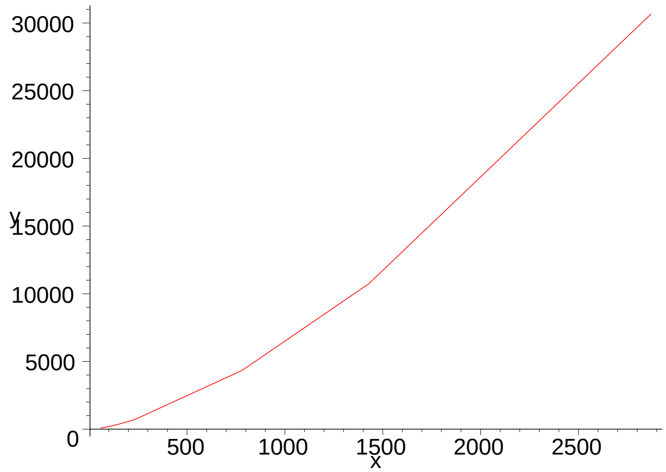
```
> restart; with(linalg):
Warning, the protected names norm and trace have been redefined and
unprotected
```

Plotting x versus y

```
> p1:=[[60,90],[110,225],[150,365],[230,690],[780,4330],[1430,1
  0750],[2870,30650]]; plot(p1, scaling=unconstrained,
  labels=["x","y"]);
```

p1 :=

[[60, 90], [110, 225], [150, 365], [230, 690], [780, 4330], [1430, 10750], [2870, 30650]]

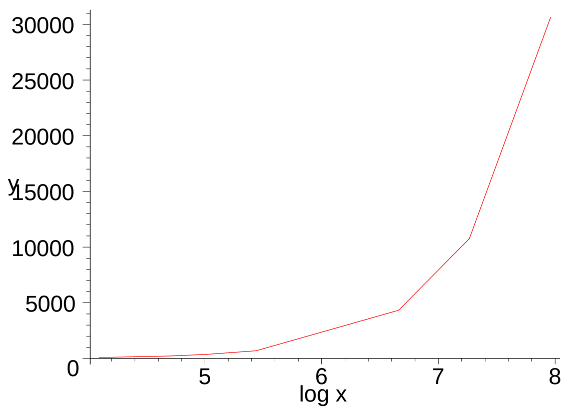


Plotting log x versus y

```
> p2:=[[log(60),90],[log(110),225],[log(150),365],[log(230),690
  ],[log(780),4330],[log(1430),10750],[log(2870),30650]];
  plot(p2, scaling=unconstrained, labels=["log x", "y"]);
```

p2 := [[ln(60), 90], [ln(110), 225], [ln(150), 365], [ln(230), 690], [ln(780), 4330],

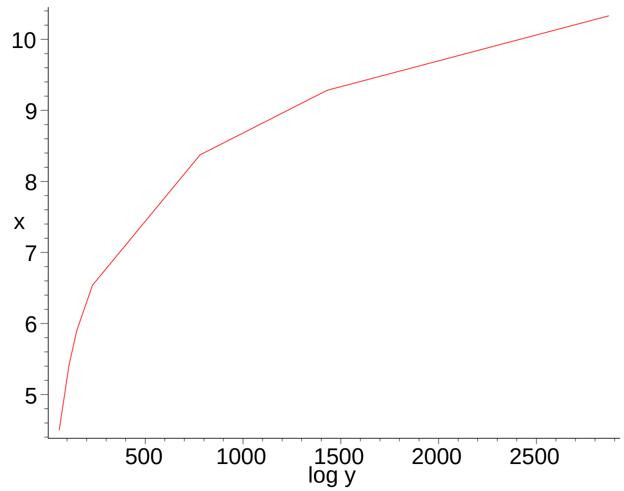
[ln(1430), 10750], [ln(2870), 30650]]



Plotting x versus log y

```
> p3:=[[60,log(90)],[110,log(225)],[150,log(365)],[230,log(690)
  ],[780,log(4330)],[1430,log(10750)],[2870,log(30650)]];
  plot(p3, scaling=unconstrained, labels=["log y", "x"]);
```

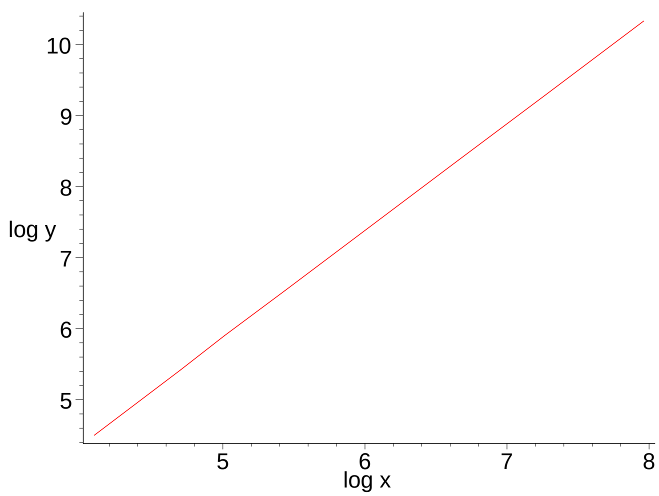
$p3 := [[60, \ln(90)], [110, \ln(225)], [150, \ln(365)], [230, \ln(690)], [780, \ln(4330)], [1430, \ln(10750)], [2870, \ln(30650)]]$



Plotting log x versus log y

```
> p4:=[[log(60),log(90)],[log(110),log(225)],[log(150),log(365)
],[log(230),log(690)],[log(780),log(4330)],[log(1430),log(107
50)],[log(2870),log(30650)]];plot(p4, scaling=unconstrained,
labels=["log x", "log y"]);
```

$p4 := [[\ln(60), \ln(90)], [\ln(110), \ln(225)], [\ln(150), \ln(365)], [\ln(230), \ln(690)], [\ln(780), \ln(4330)], [\ln(1430), \ln(10750)], [\ln(2870), \ln(30650)]]$




```
> A:=matrix([[log(60),1],[log(110),1],[log(150),1],[log(230),1]
,[log(780),1],[log(1430),1],[log(2870),1]]); B:=transpose(A);
```

$$A := \begin{bmatrix} \ln(60) & 1 \\ \ln(110) & 1 \\ \ln(150) & 1 \\ \ln(230) & 1 \\ \ln(780) & 1 \\ \ln(1430) & 1 \\ \ln(2870) & 1 \end{bmatrix}$$

$$B := \begin{bmatrix} \ln(60) & \ln(110) & \ln(150) & \ln(230) & \ln(780) & \ln(1430) & \ln(2870) \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{bmatrix}$$

```
> X:=matrix([[a], [b]]);
  V:=matrix([[log(90)],[log(225)],[log(365)],[log(690)],[log(43
  30)],[log(10750)],[log(30650)]]);
```

$$X := \begin{bmatrix} a \\ b \end{bmatrix}$$

$$V := \begin{bmatrix} \ln(90) \\ \ln(225) \\ \ln(365) \\ \ln(690) \\ \ln(4330) \\ \ln(10750) \\ \ln(30650) \end{bmatrix}$$

the map(f, a) maps a function f onto each element in the array, vector, or matrix A. In this case, I am mapping the evalf (evaluate floating-point) function on every element in A and B and setting itself equal.

```
> A:=map(evalf, A); B:=map(evalf, B); V:=map(evalf, V);
```

$$A := \begin{bmatrix} 4.094344562 & 1. \\ 4.700480366 & 1. \\ 5.010635294 & 1. \\ 5.438079309 & 1. \\ 6.659293920 & 1. \\ 7.265429723 & 1. \\ 7.962067309 & 1. \end{bmatrix}$$

$B :=$

[4.094344562 , 4.700480366 , 5.010635294 , 5.438079309 , 6.659293920 , 7.265429723 , 7.962067309]

[1. , 1. , 1. , 1. , 1. , 1. , 1.]

$$V := \begin{bmatrix} 4.499809670 \\ 5.416100402 \\ 5.899897354 \\ 6.536691598 \\ 8.373322821 \\ 9.282661034 \\ 10.33038794 \end{bmatrix}$$

```
> evalm(A)*evalm(X) =evalm(V);
```

$$\begin{bmatrix} 4.094344562 & 1. \\ 4.700480366 & 1. \\ 5.010635294 & 1. \\ 5.438079309 & 1. \\ 6.659293920 & 1. \\ 7.265429723 & 1. \\ 7.962067309 & 1. \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} 4.499809670 \\ 5.416100402 \\ 5.899897354 \\ 6.536691598 \\ 8.373322821 \\ 9.282661034 \\ 10.33038794 \end{bmatrix}$$

```
> evalm(B&*A)*evalm(X) = evalm(B&*V);
```

$$\begin{bmatrix} 254.0645261 & 41.13033048 \\ 41.13033048 & 7. \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} 314.4455093 \\ 50.33887082 \end{bmatrix}$$

```
> solve({254.0645261*a + 41.13033048*b = 314.4455093,
  41.13033048*a + 7*b = 50.33887082}, {a,b});
```

$$\{b = -1.659139396, a = 1.506256961\}$$

```
> log(T) = 1.506256961*log(r) - 1.659139396;
```

$$\ln(T) = 1.506256961 \ln(r) - 1.659139396$$

```
> solve(log(T) = 1.506256961*log(r) - 1.659139396, T);
```

$$\mathbf{e}^{(1.506256961 \ln(r) - 1.659139396)}$$

```
> T := exp(1.506256961*ln(r)-1.659139396);
```

$$T := \mathbf{e}^{(1.506256961 \ln(r) - 1.659139396)}$$

```
> T:=simplify(T);
```

$$T := .1903026849\, r^{\left(\frac{1506256961}{1000000000}\right)}$$

As can be seen here, the exponent on r is approx. 3/2, which coincides with our knowledge of Kepler's Law (T^2 = r^3)

$T = \sqrt{r^3}$, $T^2 = r^3$