Prob. 19.1 - plot exponential functions

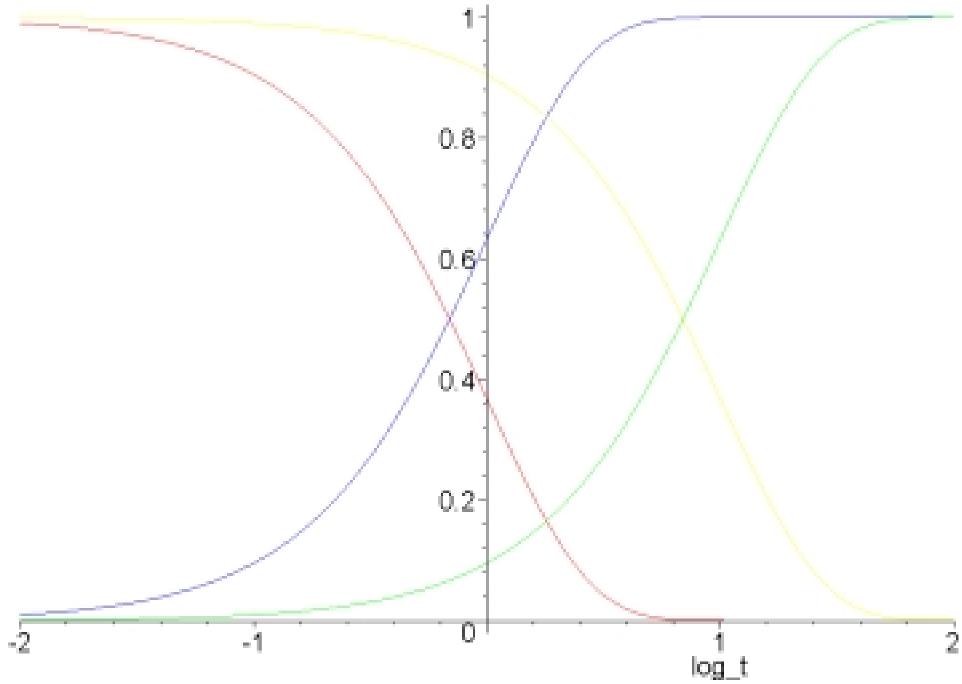
```
> f[1]:=exp(-t/tau);f[2]:=1-f[1];
```

$$f_1 := \mathbf{e}^{\left(-\frac{t}{\tau}\right)}$$

$$f_2 := 1 - \mathbf{e}^{\left(-\frac{t}{\tau}\right)}$$

Define variable for logarithmic plotting, plot over specified range:

```
> plot({subs({t=10^log_t,tau=1},f[1]),subs({t=10^log_t,tau=10},f[1])
  ,subs({t=10^log_t,tau=1},f[2]),subs({t=10^log_t,tau=10},f[2])},log
  _t=-2..2);
```



Here red and blue are tau=1, and yellow and green are tau=10. Note that an inflection occurs at the relaxation time, and the transition spans only approximately one decade of time on either side of the relaxation time. Changing the relaxation time shifts the curve along the log *t* axis without change in shape.

Prob. 19.2 - activation energy calculation

General Arrhenius expression for rate:

```
> rate:=rate_0*exp(-Estar/(R*T));
```

$$rate := rate\_0\ \mathbf{e}^{\left(-\frac{Estar}{R\,T}\right)}$$

```
> R:=8.314:Digits:=4:
```

Set ratio of rates at 30 & 20 C to 2; solve for activation energy:

```
> 'E'=solve(2=subs(T=30+273,rate)/subs(T=20+273,rate),Estar)/1000,'
  kJ/mol';
```

$$E = 50.97, \frac{kJ}{mol}$$