```
> restart:
```
Define Etotal and obtain in terms of equilibrium coefficient, E and M only
```
> eqn1:={Etotal=E+ME};
```
$$eqn1 := \{Etotal = E + ME\}$$
```
> eqn2:=algsubs( ME=BME*M*E, eqn1 );
```
$$eqn2 := \{Etotal = E + BME\ M\ E\}$$
Now obtain E as function of Etotal
```
> solve(eqn2,E);
```
$$\left\{E = \frac{Etotal}{1 + BME\ M}\right\}$$
Now, work towards getting M in terms of equilibrium coefficient and E, which will allow us to solve E and M
```
> eqn3:= {Mtotal=M+ME};
```
$$eqn3 := \{Mtotal = M + ME\}$$
```
> eqn4:= algsubs(ME=BME*M*E, eqn3 );
```
$$eqn4 := \{Mtotal = M + BME\ M\ E\}$$
Substitute the expression for E found earlier, giving Mtotal in terms of equilibrium coefficients and M only
```
> eqn5:= algsubs( E = Etotal/(1+BME*M), eqn4 );
```
$$eqn5 := \left\{Mtotal = \frac{M\ (1 + BME\ M + BME\ Etotal)}{1 + BME\ M}\right\}$$
```
> Msol := solve(Mtotal = M (1 + BME M + BME Etotal) / (1 + BME M), M);
```
$$Msol := -\frac{1}{2}\frac{1}{BME}\Big(-Mtotal\ BME + 1 + BME\ Etotal - \big(Mtotal^2\ BME^2 + 2\ Mtotal\ BME - 2\ Mtotal\ BME^2\ Etotal + 1 + 2\ BME\ Etotal + BME^2\ Etotal^2\big)^{1/2}\Big), -\frac{1}{2}\frac{1}{BME}\Big(-Mtotal\ BME + 1 + BME\ Etotal + \big(Mtotal^2\ BME^2 + 2\ Mtotal\ BME - 2\ Mtotal\ BME^2\ Etotal + 1 + 2\ BME\ Etotal + BME^2\ Etotal^2\big)^{1/2}\Big)$$
Obviously the first solution was the important one. Now, we can obtain E
```
> Esol:=Etotal/(1+BME*Msol[1]);
```
$$Esol := Etotal \Big/ \Big(\frac{1}{2} + \frac{1}{2}\ Mtotal\ BME - \frac{1}{2}\ BME\ Etotal + \frac{1}{2}\ \big(Mtotal^2\ BME^2 + 2\ Mtotal\ BME - 2\ Mtotal\ BME^2\ Etotal + 1 + 2\ BME\ Etotal + BME^2\ Etotal^2\big)^{1/2}\Big)$$

Having M and E we can obtain ME

```
> MEsol:=BME*Msol[1]*Esol;
```

$$MEsol := -\frac{1}{2}\left(\left(-Mtotal\ BME + 1 + BME\ Etotal - \left(Mtotal^2\ BME^2 + 2\ Mtotal\ BME - 2\ Mtotal\ BME^2\ Etotal + 1 + 2\ BME\ Etotal + BME^2\ Etotal^2\right)^{1/2}\right) Etotal\right) \Big/ \left(\frac{1}{2} + \frac{1}{2}\ Mtotal\ BME - \frac{1}{2}\ BME\ Etotal + \frac{1}{2}\left(Mtotal^2\ BME^2 + 2\ Mtotal\ BME - 2\ Mtotal\ BME^2\ Etotal + 1 + 2\ BME\ Etotal + BME^2\ Etotal^2\right)^{1/2}\right)$$

Now we can substitute the concentrations of M and ME into the expression for the observed fluorescence in terms of molar emission coefficients for M and ME

```
> eqn6 := IM·Msol[1] + IME·MEsol;
```

$$eqn6 := -\frac{1}{2}\ \frac{1}{BME}\left(IM\left(-Mtotal\ BME + 1 + BME\ Etotal - \left(Mtotal^2\ BME^2 + 2\ Mtotal\ BME - 2\ Mtotal\ BME^2\ Etotal + 1 + 2\ BME\ Etotal + BME^2\ Etotal^2\right)^{1/2}\right)\right) - \frac{1}{2}\left(IME\left(-Mtotal\ BME + 1 + BME\ Etotal - \left(Mtotal^2\ BME^2 + 2\ Mtotal\ BME - 2\ Mtotal\ BME^2\ Etotal + 1 + 2\ BME\ Etotal + BME^2\ Etotal^2\right)^{1/2}\right) Etotal\right) \Big/ \left(\frac{1}{2} + \frac{1}{2}\ Mtotal\ BME - \frac{1}{2}\ BME\ Etotal + \frac{1}{2}\left(Mtotal^2\ BME^2 + 2\ Mtotal\ BME - 2\ Mtotal\ BME^2\ Etotal + 1 + 2\ BME\ Etotal + BME^2\ Etotal^2\right)^{1/2}\right)$$

Now substitute some trial values for SCC

$$> IntensitySCC := subs\left(BME = 1000000, IM = \frac{0.838}{Mtotal}, IME = \frac{2}{Mtotal}, Mtotal = 0.00005, eqn6\right);$$

$$IntensitySCC := 0.4106200000 - 8380.000000 Etotal + 0.008380000000 \sqrt{2601.000000 - 9.800000001 10^7 Etotal + 1000000000000 Etotal^2} - \left(20000.00000\left(-49.00000 + 1000000 Etotal - \left(2601.000000 - 9.800000001 10^7 Etotal + 1000000000000 Etotal^2\right)^{1/2}\right) Etotal\right) \Big/ \left(25.50000000 - 500000 Etotal + \frac{1}{2}\left(2601.000000 - 9.800000001 10^7 Etotal + 1000000000000 Etotal^2\right)^{1/2}\right)$$

this command is needed for Maple to use its full graphing capability

```
> with(plots);
```

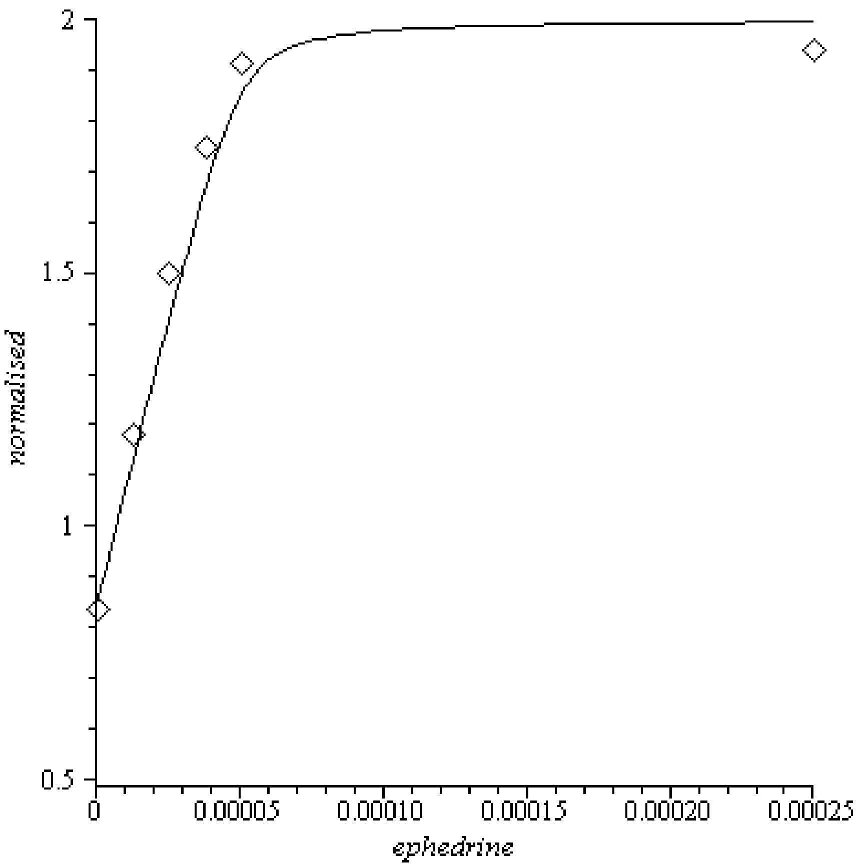
[*animate*, *animate3d*, *animatecurve*, *arrow*, *changecoords*, *complexplot*, *complexplot3d*, *conformal*, *conformal3d*, *contourplot*, *contourplot3d*, *coordplot*, *coordplot3d*, *densityplot*, *display*, *dualaxisplot*, *fieldplot*, *fieldplot3d*, *gradplot*, *gradplot3d*, *graphplot3d*, *implicitplot*, *implicitplot3d*, *inequal*, *interactive*, *interactiveparams*, *intersectplot*, *listcontplot*, *listcontplot3d*, *listdensityplot*, *listplot*, *listplot3d*, *loglogplot*, *logplot*, *matrixplot*, *multiple*, *odeplot*, *pareto*, *plotcompare*, *pointplot*, *pointplot3d*, *polarplot*, *polygonplot*, *polygonplot3d*, *polyhedra_supported*, *polyhedraplot*, *rootlocus*, *semilogplot*, *setcolors*, *setoptions*, *setoptions3d*, *spacecurve*, *sparsematrixplot*, *surfdata*, *textplot*, *textplot3d*, *tubeplot*]

The data for SCC emission at 510 nm

```
> dataSCC:=
{[0,0.838247],[0.0000125,1.185894],[0.000025,1.50246
],[0.0000375,1.749829],[0.00005,1.916836],[0.00025,1.944795
]]}:
> pntplotSCC :=
pointplot(dataSCC,symbol=diamond,symbolsize=20);
```

$$pntplotSCC := PLOT(\ldots)$$

```
> intensityplotSCC:=
plot(IntensitySCC,Etotal=0..0.00025,color=black):
display([pntplotSCC,intensityplotSCC],view=[0..0.00025,0.5.
.2],labels=[ephedrine,
normalised],labeldirections=[horizontal, vertical]);
```



Now some trial values for VCC

```
> IntensityVCC := subs(BME = 1000000, IM = .991/Mtotal, IME
= 0.5/Mtotal, Mtotal = 0.5e-4, eqn6);
```

$$IntensityVCC := 0.4855900000 - 9910.000000 Etotal + 0.009910000000 \sqrt{2601.000000 - 9.8000000010^{7}\, Etotal + 1000000000000 Etotal^{2}} - \left(5000.000000\left(-49.00000 + 1000000 Etotal - \left(2601.000000 - 9.8000000010^{7}\, Etotal + 1000000000000 Etotal^{2}\right)^{1/2}\right) Etotal\right) \Big/ \left(25.50000000 - 500000 Etotal + \frac{1}{2}\left(2601.000000 - 9.8000000010^{7}\, Etotal + 1000000000000 Etotal^{2}\right)^{1/2}\right)$$

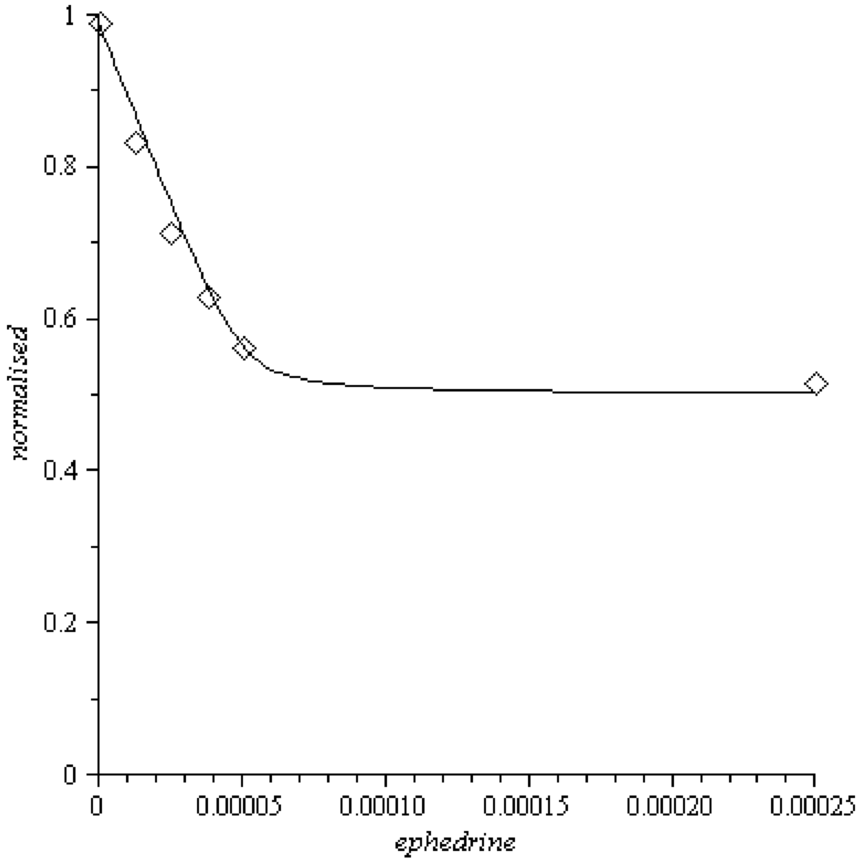
and the data for VCC at 510 nm

> $dataVCC := \{[0, 0.990993], [0.0000125, 0.834232], [0.000025, 0.71398$
$], [0.0000375, 0.631177], [0.00005, 0.565339], [0.00025, 0.517887]\}:$

```
> pntplotVCC := 
pointplot(dataVCC,symbol=diamond,symbolsize=20);
```

$$pntplotVCC := PLOT(...)$$

```
> intensityplotVCC:= 
plot(IntensityVCC,Etotal=0..0.00025,color=black):
display([pntplotVCC,intensityplotVCC],view=[0..0.00025,0..1
],labels=[ephedrine,
normalised],labeldirections=[horizontal, vertical]);
```



Now some trial values for PV

```
> IntensityPV := subs(BME = 100000, IM = 1/Mtotal, IME = 
0.4/Mtotal, Mtotal = 0.5e-4, eqn6);
```

$$IntensityPV := 0.4000000000 - 10000.00000 Etotal + 0.1000000000 \sqrt{36.00000000 - 8.0000000010^{5}\, Etotal + 10000000000 Etotal^{2}} - \left(4000.000000 \left(-4.00000 + 100000 Etotal - \sqrt{36.00000000 - 8.0000000010^{5}\, Etotal + 10000000000 Etotal^{2}}\right) Etotal\right) \Big/ \left(3.000000000 - 50000 Etotal + \frac{1}{2} \sqrt{36.00000000 - 8.0000000010^{5}\, Etotal + 10000000000 Etotal^{2}}\right)$$

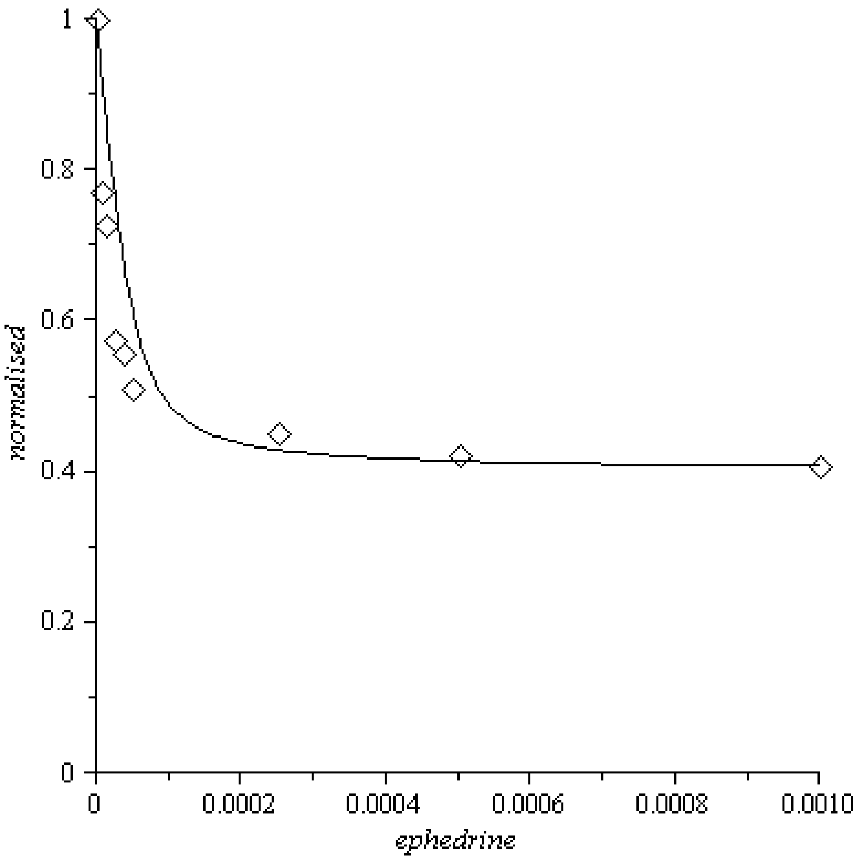
and the data for PV at 454 nm

```
> dataPV := {[0, 1], [0.00000625, 0.772236], [0.0000125, 0.72846],
    [0.000025, 0.573828], [0.0000375, 0.558383], [0.00005, 0.50982],
    [0.00025, 0.452838], [0.0005, 0.421438], [0.001, 0.408197]} :
```

```
> pntplotPV :=
pointplot(dataPV,symbol=diamond,symbolsize=20);
```

$$pntplotPV := PLOT(...)$$

```
> intensityplotPV:=
plot(IntensityPV,Etotal=0..0.001,color=black):
display([pntplotPV,intensityplotPV],view=[0..0.001,0..1],la
bels=[ephedrine, normalised],labeldirections=[horizontal,
vertical]);
```



Now some trial values for PS

```
> IntensityPS := subs(BME = 100000, IM = .991/Mtotal, IME =
0.6/Mtotal, Mtotal = 0.5e-4, eqn6);
```

$$IntensityPS := 0.3964000000 - 9910.000000\,Etotal + 0.09910000000\sqrt{36.00000000 - 8.0000000010^{5}\,Etotal + 10000000000\,Etotal^{2}} - \left(6000.000000\left(-4.00000 + 100000\,Etotal - \sqrt{36.00000000 - 8.0000000010^{5}\,Etotal + 10000000000\,Etotal^{2}}\right) Etotal\right) \Big/ \left(3.000000000 - 50000\,Etotal + \frac{1}{2}\sqrt{36.00000000 - 8.0000000010^{5}\,Etotal + 10000000000\,Etotal^{2}}\right)$$

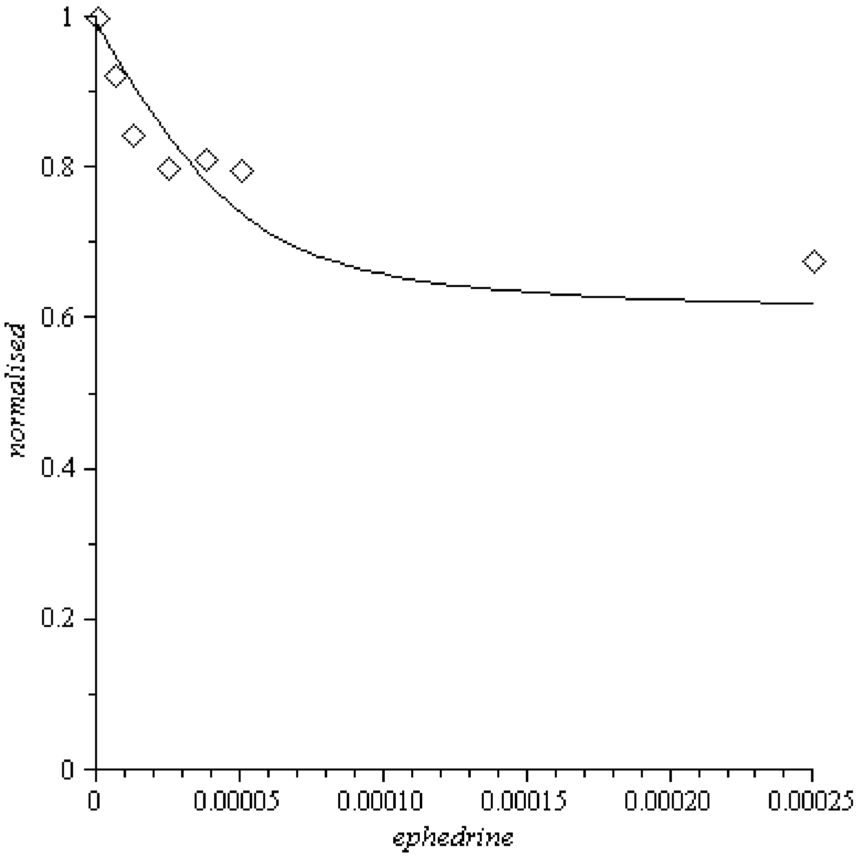
and the data for PS at 510 nm

```
> dataPS := {[0, 1], [0.00000625, 0.923817], [0.0000125, 0.844778],
   [0.000025, 0.801754], [0.0000375, 0.813593], [0.00005, 0.796886],
   [0.00025, 0.677061], [0.0005, 0.633561], [0.001, 0.621755]} :
```

```
> pntplotPS :=
pointplot(dataPS,symbol=diamond,symbolsize=20);
```

$pntplotPS := PLOT(...)$

```
> intensityplotPS:=
plot(IntensityPS,Etotal=0..0.00025,color=black):
display([pntplotPS,intensityplotPS],view=[0..0.00025,0..1],
labels=[ephedrine, normalised],labeldirections=[horizontal,
vertical]);
```



> ?

> ?