

Applications of Derivatives: math test, College – download the PDF

Suggested time: 45 minutes. Out of 20 points. Calculator allowed only when the problem says so.

1 Monotonicity and extrema

/ 4 pts

Let $f(x) = 2x^3 - 3x^2 - 12x + 4$. (a) Compute f' and find the critical points. (b) Give the intervals where f increases or decreases. (c) Find the local extrema.

2 Concavity

/ 3 pts

For the same function f : (a) Find the intervals of concavity. (b) Find the inflection point. (c) Confirm the nature of the extrema with the second derivative test.

3 Mean Value Theorem

/ 3 pts

Let $f(x) = \sqrt{x}$ on $[1, 9]$. Verify the hypotheses of the Mean Value Theorem and find the guaranteed value c .

4 Two pens

/ 4 pts

A rancher has 240 m of fencing for a rectangular field divided into two equal pens by one interior fence parallel to a width w . The length is L . (a) Write L in terms of w . (b) Find w and L that maximize the total area, and the area.

5 Oil spill

/ 3 pts

A circular oil slick has radius growing at 0.5 ft/min. How fast is its area increasing when the radius is 15 ft? Give the exact value and a decimal approximation.

6 Limits and linearization

/ 3 pts

(a) Compute $\lim_{x \rightarrow 0} \frac{e^{3x} - 1}{\sin 2x}$. (b) Use the linear approximation of $\ln(1 + x)$ at 0 to estimate $\ln 1.05$.



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