2. With respect to a fixed origin O, the lines l_1 and l_2 are given by the equations

$$l_1: \quad \mathbf{r} = \begin{pmatrix} -2 \\ 5 \\ 3 \end{pmatrix} + \lambda \begin{pmatrix} 2 \\ -1 \\ 5 \end{pmatrix} \qquad l_2: \quad \mathbf{r} = \begin{pmatrix} 6 \\ 12 \\ -5 \end{pmatrix} + \mu \begin{pmatrix} 4 \\ -3 \\ 10 \end{pmatrix}$$

where λ and μ are scalar parameters.

(a) With reference to the equations, explain why l_1 and l_2 are not parallel.

(1)

(b) Prove by contradiction that l_1 and l_2 do not intersect.

(5)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 2 continued

(Total for Question 2 is 6 marks)

3. The curve C is defined by the parametric equations

$$x = \frac{4}{t+2} \qquad y = \frac{6t}{t+4} \qquad t > -1$$

The point P with parameter $t = 2$ lies on C.

(a) Use parametric differentiation to find the equation of the tangent to C at P. Give the answer in the form $y = mx + c$, where m and c are constants.

(5)

(b) Show that the equation of C can be written in the form $y = \mathrm{f}(x)$ where

$$\mathrm{f}(x) = \frac{ax+b}{x+d} \qquad 0 < x < k$$

and where a, b, d and k are integers to be found.

(4)

(c) Hence, or otherwise, find the range of f.

(2)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA