

Q 1. Find the critical numbers of the function

a) $f(x) = 2x^3 - 3x^2 - 26x$

b) $g(t) = |3t - 4|$

c) $F(x) = x^{4/5}(x - 4)^2$

d) $h(t) = 3t - \arcsin t$

Q 2. Find the absolute maximum and absolute minimum values of f on the given interval.

a) $f(x) = 2x^3 - 3x^2 - 12x + 1$, $[-2, 3]$

b) $f(t) = \frac{\sqrt{t}}{1+t^2}$, $[0, 2]$

c) $f(x) = \ln(x^2 + x + 1)$, $[-1, 1]$

Q 3. Verify that

$$f(x) = x + \frac{1}{x}$$

satisfies the hypotheses of Rolle's Theorem on $[\frac{1}{2}, 2]$ then find all numbers c that satisfy the conclusion of Rolle's Theorem

Q 4. Verify that

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

satisfies the hypotheses of Mean Value Theorem on $[-1, 2]$ then find all numbers c that satisfy the conclusion of MVT

Q 5. Show that the equation $x^4 + 4x + c = 0$ has at most two real roots.

Q 6. Prove the identity

$$2 \arctan \sqrt{x} - \frac{\pi}{2} = \arcsin \left(\frac{x-1}{x+1} \right)$$

(Hint: Use MVT)

Q 7. For the following functions

a) $f(x) = x^4 - 2x^2 + 3$

b) $f(x) = \frac{x}{x^2 + 1}$

c) $f(x) = x^2 \ln x$

find

- *the intervals on which f is increasing or decreasing.*
- *the local maximum and minimum values of f .*
- *the intervals of concavity and the inflection points.*

Q 8. *Sketch the graph of $f(x) = x^4 - 2x^2$*

Q 9. *Sketch the graph of $f(x) = \frac{x^2}{x^2 - 1}$*