

1. [5 points; p136] State the limit definition of the derivative of a function.

2. [15 pts] Find these derivatives. You do not need to simplify your answers.

(a) [p156#13,16]  $f(x) = x^2 + \frac{1}{x^2} + x^{4/3} - x^{2/3}$

(b) [p156#21]  $f(x) = (x^3 - x + 1)(x^{-2} + 2x^{-3})$

(c) [p156#26]  $f(x) = \frac{\sqrt{x} - 1}{\sqrt{x} + 1}$

3. [5 pts; p48#38] Find (and simplify) the composite function  $f(f(x))$ , for  $f(x) = \frac{x-1}{x+1}$ .

4. [25 pts] Compute these limits:

(a) [p92#20]  $\lim_{x \rightarrow 2} \frac{x^2 + x - 6}{x^2 - 4} =$

(b) [p83#22]  $\lim_{x \rightarrow 5^-} \frac{6}{x - 5} =$

(c) [p92#38]  $\lim_{x \rightarrow -4^+} \frac{|x + 4|}{x + 4} =$

(d) [p92#16]  $\lim_{x \rightarrow 1} \frac{x^3 - 1}{x^2 - 1} =$

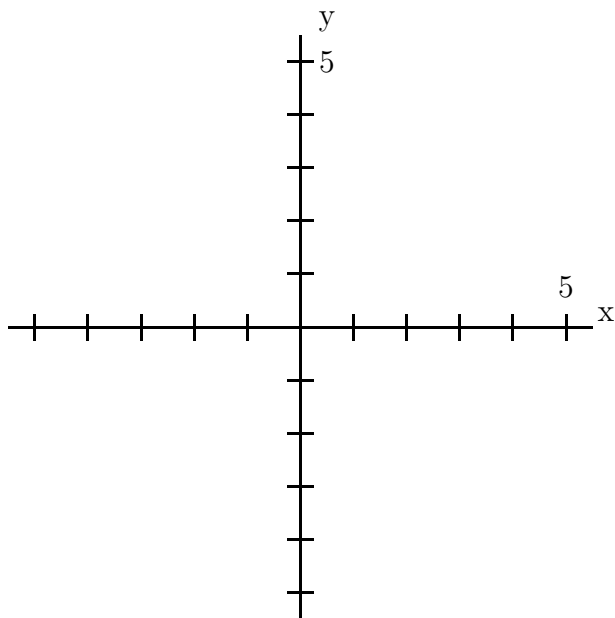
(e) [p92#25]  $\lim_{x \rightarrow 0} \left[ \frac{1}{x\sqrt{1+x}} - \frac{1}{x} \right]$

5. [8 pts] Use the limit definition of the derivative to find  $f'(x)$ , for the function  $f(x) = x^2$ .

6. [10 pts; p125#23] For the function  $f(x)$  given below, check whether or not  $f(x)$  is continuous at  $x = 0$  and at  $x = 3$ . Explain your answer by computing the value of the function, the limit from the left, and the limit from the right.

$$f(x) = \begin{cases} \sqrt{-x} & \text{if } x < 0 \\ 3 - x & \text{if } 0 \leq x < 3 \\ (x - 3)^2 & \text{if } 3 \leq x \end{cases}$$

7. [7 pts; p47#18] On the axes below, graph the function  $y = \frac{2x + 3}{x + 1}$ .



8. [9 pts; 3.3 Ex4] Find the points on the curve  $y = x^4 - 6x^2 + 4$  where the tangent line is horizontal.

9. [6 points; p114#43] Use the Intermediate Value Theorem to explain why the equation  $x^3 - 3x + 1 = 0$  has a solution. Find an interval that contains this solution.

10. [10 pts; 3.2 Ex4] Use the limit definition of the derivative to find  $f'(x)$ , for the function  $f(x) = \sqrt{x-1}$ . Check your answer by using the derivative formulas.

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Grade	