

**Advanced Higher Homework 9**

1. Find all the vertical asymptotes of each of the following rational functions and show, by sketching asymptote diagrams, how each function behaves immediately to the left and right of each asymptote.

(a)  $f(x) = \frac{-2}{x-3}$

(b)  $f(x) = \frac{2x+14}{x-3}$

(c)  $f(x) = \frac{2x^2+14}{x-3}$

(d)  $f(x) = \frac{x-3}{(x-1)(x+5)}$

(e)  $f(x) = \frac{(4x-1)(x-3)}{(2x+1)(x-4)}$

(f)  $f(x) = \frac{8x^3}{(2x-1)(x+1)}$

2. Find the non-vertical asymptotes of the rational functions from Q1 and sketch asymptote diagrams to show how the functions behave for  $x \rightarrow \pm \infty$ .

3. (a) For the functions shown in Q1(b), sketch the curve, label stationary points (if any) and indicate where the graphs cross the coordinate axes.  
 (b) Repeat for the function shown in Q1(c).  
 (c) Repeat for the function shown in Q1(d).

4. State whether the following functions are odd, even or neither. (Show working.)

(a)  $f(x) = \frac{x^2}{x^3+1}$

(b)  $f(x) = \frac{x^2}{x^4+1}$

(c)  $f(x) = x \cos x$

(d)  $f(x) = x^3 \sin x$