以下所有結果 需要寫出詳細計算過程

1. (10 points) Consider a function $f(x) = |x - 2|$, for all $x \in \mathbb{R}$.

   (a) Whether $f(x)$ is continuous at all $x \in \mathbb{R}$? Explain your reason.

   (b) Whether $f(x)$ is differentiable at all $x \in \mathbb{R}$? Explain your reason.

2. (10 points) Find the limits

   (a) $\lim\limits_{x \to 3} \frac{x-3}{x^3 - 4x^2 + x + 6}$

   (b) $\lim\limits_{x \to 0} \frac{7x}{\sin(\sqrt{5}x)}$

3. (10 points) Find y'

   (a) $y = \int_0^{x^2} \sqrt{1 + e^t}\,dt$

   (b) $y = f(g(h(x)))$, where $h(x) = x^3 + 1$, $g(u) = u^2$, and $f(k) = \sqrt{2k + 1}$.

4. (10 points) Find $\frac{dy}{dt}$ if $x \sin(y) - y \cos(2x) = 1$.

5. (10 points) Find the absolute maximum and absolute minimum of the function $f(x) = 2x^3 - 3x^2 - 12x + 7$ on $[-2,\ 1]$.

6. (10 points) Find $\int_0^3 x\sqrt{2x^2 + 1}\,dx$.

7. (10 points) Find $\int \frac{dx}{1 + e^{-2x}}$.

8. (10 points) For the function $f(x) = 5x^3 + 8x - 9$, find the slope of the tangent to the graph of f^{-1} (the inverse function of f) at $(f(1), 1)$.

9. (10 points) Evaluate $\int_{-1}^2 \int_x^{x^2+1} 2xy\,dy\,dx$.

10. (10 points) Differentiate $y = e^{2\sqrt{x}} \ln(3x)$.