[> restart:

1.1 Solving quadratic equations.

By hand: either try factoring, or if that doesn't work use the quadratic equation, that the roots of

[
$$a\,x^2 + b\,x + c = 0$$

are given by

$$x = \frac{-b + \sqrt{b^2 - 4\,a\,c}}{2\,a}$$

$$x = \frac{-b - \sqrt{b^2 - 4\,a\,c}}{2\,a}$$

1.1A

[
$$x^2 + 4\,x + 4 = (x + 2)^2$$

so the solution to

[
$$x^2 + 4\,x + 4 = 0$$
[

is x=-2. Maple can do this by

```
 > eqtn:=x^2+4*x+4:
   ans:=solve(eqtn=0,x);
   eqtn1:=(x-ans[1])*(x-ans[2]);
   expand(eqtn1);
```

$$ans := \text{-2, -2}$$
$$eqtn1 := (x + 2)^2$$
$$x^2 + 4\,x + 4$$

1.1B The roots of

[
$$x^2 + 2\,x + 3 = 0$$

are, (using the quadratic formula)

$$x = -1 + \sqrt{2}\,I$$
$$x = -1 - \sqrt{2}\,I$$

so the equation factors into

[
$$(x + 1 - \sqrt{2}\,I)\,(x + 1 + \sqrt{2}\,I) = 0$$

Maple check:

```
> eqtn:=x^2+2*x+3:
  ans:=solve(eqtn=0,x);
  eqtn1:=(x-ans[1])*(x-ans[2]);
  expand(eqtn1);
```

$$ans := -1 + \sqrt{2}\, I, \ -1 - \sqrt{2}\, I$$

$$eqtn1 := (x + 1 - \sqrt{2}\, I)(x + 1 + \sqrt{2}\, I)$$

$$x^2 + 2\,x + 3$$

1.1C

$$x^2 - 4\,x + 3 = (x - 3)(x - 1)$$

so the roots of eqtn=0 are

$$x = 3$$

$$x = 1$$

Maple:

```
> eqtn:=x^2-4*x+3:
  ans:=solve(eqtn=0,x);
  eqtn1:=(x-ans[1])*(x-ans[2]);
  expand(eqtn1);
```

$$ans := 3, \ 1$$
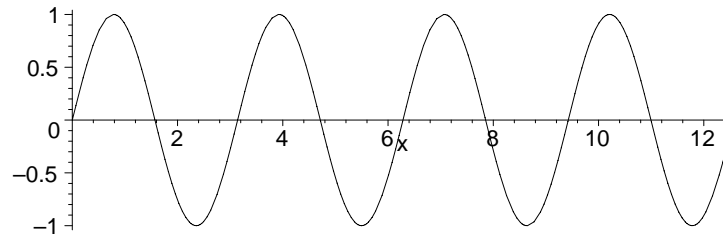
$$eqtn1 := (x - 3)(x - 1)$$

$$x^2 - 4\,x + 3$$

Problem 2:

```
> with(plots):
Warning, the name changecoords has been redefined
```

1.2.A

```
> f:=x->sin(2*x);
  plot(f(x),x=0..4*Pi,color=black);
```
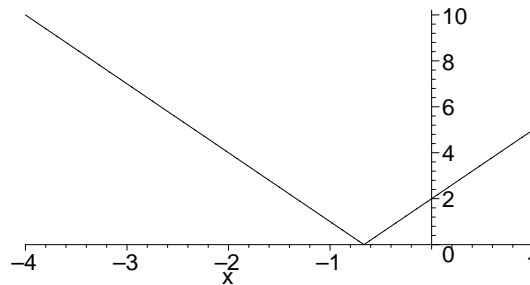
$$f := x \rightarrow \sin(2\,x)$$

1.2.B

```
> g:=x->abs(3*x+2);
  plot(g(x),x=-4..1,color=black);
```

$$g := x \rightarrow \left| 3\,x + 2 \right|$$

1.2.C

```
> h:=x->10+1.5*sin(Pi/12*(t-12));
  plot(h(t),t=0..24,color=black);
```

$$h := x \rightarrow 10 + 1.5\,\sin\!\left(\frac{\pi\,(t-12)}{12}\right)$$