

MATH 103 200710 Problem Set 2

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Thursday, January 25, 2007

The following problems from chapters 1.3, 1.4, and 1.5 may appear on the test on Thursday, February 8.

1. Use the power rule to find the derivatives of the following functions:

(a) $f(x) = x^{2/3}$

(b) $f(x) = 1/\sqrt[6]{x}$

(c) $f(x) = 2^5$

2. (a) If $f(x) = x^{4/3}$, find $f(8)$ and $f'(8)$.
(b) The line $y = ax + b$ is tangent to the graph of $f(x) = x^{4/3}$ at the point where $x = 8$. Find a and b .

3. Calculate the following limits.

(a) $\lim_{x \rightarrow 8} \frac{\sqrt{5x-4} - 1}{3x^2 + 2}$

(b) $\lim_{x \rightarrow 0} \frac{x^2 + 3x}{x}$

(c) $\lim_{x \rightarrow 3} \frac{x^2 - x - 6}{x - 3}$

4. Use the definition of the derivative to calculate the following derivatives.

(a) $f'(3)$ where $f(x) = x^2 + 2$

(b) $f'(4)$ where $f(x) = 1/(2x + 3)$

(c) $f'(2)$ where $f(x) = \sqrt{5-x}$

5. Determine whether each of the following functions is continuous and/or differentiable at $x = 1$.

(a) $f(x) = \begin{cases} x+2 & \text{for } -1 \leq x \leq 1 \\ 3x & \text{for } 1 < x \leq 5 \end{cases}$

(b) $f(x) = \begin{cases} x & \text{for } x \neq 1 \\ 2 & \text{for } x = 1 \end{cases}$

6. The following functions are defined for all x except for one value of x . If possible, define $f(x)$ at the exceptional point in a way that makes $f(x)$ continuous for all x .

(a) $f(x) = \frac{x^2 + x - 12}{x + 4}, x \neq -4$

(b) $f(x) = \frac{x^2 + 25}{x - 5}, x \neq 5$

(c) $f(x) = \frac{\sqrt{9+x} - \sqrt{9}}{x}, x \neq 0$

7. (a) Draw the graphs of $f(x) = x^2$ and $g(x) = x^3$ on the same axes.
(b) Compute $f'(1)$ and $g'(1)$. Which is larger? Interpret your answer as a fact about the graphs.
8. The owner of a photocopy store charges 10 cents per copy for the first 150 copies and charges 7 cents per copy for each copy exceeding 150. In addition the owner charges a flat fee of \$2.50 for setup.
- (a) Determine $R(x)$, the revenue from a transaction in which x copies are sold.
(b) If one copy costs the store owner 3 cents, what is the profit $P(x)$ from selling x copies?
(c) Is the profit function continuous and/or differentiable?

Please do the following problems from the textbook. They may appear on Midterm Test 1.

1.3 C-level: 3–41, 49–55, 63–70; B-level: 42–46, 48, 57, 71–82, 84; A-level: 59–62, 83–88;

1.4 C-level: 1–26, 29–32, 37–38; B-level: 27–28, 33–36, 39–44; A-level: 45–72;

1.5 C-level: 1–25; B-level: 26–28, 31–34;