# Mathematica Class 2

The following **Clear** command is useful if you want to rerun the notebook. (You don't want to have any defintions from the previous execution of the notebok still around.)

```
Clear["Global`*"]
```

## Lists

```
a = {1, 2, 3, 4}; b = {1, 4, 9, 16};
```

```
Join[a, b]
```

```
{1, 2, 3, 4, 1, 4, 9, 16}
```

```
Union[a, b]
```

```
{1, 2, 3, 4, 9, 16}
```

```
Intersection[a, b]
```

```
{1, 4}
```

```
c = {b, 100}
```

```
{{1, 4, 9, 16}, 100}
```

```
f = {a, b, c}
```

```
{{1, 2, 3, 4}, {1, 4, 9, 16}, {{1, 4, 9, 16}, 100}}
```

```
g = Flatten[f]
```

```
{1, 2, 3, 4, 1, 4, 9, 16, 1, 4, 9, 16, 100}
```

```
g2 = Table[{i, j, k}, {i, 1, 4}, {j, 1, 4}, {k, 1, 3}]
```

```
{{{{1, 1, 1}, {1, 1, 2}, {1, 1, 3}}, {{1, 2, 1}, {1, 2, 2}, {1, 2, 3}},
  {{1, 3, 1}, {1, 3, 2}, {1, 3, 3}}, {{1, 4, 1}, {1, 4, 2}, {1, 4, 3}}},
 {{{2, 1, 1}, {2, 1, 2}, {2, 1, 3}}, {{2, 2, 1}, {2, 2, 2}, {2, 2, 3}},
  {{2, 3, 1}, {2, 3, 2}, {2, 3, 3}}, {{2, 4, 1}, {2, 4, 2}, {2, 4, 3}}},
 {{{3, 1, 1}, {3, 1, 2}, {3, 1, 3}}, {{3, 2, 1}, {3, 2, 2}, {3, 2, 3}},
  {{3, 3, 1}, {3, 3, 2}, {3, 3, 3}}, {{3, 4, 1}, {3, 4, 2}, {3, 4, 3}}},
 {{{4, 1, 1}, {4, 1, 2}, {4, 1, 3}}, {{4, 2, 1}, {4, 2, 2}, {4, 2, 3}},
  {{4, 3, 1}, {4, 3, 2}, {4, 3, 3}}, {{4, 4, 1}, {4, 4, 2}, {4, 4, 3}}}}
```

```
g3 = Flatten[g2, 2]
```

```
{{1, 1, 1}, {1, 1, 2}, {1, 1, 3}, {1, 2, 1}, {1, 2, 2}, {1, 2, 3}, {1, 3, 1}, {1, 3, 2},
 {1, 3, 3}, {1, 4, 1}, {1, 4, 2}, {1, 4, 3}, {2, 1, 1}, {2, 1, 2}, {2, 1, 3}, {2, 2, 1},
 {2, 2, 2}, {2, 2, 3}, {2, 3, 1}, {2, 3, 2}, {2, 3, 3}, {2, 4, 1}, {2, 4, 2}, {2, 4, 3},
 {3, 1, 1}, {3, 1, 2}, {3, 1, 3}, {3, 2, 1}, {3, 2, 2}, {3, 2, 3}, {3, 3, 1}, {3, 3, 2},
 {3, 3, 3}, {3, 4, 1}, {3, 4, 2}, {3, 4, 3}, {4, 1, 1}, {4, 1, 2}, {4, 1, 3}, {4, 2, 1},
 {4, 2, 2}, {4, 2, 3}, {4, 3, 1}, {4, 3, 2}, {4, 3, 3}, {4, 4, 1}, {4, 4, 2}, {4, 4, 3}}
```

```
Length[g3]
```

```
48
```

```
Table[g3[[i, 3]], {i, 1, Length[g3]}]
```

```
{1, 2, 3, 1, 2, 3, 1, 2, 3, 1, 2, 3, 1, 2, 3, 1, 2, 3, 1, 2, 3, 1,
 2, 3, 1, 2, 3, 1, 2, 3, 1, 2, 3, 1, 2, 3, 1, 2, 3, 1, 2, 3, 1, 2, 3}
```

```
g[[3]]
```

```
3
```

```
g2[[1, 2, 3]]
```

```
{1, 2, 3}
```

```
g2[[1, 2]]
```

```
{{1, 2, 1}, {1, 2, 2}, {1, 2, 3}}
```

```
PrimeQ[3]
```

```
True
```

```
l1 = Table[j, {j, 1, 35}]
```

```
{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35}
```

```
l1 = Table[j, {j, 10^8, 10^8 + 10^3}];
```

```
Length[Select[l1, PrimeQ]]
```

```
54
```

```
primelist = Select[Table[n, {n, 1000, 2000}], PrimeQ]
```

```
{1009, 1013, 1019, 1021, 1031, 1033, 1039, 1049, 1051, 1061, 1063, 1069, 1087, 1091, 1093,
 1097, 1103, 1109, 1117, 1123, 1129, 1151, 1153, 1163, 1171, 1181, 1187, 1193, 1201, 1213,
 1217, 1223, 1229, 1231, 1237, 1249, 1259, 1277, 1279, 1283, 1289, 1291, 1297, 1301, 1303,
 1307, 1319, 1321, 1327, 1361, 1367, 1373, 1381, 1399, 1409, 1423, 1427, 1429, 1433, 1439,
 1447, 1451, 1453, 1459, 1471, 1481, 1483, 1487, 1489, 1493, 1499, 1511, 1523, 1531, 1543,
 1549, 1553, 1559, 1567, 1571, 1579, 1583, 1597, 1601, 1607, 1609, 1613, 1619, 1621, 1627,
 1637, 1657, 1663, 1667, 1669, 1693, 1697, 1699, 1709, 1721, 1723, 1733, 1741, 1747, 1753,
 1759, 1777, 1783, 1787, 1789, 1801, 1811, 1823, 1831, 1847, 1861, 1867, 1871, 1873, 1877,
 1879, 1889, 1901, 1907, 1913, 1931, 1933, 1949, 1951, 1973, 1979, 1987, 1993, 1997, 1999}
```

```
Length[primelist]
```

```
135
```

```
Take[primelist, {1, 10}]
```

```
{1009, 1013, 1019, 1021, 1031, 1033, 1039, 1049, 1051, 1061}
```

## Functions

```
Clear[f, a, b]
```

```
f[x_] = 3 x^2
```

$3\,x^2$

```
f[y]
```

$3\,y^2$

```
f[2]
```

12

```
{a, b, d}^2
```

$\{a^2, b^2, d^2\}$

```
f[{1, 2, 3}]
```

{3, 12, 27}

```
Clear[f, a, b]
```

```
k = 10;
```

```
f[x_] := x + k x^2
```

```
? f
```

Global`f

$f[x\_] := x + k\,x^2$

```
f[x]
```

$x + 10\,x^2$

```
f[2]
```

42

```
k = 1;
```

```
f[2]
```

6

```
f[x]
```

$x + x^2$

```
fun[x_?NumericQ] := x^2;
```

```
fun[100]
```

10 000

```
fun[x]
```

fun[x]

```
fun3[x_] := 0;
```

```
fun3[x_] := 1 /; PrimeQ[x]
```

```
ints = Table[i, {i, 1, 5}]
```

```
{1, 2, 3, 4, 5}
```

```
fun3[ints]
```

```
0
```

```
Map[fun3, ints]
```

```
{0, 1, 1, 0, 1}
```

```
gg[x_] := Sin[3 x]^2 + 11 ArcTan[1 / x]
```

```
gg[2]
```

$$11\,\text{ArcTan}\left[\frac{1}{2}\right] + \text{Sin}[6]^2$$

```
gg[2.]
```

```
5.1782
```

```
gg'[y]
```

$$-\frac{11}{\left(1+\frac{1}{y^2}\right)y^2} + 6\,\text{Cos}[3\,y]\,\text{Sin}[3\,y]$$

```
gg'[.3]
```

```
-7.1702
```

```
f1 = Cos[#] + Sin[#] &
```

```
Cos[#1] + Sin[#1] &
```

```
f1[Pi / 4]
```

$$\sqrt{2}$$

```
f1'
```

```
Cos[#1] - Sin[#1] &
```