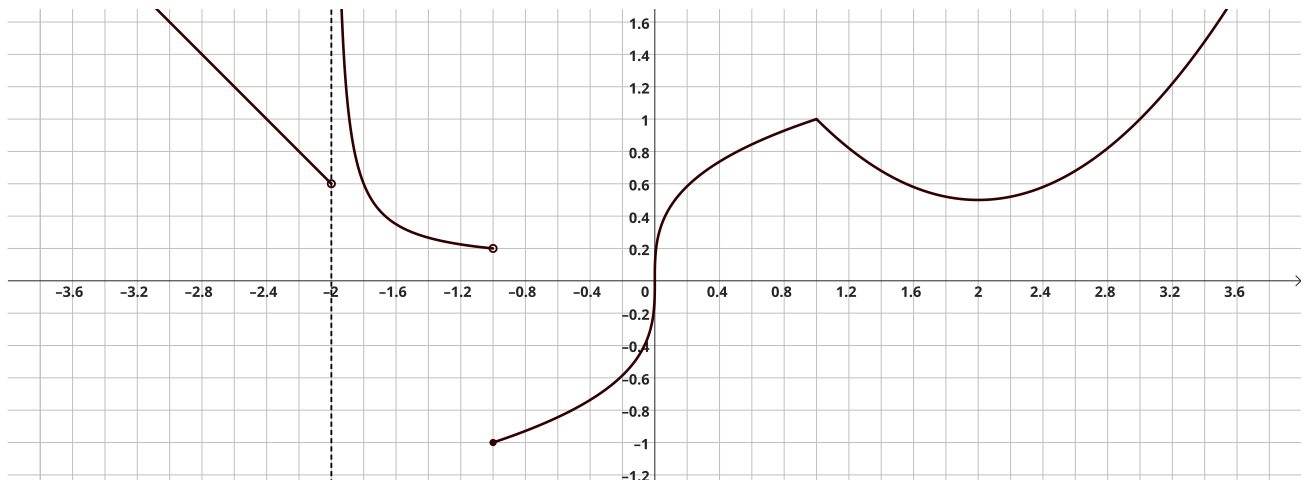


Books, watches, notes or cell phones are **not** allowed. The **only** calculators allowed are the Sharp EL-531**. You **must** show all your work, the correct answer is worth 1 mark the remaining marks are given for the work.

Question 1. Given the graph of the function $f(x)$.



- a. (5 marks) Sketch the graph of $f'(x)$ on the graph above. Label key points of your graph.
- b. (5 marks) Identify the points where the function is not differentiable. Justify why it is not differentiable.

Question 2. Given the function $f(x) = 1 - \frac{2}{x}$

- a. (5 marks) Is the function differentiable at $x = 3$? Use the limit definition of the derivative.
- b. (3 marks) Find the equation of the tangent line to the graph of $f(x)$ at $x = 3$.

Question 3. (5 marks) Find the value(s) of x for which the tangent to the graph of $f(x) = (\cos x)(\cos x) - 2 \sin x$ is horizontal on the interval $[-2\pi, 2\pi]$.

Question 4. (5 marks) Find the derivative of $f(x) = \frac{\sqrt{x} \tan x}{x \sec x + \pi}$ but do not simplify.

Bonus Question. (2 marks) Find $\frac{d}{dx} |x^2 + x|$.