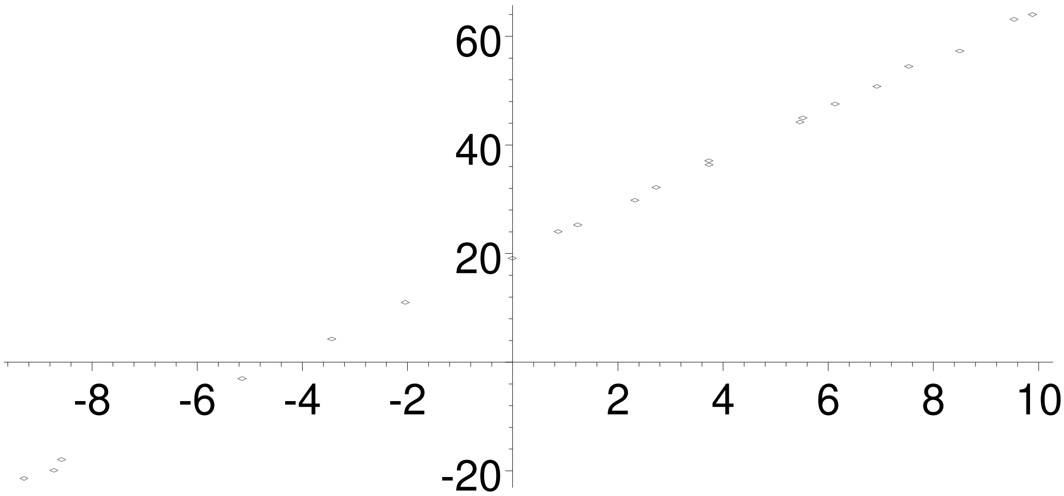
```
> read
  "/home/mat331/Worksheets1/lsq_da
  ta.txt";
defined line_pts(), bad_line_pts(), quadr
atic_pts(), cubic_pts(), and circle_pts()
> pts:=line_pts():
> plot(pts,style=point);
```




```
> pts[7];
```

$$[-3.440918072, 4.269011456]$$

```
> pts[7][1];
```

$$-3.440918072$$

```
> nops(pts);
```

$$21$$

```
> epsilon:= (m,b, pt) ->  (m*pt[1]
```

```
+ b - pt[2]);
```

$$\varepsilon := (m, b, pt) \to m\, pt_1 + b - pt_2$$

```
> E :=(m,b, pts) -> sum( (
epsilon(m, b, pts[i]))^2 ,
i=1..nops(pts));
```

$$E := (m, b, pts) \to \sum_{i=1}^{\mathrm{nops}(pts)} \varepsilon(m, b, pts_i)^2$$

```
> epsilon( 2, 0, [1,1]);
```

$$1$$

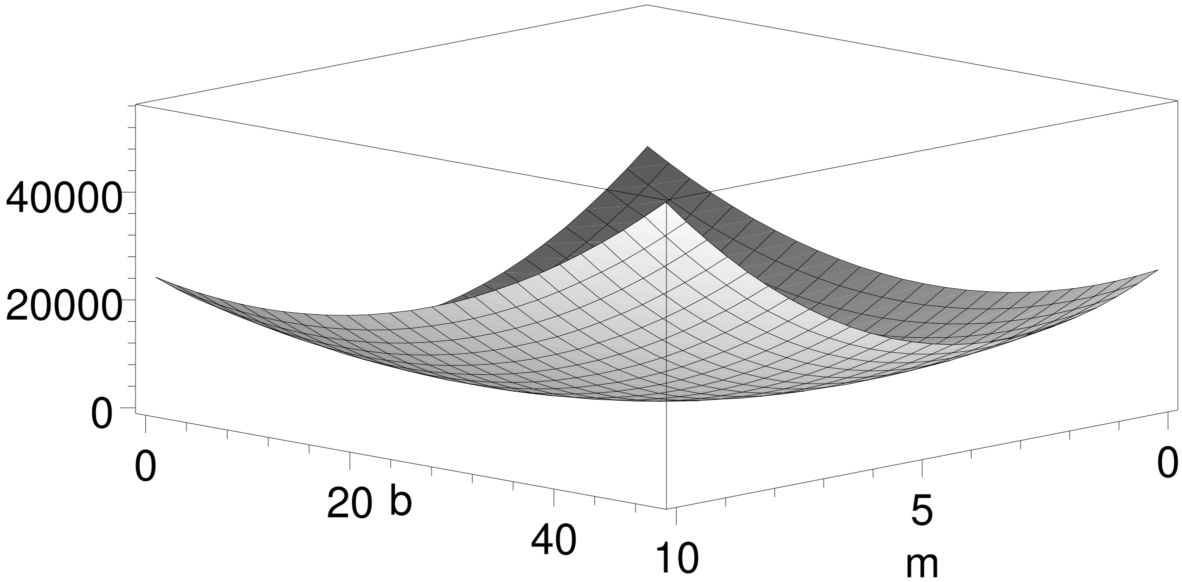
```
> E(5,19, pts);
```

$$197.5100234$$

```
>
E(6,19, pts);
```

$$1729.015303$$

```
> plot3d( E(m,b,pts), m=0..10,
b=0..50);
```



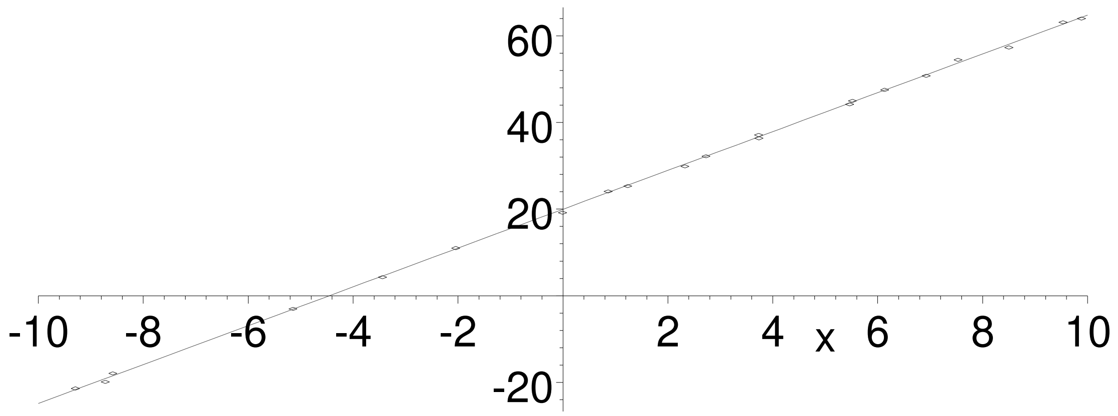

```
> solve( { diff(E(m,b,pts), m) = 0,
           diff(E(m,b,pts), b) = 0}, {m,b});
```

$$\{b = 19.91233434, m = 4.481562959\}$$

```
> myline:= ( subs(%, m*x+b) );
```

$$myline := 4.481562959\,x + 19.91233434$$

```
> linepic:=plot(myline,x=-10..10):
  ptpic:=plot(pts,style=point,color=blue):
> with(plots):
> display([linepic,ptpic]);
```

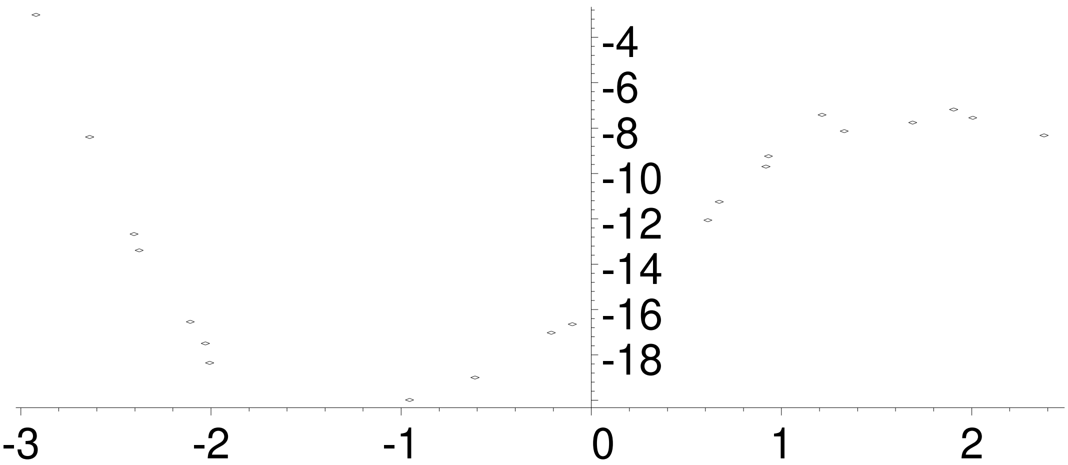



```
> E(4.481562959,19.91233434, pts);
```

3.935580215

Let's try a cubic!

```
> cpts:=cubic_pts():
  plot(cpts,style=point,color=blue
  );
```




```
> delta:= (a,b,c,d, pt) ->
    (a*pt[1]^3 + b*pt[1]^2 +
  c*pt[1] + d - pt[2]);
  H:= (a,b,c,d, pts) -> sum(
  (delta(a,b,c,d,pts[i]))^2,
  i=1..nops(pts));
```

$\delta :=$

$$(a, b, c, d, pt) \rightarrow a\, pt_1^{\,3} + b\, pt_1^{\,2} + c\, pt_1 + d - pt_2$$

$$H := (a, b, c, d, pts) \rightarrow \sum_{i=1}^{\mathrm{nops}(pts)} \delta(a, b, c, d, pts_i)^2$$

```
> solve( { diff(H(a,b,c,d,cpts),
  a) = 0,
```

```
                 diff(H(a,b,c,d,cpts),
  b) = 0,
                 diff(H(a,b,c,d,cpts),
  c) = 0,
                 diff(H(a,b,c,d,cpts),
  d) = 0}, {a,b,c,d});
```

$$\{ c = 6.616224444, a = -1.005087393, b = .8355506861, d = -15.74841159 \}$$

```
> mycub := subs(%, a*x^3 + b*x^2 +
  c*x + d);
```

$$mycub := -1.005087393\, x^3 + .8355506861\, x^2 + 6.616224444\, x - 15.74841159$$

```
>
```