Basic Operations, Variables

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We can do basic operations like addition (+), subtraction (-), multiplication (*), division (/), exponentiation (^)

We can assign variables a value with `x = 5`, and long variable names with `DaysPerYear = 365`

- Spaces are not allowed
- Spaces are case sensitive

We can use variables in algebra `leapyear = DaysPerYear + 1`

Computer Algebra

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We can perform symbolic manipulation to solve equations

First we must declare the variables with `syms x y`

We can define expressions with `a = (x +y )^3`

We can expand the expression with `expand(a)`

ans = x^3 + 3*x^2*y + 3*x*y^2 + y^3

We can factor an expression with `

factor(x^3 + 3*x^2*y + 3*x*y^2 + y^3)

ans = (x + y)^3

We can take derivatives ad integrals with `diff` and `int`

diff(expression, variable)

int(expression, variable)

Making Matrices

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We construct matrices with [], where entries in each row are separated with "," or " " and each row separated ";"

To get the entry at the ith row and jth column: `A(i, j)`

To get the entire ith row: `A(i, :)`
To get the entire jth column: `A(:, j)`

To get a range of values, we can use the colon to denote a range of values: `A(x:y, a:b)` will get the values between rows x and y and columns a and b

We can make a random n*n matrix with `rand(n)`

We can make an n*n identity matrix using `eye(n)`

Solving Systems of Linear Equations

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We can define the matrix A and column vector b. Then we can solve the system Ax = b with `x = A\b`

It can only be used for systems with one solution

Reducing Matrices

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After creating a matrix A and column vector b, we can reduce the augmented matrix that represents the system Ax = b with: `rref([A b])`

Matrix Operations, Transpose, Inverse, Determinant

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We can conduct some matrix operations on two matrices.

We can add two matrices with (+)
`A+B`

We can multiply two matrices with (*)
`A*B`

The transpose of a matrix is: `A'`

We can use `inv(A)`

We can take the power of matrix with `A^n`

We can get the determinant of a matrix with `det(A)`

Eigenvalues, Eigenvectors, Diagonalization

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To get the eigenvalues of a matrix we can use `b = eig(A)`

To get the eigenvectors and eigenvalues in one go, we can use `[P, D] = eig(A)` where `A = P*D*inv(P)`

We can use this to find the diagonalization of a matrix