -1 | | 8 | 18 | 5 | |

***Умножение матрицы на число.***

***Amn \* x = Bmn , при этом (bij) = (aij) \* x***

x = 2,

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| A = | |  |  | | --- | --- | | 0 | 1 | | 2 | 3 | | 4 | 5 | |

B = A \* x

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| B = | |  |  | | --- | --- | | 0 | 1 | | 2 | 3 | | 4 | 5 | | \* | 2 | = | |  |  | | --- | --- | | 0 \* 2 | 1 \* 2 | | 2 \* 2 | 3 \* 2 | | 4 \* 2 | 5 \* 2 | | = | |  |  | | --- | --- | | 0 | 2 | | 4 | 6 | | 8 | 10 | |

***Умножение матрицы на матрицу.***

***Матрицу Amn можно умножить на матрицу Bpq , если количество столбцов A равно количеству строк B, т. е. n = p. Такие матрицы являются согласованными. Результатом умножения будет матрица C размером n \* p. При этом (cij) = (ai1) \* (b1j) + (ai2) \* (b2j) + (ai...) \* (b...j) + (ain) \* (bpj). A \* B может быть не равно B \* A.***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| A = | |  |  | | --- | --- | | 1 | 2 | | 3 | 4 | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| B = | |  |  |  | | --- | --- | --- | | 1 | 0 | -1 | | 3 | 2 | 0 | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| C = | |  |  | | --- | --- | | 1 | 2 | | 3 | 4 | | \* | |  |  |  | | --- | --- | --- | | 1 | 0 | -1 | | 3 | 2 | 0 | | = | |  |  |  | | --- | --- | --- | | 1 \* 1 + 2 \* 3 | 1 \* 0 + 2 \* 2 | 1 \* (-1) + 2 \* 0 | | 3 \* 1 + 4 \* 3 | 3 \* 0 + 4 \* 2 | 3 \* (-1) + 4 \* 0 | | = | |  |  |  | | --- | --- | --- | | 7 | 4 | -1 | | 15 | 8 | -3 | |

***Если матрица A квадратная, то A \* A = A2, A2 \* A = A \* A \* A = A3 и т. д.***

***Транспонирование матрицы.***

***Транспонированием матрицы называется такое преобразование данной матрицы при котором каждая её строка становится столбцом с тем же номером. Транспонированная матрица обозначается AT. Для матриц A и AT всегда возможно умножение.***