Math 111-01 Gratefully borrowed from Professor Rob Benedetto

Practice Test B for Midterm Exam 3

Instructions: This optional exam is for practice, to give you an idea of what our in-class midterm exam will be like. I'd recommend that you try taking it in exam conditions: 50 minutes, closed-book.

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1. **(10 points)** Find a function $f(x)$ such that $f(1) = 3$, $f'(1) = 5$, and $f''(x) = 12x^2 + 12x$.

2. **(25 points)** Let $f(x) = \dfrac{2x^3 + 45x^2 + 315x + 600}{x^3}$. Take my word for it that

$$f'(x) = \frac{-45(x+4)(x+10)}{x^4}, \qquad \text{and} \qquad f''(x) = \frac{90(x+5)(x+16)}{x^5}.$$

Sketch the graph of $y = f(x)$, clearly indicating **horizontal and vertical asymptotes**, **local extrema**, **inflection points**, and **intervals of increase and decrease and of concavity**.
You do **not** need to indicate locations of intercepts or y-coordinates of extrema or inflection points.
Also, please do **NOT** try to draw your graph to scale.

3. **(15 points)** Let $g(x) = 4x^5 - 5x^4 - 40x^3$. Find all critical points of g in $(-\infty, \infty)$, and classify each as a local maximum, local minimum, or neither.

4. **(25 points)** A rectangular poster is to contain $50\,\text{in}^2$ of printed matter with margins of 4 inches at each of the top and bottom, and margins of 2 inches on each side. What are the height and width of the poster fitting those requirements that has the smallest possible area?

5. **(10 points)** Here are some values of a certain continuous function $h(x)$:

x	-4	-3	-2	-1	0	1	2	3	4	5	6
$h(x)$	3	1	0	-1	-2	-2	0	1	5	8	7

Estimate $\displaystyle\int_{-3}^{5} h(x)\,dx$ using **four** approximating rectangles of equal width and **right** endpoints. That is, compute R_4.

6. **(15 points)** Compute the following definite and indefinite integrals.

(a) $\displaystyle\int (5\sec t + 7\tan t)\sec t\,dt$ (b) $\displaystyle\int_{-1}^{2} x^3(x+3)^2\,dx$