



Standard Level DIFFERENTIATION TEST 2014

Non Calculator Time 50 min

1) Let $f(x) = \frac{6x}{x+1}$, for $x > 0$.

(a) Find $f'(x)$. [5 marks]

Let $g(x) = \ln\left(\frac{6x}{x+1}\right)$, for $x > 0$.

(b) Show that $g'(x) = \frac{1}{x(x+1)}$. [4 marks]

2) Consider $f(x) = x^2 \sin x$.

(a) Find $f'(x)$. [4 marks]

3) Consider $f(x) = \ln(x^4 + 1)$.

(a) Find the value of $f(0)$. [2 marks]

(b) Find the set of values of x for which f is increasing. [5 marks]

The second derivative is given by $f''(x) = \frac{4x^2(3-x^4)}{(x^4+1)^2}$.

The equation $f''(x) = 0$ has only three solutions, when $x = 0, \pm\sqrt[4]{3}$ ($\pm 1.316\dots$).

(c) (i) Find $f''(1)$.

(ii) **Hence**, show that there is no point of inflexion on the graph of f at $x = 0$. [5 marks]

(d) There is a point of inflexion on the graph of f at $x = \sqrt[4]{3}$ ($x = 1.316\dots$).
Sketch the graph of f , for $x \geq 0$. [3 marks]



- 4) 14. Figure 1 shows the graphs of the functions f_1 , f_2 , f_3 , f_4 .

Figure 2 includes the graphs of the derivatives of the functions shown in Figure 1, e.g. the derivative of f_1 is shown in diagram (d).

Figure 1

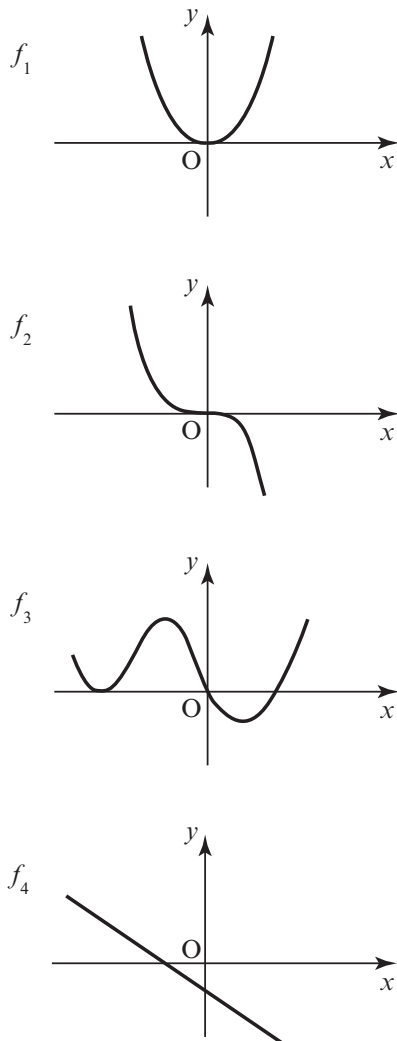
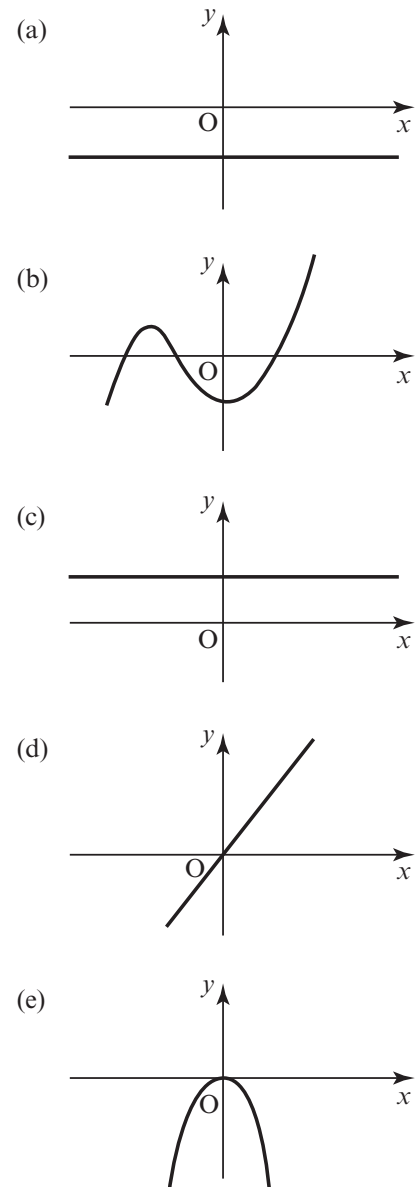


Figure 2

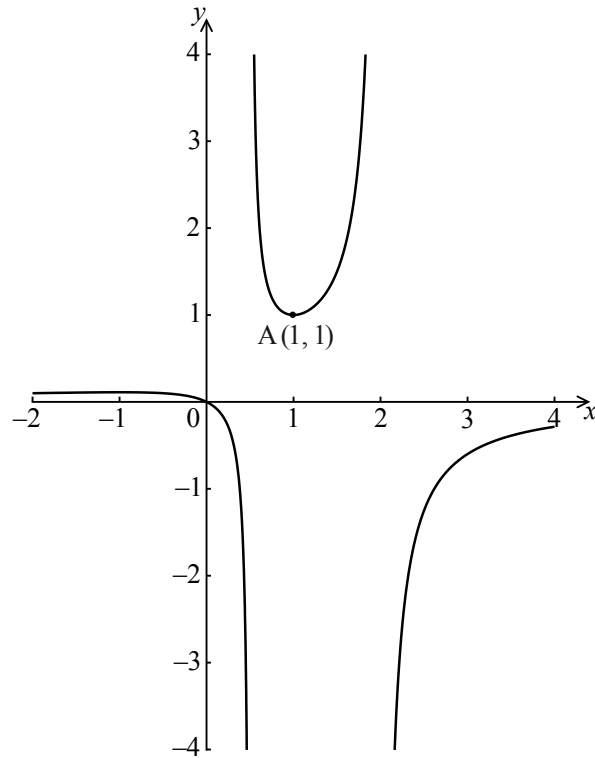


Complete the table below by matching each function with its derivative.

Function	Derivative diagram
f_1	(d)
f_2	
f_3	
f_4	



- 5) Let $f(x) = \frac{x}{-2x^2 + 5x - 2}$ for $-2 \leq x \leq 4$, $x \neq \frac{1}{2}$, $x \neq 2$. The graph of f is given below.



The graph of f has a local minimum at $A(1, 1)$ and a local maximum at B .

- (a) Use the quotient rule to show that $f'(x) = \frac{2x^2 - 2}{(-2x^2 + 5x - 2)^2}$. [6 marks]
- (b) Hence find the coordinates of B . [7 marks]