

The Derivative and Its Definition: math test, College – download the PDF

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

1 Definition of the derivative

/ 4 pts

Let $f(x) = 2x^2 - x$.

- Simplify the difference quotient $\frac{f(1+h) - f(1)}{h}$.
- Use it to find $f'(1)$.
- Check your answer with the power rule and sum rule.

2 Differentiating

/ 4 pts

Differentiate each function.

- $g(x) = 5x^4 - 2x^3 + x - 8$
- $h(x) = 3\sqrt{x} + \frac{4}{x^2}$
- $k(x) = x(x + 4)$

3 Tangent lines of a cubic

/ 4 pts

Let $f(x) = x^3 - 2x^2 + 1$.

- Find the tangent line at $x = 2$.
- Find the points of the graph where the tangent is horizontal.

4 Filling a tank

/ 3 pts

The volume of water in a tank is $V(t) = 0.5t^2 + 4t$ gallons after t minutes.

- Find the average rate of change between $t = 2$ and $t = 6$.
- Find $V'(t)$, then $V'(2)$ and $V'(6)$.
- What do the results say about the filling speed?

5 A differentiable piecewise function

/ 3 pts

Let $f(x) = x^2 + 1$ for $x \leq 2$ and $f(x) = mx + n$ for $x > 2$. Find m and n so that f is differentiable at 2.

6 Continuity and differentiability

/ 2 pts

True or false? Justify. (a) A function differentiable at a is continuous at a . (b) A function continuous at a is differentiable at a .



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