Name:_____

Student ID:_____

Section:(See Bubble Sheet)_____

Instructor:_____

Math 112 (Calculus I)
Final Exam Form A

Dec 13, 2011, 7:00-10:00 p.m.

Instructions:

- Work on scratch paper will not be graded.
- For questions 21 to 29, show all your work in the space provided. Full credit will be given only if the necessary work is shown justifying your answer. Please write neatly.
- Should you have need for more space than is allotted to answer a question, use the back of the page the problem is on and indicate this fact.
- Simplify your answers. Expressions such as $\ln(1)$, e^0, $\sin(\pi/2)$, etc. must be simplified for full credit.
- Calculators are not allowed.

For Instructor use only.

#	Possible	Earned
MC	40	
21	8	
22	5	
23	4	
24	7	
Sub	64	

#	Possible	Earned
25	7	
26	8	
27	8	
28	7	
29	6	
Sub	36	
Total	100	

Free response: Write your answer in the space provided. Answers not placed in this space will be ignored.

21. (8 points) **Short answer.** Two points each part. You do not need to show your work on this problem.

(a) Given $\epsilon > 0$, and the statement

$$\lim_{x \to -1} (-2x + 3) = 5,$$

find the largest $\delta > 0$ so that the following statement is true:

$$\text{If } 0 < |x + 1| < \delta, \text{ then } |-2x + 3 - 5| < \epsilon.$$

Answer: _____

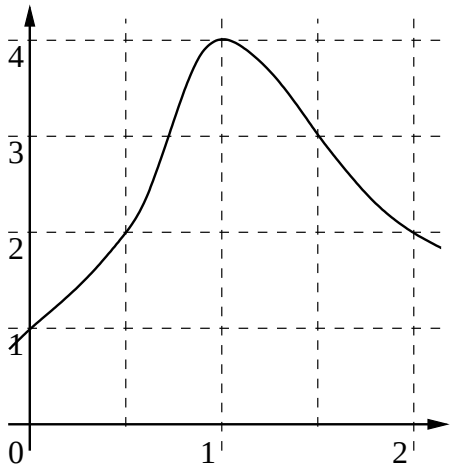
(b) Find $\lim_{x \to \infty} \dfrac{5 - 3x^3}{\sqrt{81x^6 - 16}}$.

Answer: _____

(c) Evaluate the integral $\displaystyle\int (1 + x^2)\, dx$.

Answer: _____

(d) Let $f(x)$ be the function whose graph is shown below. Use *right* hand sums with four rectangles to estimate $\displaystyle\int_0^2 f(x)dx$.



Answer: _____

22. (5 points) Use the definition of the derivative to show:

$$\text{If } f(x) = \frac{1}{x-1}, \text{ then } f'(x) = -\frac{1}{(x-1)^2}.$$

No credit will be given if a method besides the definition of the derivative is used.

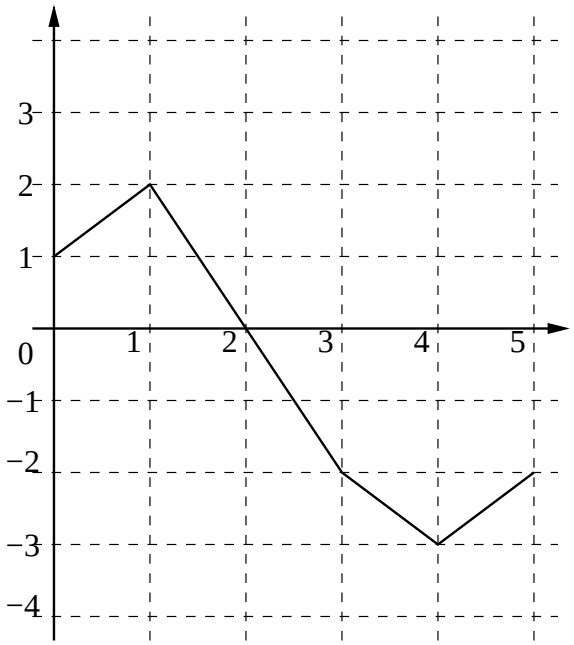
23. (4 points) Find the linear approximation of the function $f(x) = x^{3/2}$ at $a = 100$, and use it to approximate the number $\sqrt{(101)^3}$.

24. (7 points) Prove that $f(x) = 2x + \sin x$ has at most one root.

25. (7 points) Find the limit. $\lim_{x \to \infty} \left(\frac{1}{x^2} \right)^{1/x}$

26. (8 points) Suppose the area of a right triangle is 18 cm^2. Find the smallest possible length of its hypoteneuse.

27. (8 points) The graph of a function $f(x)$ is shown. Let $g(x) = \int_0^x f(t)\,dt$, for $0 \le x \le 5$.



(a) Evaluate $g(0)$, $g(2)$, and $g(5)$.

(b) Where is $g(x)$ increasing on $[0, 5]$? Decreasing?

(c) Sketch the graph of $g(x)$ on the same axes of $f(x)$, labeling all local maxima and minima.

28. (7 points) A pendulum swings with velocity $v(t) = \cos t$. Find the total distance the pendulum travels over $0 \leq t \leq \dfrac{5\pi}{2}$.

29. (6 points) Evaluate the integral. $\displaystyle\int x\sqrt{2+x}\,dx$

END OF EXAM