Calculators, Mobiles and Pagers are not allowed during exams

Question 1 : [2+2pts] Find the following limits, if exist

$$(a) \quad \lim_{\theta \to 0} \frac{\theta^2}{2 + \cos\left(\frac{1}{\theta}\right)} \qquad\qquad (b) \quad \lim_{x \to 0} \frac{x + 2\sin(x)}{\tan(3x) - x}.$$

Question 2 :[5pts] Let

$$f(x) = \frac{|x - 1|(x - 2)}{(x^2 - 3x + 2)(x - 4)}.$$

Find all points of discontinuity of f and classify each discontinuity as jump, infinite or removable.

Question 3 : [4pts] Let

$$f(x) = \frac{3x^2 + x|x|}{x^2 - x}.$$

Find the vertical and horizontal asymptotes for the graph of f, if any.

Question 4 : [1+3pts]
(a) State the Intermediate Value Theorem.
(b) Given two continuous functions f and g on $(-\infty, \infty)$ such that $f(0) = g(1) = 0$ and $f(1) = g(0) = 1$. Show that, there exists $c \in (0, 1)$ such that $f(c) = 10\, g(c)$.

Question 5 :[4pts] Find $\frac{dy}{dx}$, where

$$y = \sec(x)\tan(x) + \frac{6}{x^{\frac{1}{3}}}.$$

Question 6 :[4pts] Find an equation of the tangent line to the curve

$$y = \frac{\sqrt{x} - 1}{\sqrt{x} + 1} \quad \text{at } x = 1.$$