Mathematica Introduction for Calculus

Reminders: Press **Shift-Enter** to evaluate each command. *Mathematica* is case-sensitive; upper and lower case letters matter. Also, you do not have to retype code if you want to make changes or add options. You can edit previous input and re-evaluate it. To get the arrow character → type a hypen - followed by the greater than sign >.
Do NOT type the input labels (for example, In[1]:=). Mathematica automatically includes those and numbers them in the order you evaluate your commands. Your numbers do not have to match the numbers listed below.

■ Basic Operations

```
In[1]:= 5 (3 + 4)

In[2]:= Sqrt[49]

In[3]:= Sqrt[10!]

In[4]:= N[Pi, 1000]
```

Note: "Log" is ln. For other bases you can use Log and specify the base.

```
In[5]:= Log[E]

In[6]:= Log[10, 1000]

In[7]:= Sin[Pi / 3]

In[8]:= ArcTan[Sqrt[3]]
```

■ Algebra

```
In[9]:= Expand[(x + 3) (x - 4)]

In[10]:= Factor[6 x^3 + 23 x^2 - 33 x + 10]
```

Note: For "Solve" you need to use a double-equal sign ==.

```
In[11]:= Solve[x + 4 == 2 x - 3]

In[12]:= Solve[x - 3 y + 4 == 2 x + y / 3 - 3, y]

In[13]:= Solve[{2 x + 4 y == 3, 2 x - 5 y == 6}, {x, y}]

In[14]:= Solve[Log[2 x] == 2 Log[3 x], x]
```

■ Functions

```
In[15]:= f[x_] := x + 1

In[16]:= f[4]

In[17]:= g[x_] := x^x

In[18]:= g[f[x]]

In[19]:= g[f[3]]
```

2D Graphing

```
In[20]:= Plot[x^2 - 3, {x, -4, 4}]

In[21]:= Plot[x^2 - 3, {x, -4, 4}, PlotRange → {-4, 6}, PlotStyle → Red, AspectRatio → Automatic]

In[22]:= Plot[Cos[x], {x, 0, 2 Pi}]

In[23]:= Plot[{x, x^2, x^3}, {x, -1, 1}, AspectRatio → Automatic]

In[24]:= ParametricPlot[{Cos[3 t], Sin[4 t]}, {t, 0, 2 Pi}]

In[25]:= data = RandomInteger[{0, 20}, {50, 2}]

In[26]:= ListPlot[data]

In[27]:= ListPlot[data, PlotStyle → {Blue, PointSize[Large]}]
```

3D Graphing

You can rotate 3D output with click-and-drag. You can zoom in and out by holding the Ctrl key while dragging.

```
In[28]:= Plot3D[y * Cos[x], {x, 0, 2 Pi}, {y, -3, 3}, PlotStyle → Red]

In[29]:= Plot3D[{2 - x^2 / 2 - y^2 / 2, x / 3 - y / 5 - 1}, {x, -3, 3}, {y, -3, 3},
          PlotStyle → {Yellow, Blue}, BoxRatios → Automatic]

In[30]:= ParametricPlot3D[{5 Cos[v] Sin[u], u * Cos[v], u * Sin[v]},
          {u, 0, 2 Pi}, {v, 0, 2 Pi}, BoxRatios → Automatic]

In[31]:= ParametricPlot3D[{5 Cos[v] Sin[u], u * Cos[v], u * Sin[v]}, {u, 0, 2 Pi},
          {v, 0, 2 Pi}, BoxRatios → Automatic, MeshShading → {{Blue, Yellow}},
          Boxed → False, Axes → False, Lighting → "Neutral"]
```

Manipulate

```
In[32]:= Manipulate[n, {n, 1, 10}]

In[33]:= Manipulate[Plot[Sin[b * x], {x, 0, 2 Pi}], {b, 1, 5}]

In[34]:= Manipulate[Plot[a * Sin[b * x], {x, 0, 2 Pi}, PlotRange → 5], {a, 0, 5}, {b, 1, 5}]

In[35]:= Manipulate[ParametricPlot3D[{u * Cos[v], u * Sin[v], u}, {u, -a, a},
           {v, 0, b}, PlotRange → 1, BoxRatios → Automatic, PlotStyle → clr],
         {a, 0.001, 1}, {b, 0.001, 2 Pi}, {clr, ColorSlider}]
```

Web Sites

www.MathematiClub.com

www.MathRules.org

www.wolfram.com

demonstrations.wolfram.com