**Chemistry 1S - Dr Paul May**

**Calculus Question for January Exam 2010**

1. Consider the function: *y*(*x*) = 

(a) Differentiate *y*(*x*) using the Quotient Rule.

*(5 marks)*

(b) Use the Chain Rule (or Function-of-a-Function Rule) to differentiate:  
 *v*(*x*) = (*x* – 5)‑1

*(5 marks)*

(c) Using your answer to part (b) and by rewriting *y*(*x*) as:  
 *y*(*x*) = (*x* + 3)×(*x* – 5)‑1,   
differentiate *y*(*x*) using the Product Rule, and check that the answer is the same as that from part (a).

*(6 marks)*

(d) Determine the co-ordinates (*x*,*y*) of the stationary point(s) of *y*(*x*), if it has any.

*(6 marks)*

(e) Using your answer to part (d) sketch *y*(*x*) between *x* = ‑2 and *x* = +4.

*(8 marks)*

**Answers**

3)

(a) Using Quotient Rule, *y*(*x*) = , 

(b) *v*(*x*) = (*x* ‑ 5)-1; using F-of-F Rule, d*v*/d*x* = ‑1(*x* – 5)-2(1) = ‑(*x* – 5)-2 = 

(c) If *y*(*x*) = (*x* + 3)×(*x* ‑ 2)-1; using Product Rule: *y*(*x*) = *u*(*x*)×*v*(*x*),

 = *u* + *v* and noticing that *v*(*x*) is the same as that in part (b) so that we’ve already worked out d*v*/d*x*,

= (*x* + 3)×() + (*x* ‑ 5)-1×(1) = 

Putting over a common denominator: =

This is the same as (a).

(d) At the t.p. d*y/*d*x* = 0, so = 0, so the only turning points are at *x* = ± infinity. This is a bit of a trick question, since the curve doesn’t really have any *real* turning points as such.

(e) The curve obviously does something odd at *x* = +5, since both the corresponding *y* value and the gradient go to infinity. The curve also goes to zero at *x* = ‑3. When *x* is very large and +ve, *y* looks like +1. When *x* is large and –ve, *y* looks like +1. When *x*=0, *y* = – 3/5.  
(The curve must be the right shape, the axes must be labelled, and the t.p. and *y* intercept must also be labelled to get the full marks. You only need to plot up as far as *x*=+4 to get the marks.)

