

Differentiation 2 - Graphs of functions

Please simplify your answers whenever possible.

Question 9 Check whether the following functions have extrema (minima and/or maxima). Also sketch graphs of the functions using the steps shown in class:

1. Intersections with x and y axis ($f(x) = 0$ and $f(0)$)
2. Minima and maxima ($f'(x) = 0$)
3. Inflection points ($f''(x) = 0$)
4. Vertical asymptotes (vertical lines $x = x_a$ for which $\lim_{x \rightarrow x_a} f(x) = \pm\infty$)
5. Horizontal asymptotes (horizontal lines $y = y_a$ for which $\lim_{x \rightarrow \infty} f(x) = y_a$ or $\lim_{x \rightarrow -\infty} f(x) = y_a$)

a $f(x) = x^2 - 3x - 2$

b $f(x) = x(x^2 - 1)^2$

c $f(x) = \frac{x+1}{x-2}$

d $f(x) = 3x^2 + 5x - 7$

e $f(x) = x \cdot \ln x$, for $x > 0$

Question 10 The concentration of intravenous medication in the blood as a function of time is given by:

$$y(t) = a(e^{-bt} - e^{-ct}), \quad c > b > 0 \quad \text{and} \quad a > 0$$

- a** Show that $y(t) > 0$ for $t > 0$
- b** Find the maximum of y and at which time t this is reached
- c** Find the time t where the graph has a inflection point
- d** Sketch the graph for $t > 0$ for $a = c = 2$ and $b = 1$