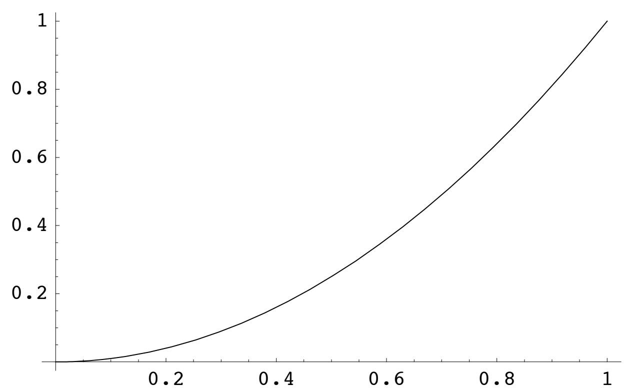
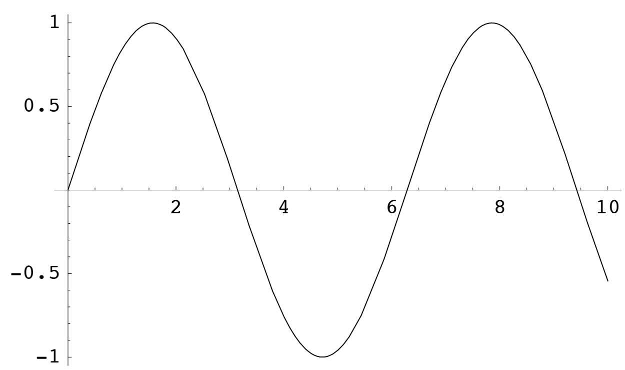
```
(* PHYSICS 171.106 MATHEMATICA SAMPLER *)

(* NB:  the (* ... *) delimit "comments" ie helpful
    text which Mathematica does not attempt to execute
    as input *)

(* This was prepared on a Mac, so it may look
      superficially different from PC-created output *)

(* Remember: hit SHIFT+RETURN to execute code *)

(* Note the "cell" structure on RH margin. Only
    code within one cell is executed at one time,
    but functions, constants etc defined in other
    cells are remembered. *)


(* Example 1: Simple Plotting *)

Plot[x^2, {x, 0, 1}]
```



- Graphics -

```
Plot[Sin[x], {x, 0, 10}]
```



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```
(* Example 2: Evaluating Functions:
         N[..] gives numerical value.  Note that
Mathematica functions use capital 1st letters
and enclose their arguments in square [] brackets
eg:  Sin[x], Cos[x], Exp[x], Log[x] *)
```

```
N[Sin[1]] (* default is radians *)
```

0.841471

```
N[Exp[1]]
```

2.71828

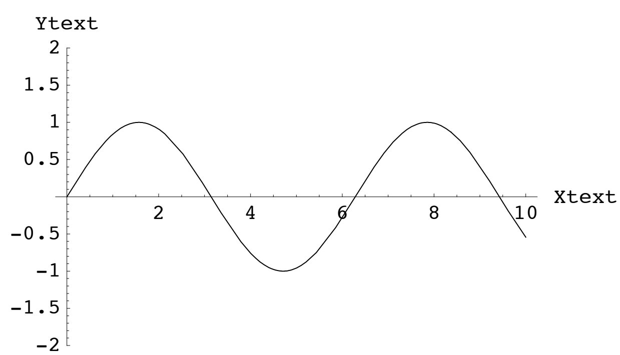
```
N[Sin[45 Degree]]  (* Degree is a constant defined
                       to be Pi/180 *)
```

0.707107

```
(* Example 3: Fancier Plotting *)
```

```
(* User-defined y-axis range, labeling x and
    y axes *)
```

```
Plot[Sin[x], {x, 0, 10}, PlotRange -> {-2, 2},
       AxesLabel -> {Xtext, Ytext}]
```



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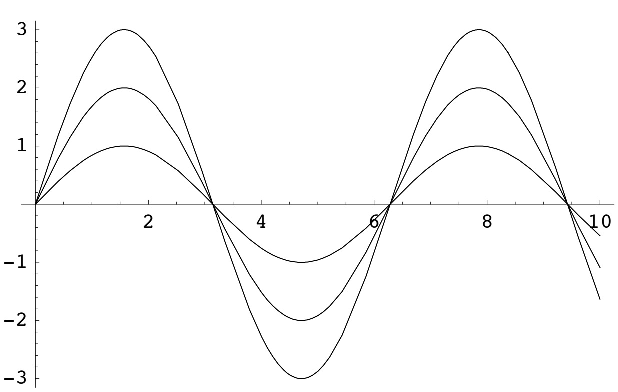
```
(* Multiple curves on one axis *)
```

```
Plot[{Sin[x], 2 Sin[x], 3 Sin[x]}, {x, 0, 10}]
```

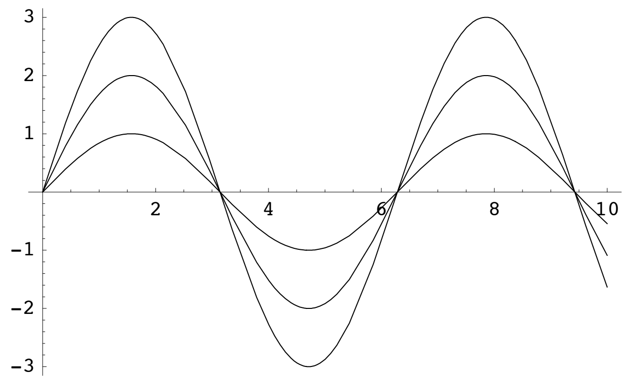


- Graphics -

```
(* Another way to do this:  Define a function
    with 2 arguments first.  Can save typing *)

(* Function definition: *)
f1[x_, a_] := a Sin[x]

(* Now plot f1[x,a] vs x at various a *)
Plot[{f1[x, 1], f1[x, 2], f1[x, 3]}, {x, 0, 10}]
```



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SYMBOLIC MATH

```
(* Solve a polynomial eqn
   NB: It has remembered that it set
a = 3 in the previous example*)
Solve[a x^2 + b x + c == 0, x]
```

MATH SYMBOLIC

$$\left\{\left\{x \to \frac{1}{6}\left(-b - \sqrt{b^2 - 12\,c}\right)\right\}, \left\{x \to \frac{1}{6}\left(-b + \sqrt{b^2 - 12\,c}\right)\right\}\right\}$$

```
(* Symbolic Differentiation *)

D[x^2, x]
```

2 x

```
D[Sin[x], x]
```

Cos[x]

```
D[Sin[b x]^2, x]
```

2 b Cos[b x] Sin[b x]

```
(* Symbolic Integration *)

(* Indefinite Integral *)
Integrate[b x^2, x]
```

$$\frac{b\,x^3}{3}$$

```
(* Definite Integral *)
Integrate[x^2, {x, b, c}]
```

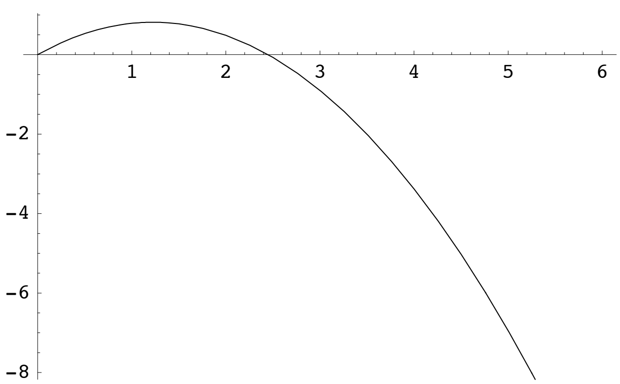
$$-\frac{b^3}{3}+\frac{c^3}{3}$$

```
(* Numerical Integration *)
NIntegrate[x^2, {x, 0, 1}]
```

0.333333

```
(* Parametric Plot
    This shows a parabolic trajectory such
as one might find for projectile motion*)

ParametricPlot[{3 t, 4 t - 9.8 t^2 / 2}, {t, 0, 2}]
```



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