Problem 5.4

Define points on 20C line

```
> with(geometry):point(p1_20,44e6/(20+273),ln(1e-4)):
> point(p2_20,53.2e6/(20+273),ln(1e-2)):
```

get slope of line and multiply by 2R to get activation volume

```
> Digits:=4:'V (m^3/mol)'= 2*8.314*slope(p2_20,p1_20);
```

$$V\left(\frac{m^3}{mol}\right) = .002440$$

Compute activation energy by horizontal difference between 20C and -60C lines

```
> eq:=(V/2)*((69e6/(-60+273)) -
  (44e6/(20+273)))=Delta[H]*(1/(-60+273) - 1/(20+273));
```

$$eq := 211.9 = \frac{80}{62409}\,\Delta_H$$

```
> 'Delta[H] (kJ/mol) ' = solve(eq,Delta[H])/1000;
```

$$\Delta_H\left(\frac{kJ}{mol}\right) = 165.3$$