Name:

1. (5 points) Differentiate from the first principles the following functions:

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

   (b) $g(x) = \dfrac{2}{\sqrt{x}}$

2. (4 points) Consider the following function:

$$f(x) = \begin{cases} x^3 & for \;\; x < 1 \\ ax + b & for \;\; x \geqslant 1 \end{cases}$$

Find the values of a and b so that f is differentiable at $x = 1$.

3. (4 points) Solve the following equation:

$$\cos x + \cos \frac{x}{2} + 1 = 0$$

for $0 \leqslant x \leqslant 3\pi$.

4. (7 points) Consider the function

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

(a) Write down the equations of the asymptotes of the graph of $y = f(x)$.

(b) Show that the range of values of $f(x)$ is all real numbers.

(c) Sketch the graph of $g(x) = f(|x|)$ and hence state the set of all possible values of parameter k, such that the equation:

$$g(x) = k$$

has four solutions.