

MATH 180
Sample exam problems for the 1st hour exam
Fall 2009

1. Evaluate the following limits, or if the limit does not exist, explain why.

(a) $\lim_{x \rightarrow \pi} 2 \cos x$

(b) $\lim_{x \rightarrow 2} \frac{x^2 - 4}{x + 2}$

(c) $\lim_{x \rightarrow 9} \frac{2 - \sqrt{x - 5}}{x - 9}$

2. Determine the location and type (removable, jump, infinite, or other) of all discontinuities of the function $\frac{x^2 - 3x + 2}{x^2 - 1}$
3. Find the equation of the tangent line to $y = x^3 - 2x^2 + 2$ at $x = 1$.
4. Determine the value of c so that the function:

$$f(x) = \begin{cases} 3cx + 1 & x < 1 \\ 5x^2 + c & x \geq 1 \end{cases}$$

is continuous on \mathbb{R} .

5. Use the intermediate value theorem in order to show that the equation $x^5 - x + 1 = 0$ has at least one real solution.
6. Use the δ - ε definition of the limit to prove that $\lim_{x \rightarrow 3} 3x - 1 = 8$.

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

- (a) Write the derivative, $f'(3)$, as a limit of the difference quotient.
- (b) Evaluate this limit to find $f'(3)$.

8. Find the derivatives of the following functions using the basic rules. Leave your answers in an unsimplified form so that your method is obvious.

(a) $f(x) = x^3 + x^{-1} - x^{1/3}$,

(b) $g(x) = x^3e^x$,

(c) $h(x) = \frac{3x}{1+x^2}$.

9. The table below shows values of the functions $f(x)$, $g(x)$, and $h(x)$ for x near 0. Based on the data is $h = f'$ or is $h = g'$. Explain your answer by citing some feature of the data.

x	-0.2	-0.1	0	0.1	0.2
$f(x)$	0.494	0.498	0.500	0.498	0.494
$g(x)$	0.460	0.480	0.500	0.519	0.539
$h(x)$	0.059	0.029	0	-0.029	-0.059

10. Suppose that $f(2) = 3$, $f'(2) = -1$, $g(2) = 5$, and $g'(2) = -2$. Find the derivative of the product $f(x)g(x)$ at $x = 2$.