

Answer all of the following questions. Each question is worth 10 points.

Calculators are not allowed.

1. (a) Solve the inequality

$$\frac{|x| - 1}{|x| - 2} \leq 0.$$

- (b) Let $A(-5, 1)$ and $B(1, 3)$.

(i) Find the equation of the circle in which AB is a diameter.

(ii) Find the equation of the tangent to the circle at A .

2. (a) Let f and g be two functions given by $f(x) = \sqrt{x-2}$, and $g(x) = \sqrt{x-3}$.

Compute $(f \circ g)(x)$ and its domain.

- (b) Evaluate the following limits (if they exist)

(i) $\lim_{x \rightarrow \frac{\pi}{2}} \frac{\cos 2x}{\cos x - \sin x}$

(ii) $\lim_{x \rightarrow 0} (1 + x^2 \sin(\frac{1}{\sqrt[3]{x}}))$.

3. (a) Let the function f be given by

$$f(x) = \begin{cases} \frac{\sqrt{6x-5} - \sqrt{3x+10}}{x-5}, & \text{if } x > 5 \\ \frac{A}{10}, & \text{if } x = 5 \\ \frac{7|x-5|}{x^2 - 3x - 10} + B, & \text{if } x < 5 \end{cases}$$

Find the values of A and B so that f is continuous for every $x \in \mathbb{R}$.

- (b) Use the definition of the limit to prove that $\lim_{x \rightarrow 2} (-3x + 10) = 4$.

4. (a) Find the horizontal and vertical asymptotes (if any) for the function f given by

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

- (b) Solve the following equation for $\theta \in [0, 2\pi)$

$$2 \sin^2 \theta + 3 \cos \theta - 3 = 0.$$

Good Luck