Introduction to Mathematica - Examples

This will clear all definitions:

```
ClearAll["Global`*"]
```

Calculations

In[1405]:= $6/5.0$

Out[1405]= 1.2

In[1406]:= 5^2

Out[1406]= 25

In[1409]:= $N[\sqrt{5}]$

Out[1409]= 2.23607

In[1417]:= $\frac{1+2-9}{7.0}$

Out[1417]= -0.857143

$$\frac{6.67*\hat{}-11 * 5.972*\hat{}24 * 70}{(6.371*\hat{}6)^2}$$

Out[1410]= 6.67×10^{-11}

In[1419]:= $\pi * 2.$

Out[1419]= 6.28319

In[1411]:= $6.67 * 10^{-11}$

Out[1411]= 6.67×10^{-11}

Variables

In[1421]:= ω

Out[1421]= 8

In[1423]:=
```
m = 70;
REarth = 6.371*^6;
mEarth = 5.972*^24;
GravConstant = 6.67*^-11;
```

In[1433]:= $\frac{\texttt{GravConstant} * \texttt{m} * \texttt{mEarth} * \texttt{mysteriousForceFactor}}{\texttt{REarth}^2}$

Out[1433]= 4808.69

In[1429]:=
```
mysteriousForceFactor = 7;
```

In[1438]:=
```
REarth
```

Out[1438]= 6.371×10^6

Functions

In[1466]:=
```
m =.;
```

$\texttt{GravForce[h\_, m\_]} = \frac{\texttt{GravConstant} * \texttt{m} * \texttt{mEarth}}{(\texttt{REarth} + \texttt{h})^2}$

Out[1467]= $\frac{3.98332 \times 10^{14}\, m}{(6.371 \times 10^6 + h)^2}$

In[1442]:= $\frac{\texttt{GravForce[408 000]}}{\texttt{GravForce[0]}}$

Out[1442]= 0.883251

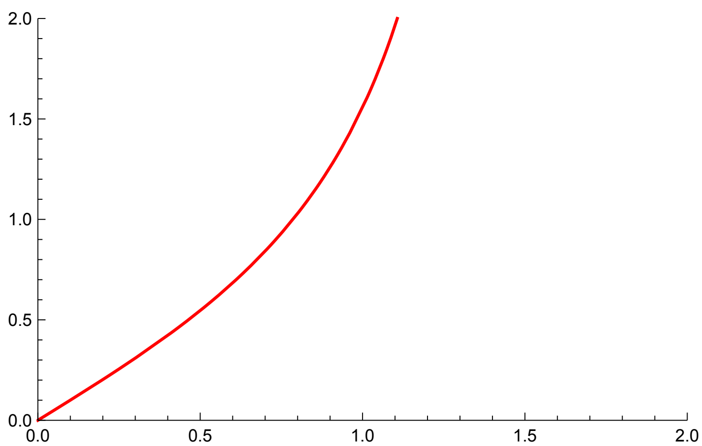
note taking ability

```
Manipulate[]
```

Plotting

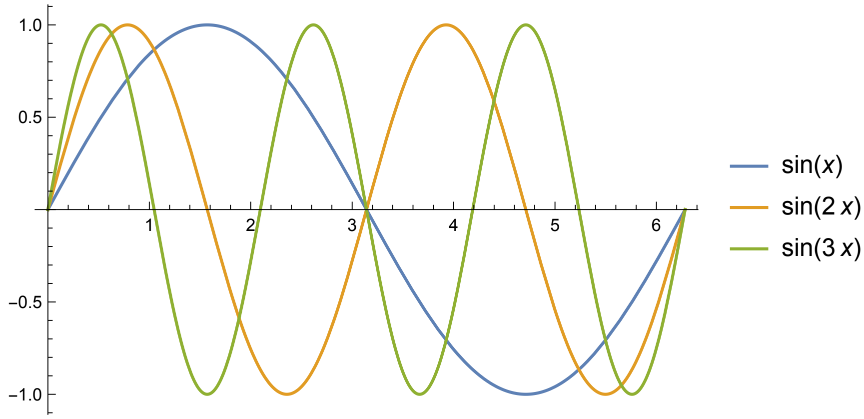
In[1453]:=
```
Plot[Tan[x], {x, 0, 10}, PlotRange → {{0, 2}, {0, 2}}, PlotStyle → Red]
```

Out[1453]=



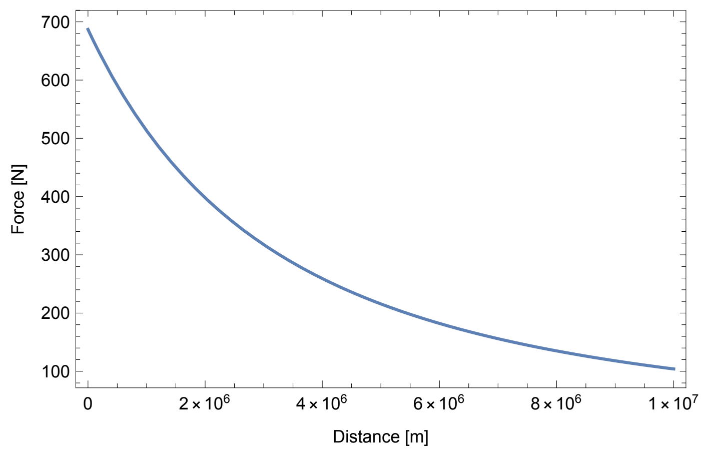
In[1454]:=
```
Plot[{Sin[x], Sin[2 x], Sin[3 x]}, {x, 0, 2 Pi}, PlotLegends → "Expressions"]
```

Out[1454]=



In[1462]:=
```
Plot[GravForce[h], {h, 0, 1*^7}, Frame → True,
 FrameLabel → {"Distance [m]", "Force [N]"}]
```

Out[1462]=

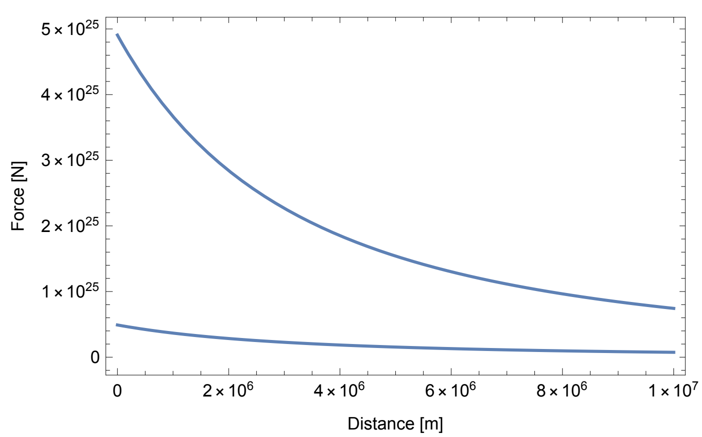


In[1468]:=
```
m = {5*^24, 5*^23}
```

Out[1468]= {5 000 000 000 000 000 000 000 000, 500 000 000 000 000 000 000 000}

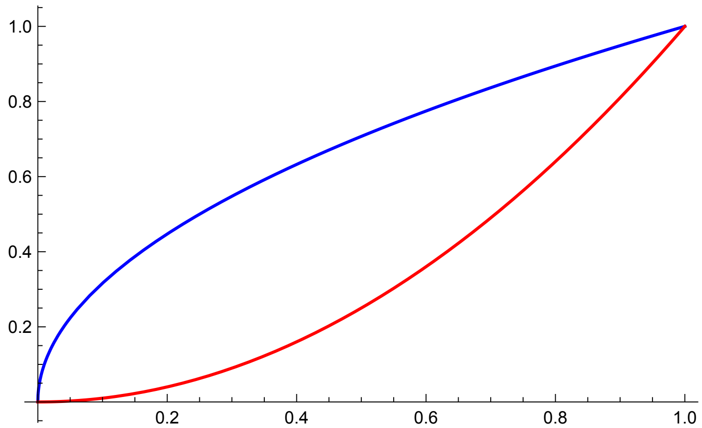
In[1469]:=
```
Plot[GravForce[h, m], {h, 0, 1*^7},
 Frame → True, FrameLabel → {"Distance [m]", "Force [N]"}]
```

Out[1469]=



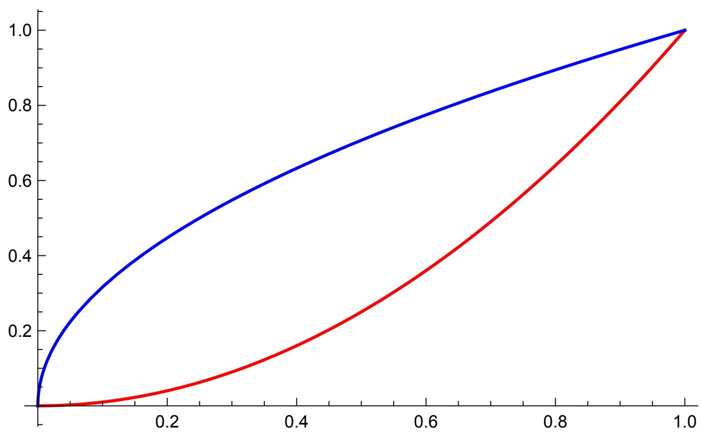
In[1482]:=
```
Plot[{√x, x^2}, {x, 0, 1}, PlotStyle → {Blue, Red}]
```

Out[1482]=



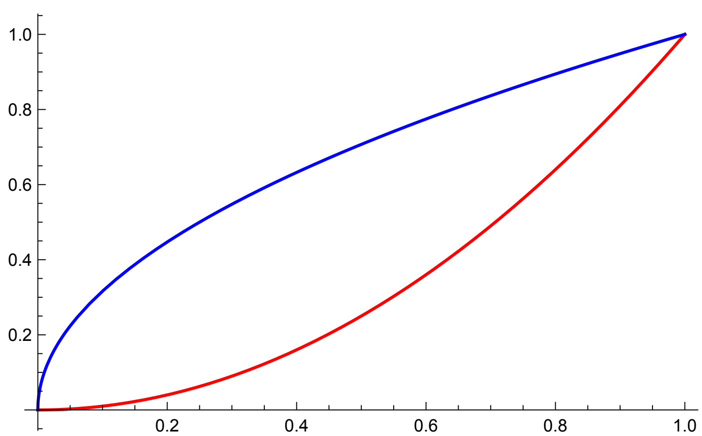
In[1478]:=
```
p1 = Plot[x^2, {x, 0, 1}, PlotStyle → Red];
p2 = Plot[√x, {x, 0, 1}, PlotStyle → Blue];
Show[p1, p2]
```

Out[1480]=



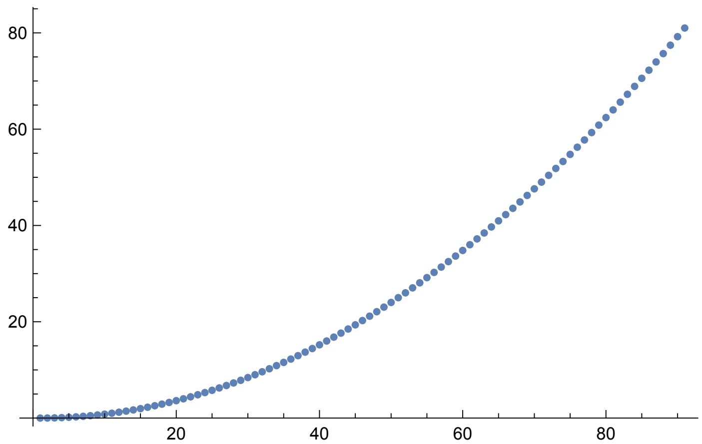
In[1474]:=
```
Show[p1, p2]
```

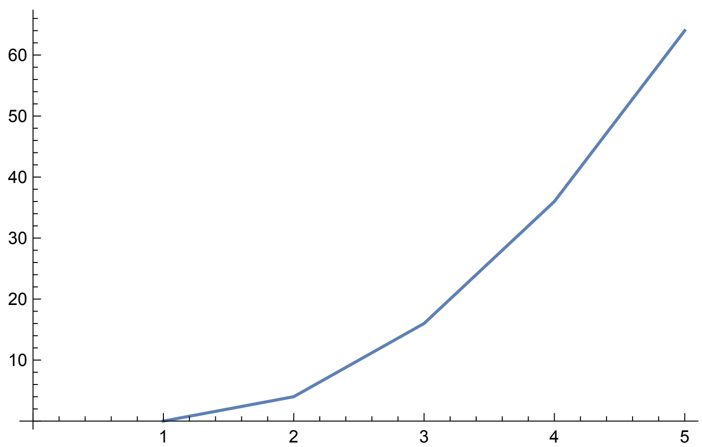
Out[1474]=

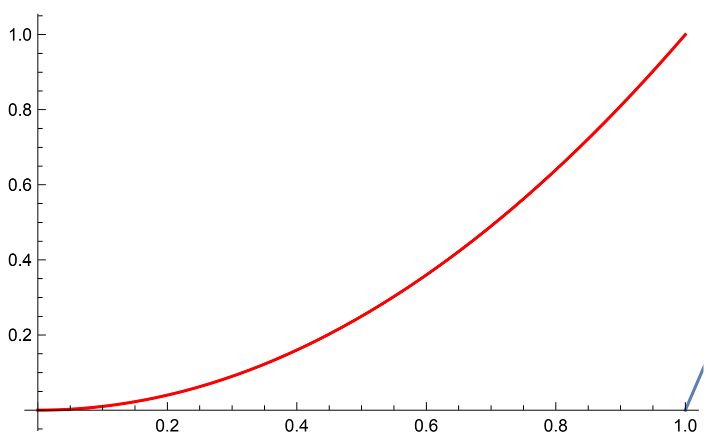


Lists/Tables/Arrays etc

In[1493]:=
```
squareTable = Table[x^2, {x, 0, 9, 2}]
```
Out[1493]= {0, 4, 16, 36, 64}

In[1491]:=
```
ListPlot[squareTable]
```
Out[1491]=


In[1495]:=
```
p3 = ListLinePlot[squareTable]
```
Out[1495]=


In[1497]:=
```
Show[p1, p3]
```
Out[1497]=


Calculus

In[1498]:= `f[x_] = x^2`

Out[1498]= x^2

In[1499]:= `D[f[x], x]`

Out[1499]= $2\,x$

In[1500]:= `Integrate[f[x], x]`

Out[1500]= $\frac{x^3}{3}$

$\int x^3$

••• Integrate: $\int x^3$ cannot be interpreted. Integrals are entered in the form $\int f\,dx$, $\int_a^b f\,dx$, or $\int_{vars\in region} f$, where d is entered as ESC dd ESC.

In[1504]:= $\int x^2\,dx$

Out[1504]= $\frac{x^3}{3}$

$$m\frac{d^2y}{dt^2} = -y$$

In[1508]:= `DSolve[{y''[t] == -y[t], y[0] == 0}, y[t], t]`

Out[1508]= `{{y[t] → C[2] Sin[t]}}` ($\{\{y[t] \to c_2\,\mathrm{Sin}[t]\}\}$)