



**Instructions:** Only ordinary calculators are allowed.

**Question 1.** [ 10 marks ] Evaluate the following limits:

$$(i) \lim_{x \rightarrow 0} \frac{x}{\sqrt{x+3} - \sqrt{3}} \quad (ii) \lim_{x \rightarrow 2} \frac{|x-2|}{x-2}$$

$$(iii) \lim_{x \rightarrow -\infty} \frac{-x}{\sqrt{x^2+1}} \quad (iv) \lim_{x \rightarrow \infty} \frac{\cos x}{x^2}$$

$$(v) \lim_{x \rightarrow 0} \frac{\sin 2x \cdot \cos 3x}{x}$$

**Question 2.** [ 3 marks ] Find the values of  $a$  and  $b$  in order to the following function be continuous:

$$f(x) = \begin{cases} \frac{2 \sin(3x)}{x}, & \text{if } x < 0 \\ b + 1, & \text{if } x = 0. \\ a \cos(2x) - 1, & \text{if } x > 0 \end{cases}$$

**Question 3.** [ 3 marks ] Find the vertical and horizontal asymptotes for:

$$f(x) = \frac{4 - x^2}{x^2 - 9}.$$

**Question 4.** [ 4 marks ]

(a) Use the formal definition of the limit to prove that  $\lim_{x \rightarrow 1} (5x - 1) = 4$ .

(b) Use the definition of the derivative to find  $f'(x)$  if  $f(x) = x^2 + 3$ .

End Questions & Good Luck