Math 1151
MIDTERM 3
November 18, 2014
Form A

NAME : ___ ___ ___ ___ ___ ___ ___ ___

OSU Name.# : ___ ___ ___ ___ ___ ___ __

Lecturer:: ___ ___ ___ ___ ___ ___ ___

Recitation Instructor : ___ ___ ___ ___

Recitation Time : ___ ___ ___ ___ ___ __

INSTRUCTIONS

- **SHOW ALL WORK in problems 1, 2, 3, 4 and 6 .**
  Incorrect answers with work shown may receive partial credit, but unsubstantiated correct answers may receive NO credit.

  You don't have to show work in problem 5.

- **Give EXACT answers unless asked to do otherwise.**
  Include units in your answer where that is appropriate.

- **You do not need to simplify numerical answers such as** $\frac{5}{\sqrt{8}} - \frac{3}{\sqrt{32}}$.

- **Calculators are NOT permitted !**
  PDA's , laptops, and cell phones are prohibited.
  Do not have these devices out !

- **The exam duration is 55 minutes.**

- **The exam consists of 5 problems starting on page 2 and ending on page 8.**
  Make sure your exam is not missing any pages before you start.

PROBLEM NUMBER	SCORE
1	(20)
2	(20)
3	(16)
4	(14)
5	(18)
6	(12)
TOTAL	(100)

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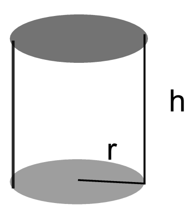
1. (20 pts) SHOW YOUR WORK !

Find the <u>radius</u> of a cylindrical container with a volume of 16π m^3 that minimizes the <u>surface area</u>.

Justify your answer !



(HINT : surface area , $S = 2\pi rh + 2r^2\pi$;
volume , $V = r^2\pi h$.)

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2. (20 pts)

Sketch (neatly!) the graph of a function f satisfying all of the following conditions:

(a) $f(-8) = 5$, $f(8) = 5$

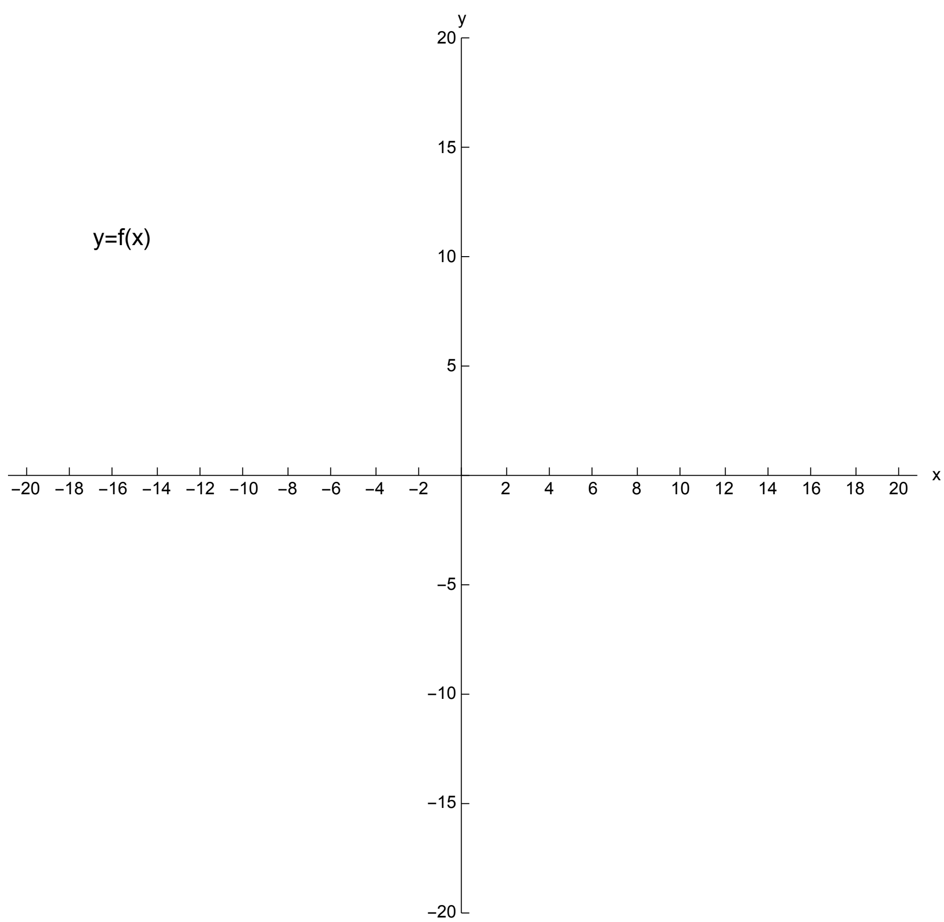
(b) $\lim_{x \to 0} f(x) = +\infty$, $\lim_{x \to -\infty} f(x) = 0$, $\lim_{x \to +\infty} f(x) = 10$,

(c) $f'(x) > 0$ on $(-\infty, -8)$, $(-4, 0)$, and on $(8, +\infty)$,

(d) $f'(x) < 0$ on $(-8, -4)$, and $(0, 8)$,

(e) $f''(x) > 0$ on $(-\infty, -8)$, $(-8, 0)$, and on $(0, 12)$,

(f) $f''(x) < 0$ on $(12, +\infty)$.



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3. (16 pts) SHOW YOUR WORK !

(I) (8 pts) Evaluate the limit . You may use L ' Hospital ' s Rule.

$$\lim_{x \to 0^+} (x + \cos x)^{\frac{4}{x}}$$

(II) (8 pts) Determine the indefinite integral.

$$\int \frac{x + 3 x^5}{x^3} \, dx$$

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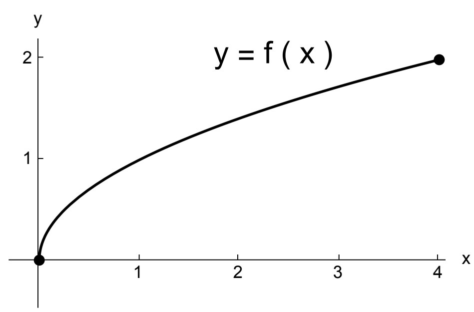
4. (14 pts)

The graph of the function $f(x) = \sqrt{x}$ on the interval [0, 4] is given below.



(a) Write the equation of the line that represents the linear approximation to the function f at a = 1.

(b) In the figure above, sketch the graph of the linear approximation from part (a).

(c) Use the linear approximation from part (a) to estimate $f(2) = \sqrt{2}$.

(d) Determine whether the Mean Value Theorem applies to the function f on the given interval.

(e) If so, find the point (or ponts) that are guaranteed to exist by the Mean Value Theorem.

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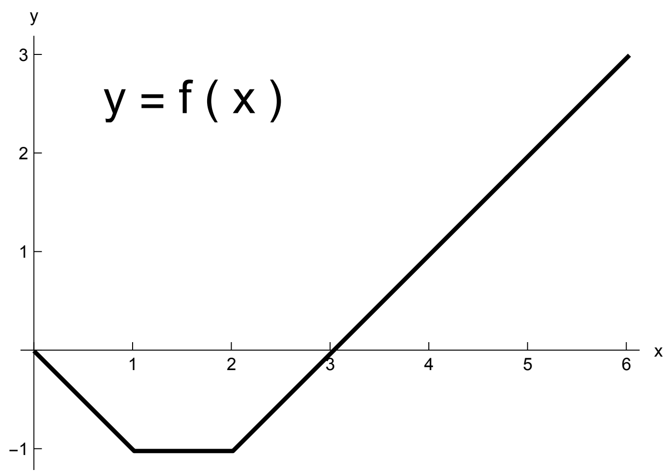
5. (18 pts) MULTIPLE CHOICE ! CIRCLE THE CORRECT ANSWER IN EACH PART.

The graph of f is shown in the figure.



(I) (3 pts) $\boxed{\text{Evaluate } \int_0^3 f(x)\,dx.}$

(a) 0; (b) 1 ; (c) -1 ; (d) 2 ; (e) -2 ;

(f) $\frac{3}{2}$; (g) $\frac{-3}{2}$; (h) NONE OF THE PREVIOUS ANSWERS.

(II) (3 pts) $\boxed{\text{Evaluate } \int_3^0 f(x)\,dx.}$

(a) 0; (b) 1 ; (c) -1 ; (d) 2 ; (e) -2 ;

(f) $\frac{3}{2}$; (g) $\frac{-3}{2}$; (h) NONE OF THE PREVIOUS ANSWERS.

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5. (18 pts) MULTIPLE CHOICE ! CIRCLE THE CORRECT ANSWER IN EACH PART.

(III) (3 pts) $\boxed{\text{Evaluate } \int_0^5 f(x)\, dx\,.}$

(a) 0; (b) 1; (c) -1; (d) 4;

(e) 2; (f) NONE OF THE PREVIOUS ANSWERS.

(IV) (3 pts) $\boxed{\text{Evaluate } \int_0^5 (4 f(x) + 1)\, dx\,.}$

(a) 0; (b) 9; (c) 13; (d) 21;

(e) 5; (f) NONE OF THE PREVIOUS ANSWERS.

(V) (3 pts) $\boxed{\text{Evaluate } \int_0^5 |f(x)|\, dx\,.}$

(a) 0; (b) 1; (c) 2; (d) 4;

(e) 6; (f) NONE OF THE PREVIOUS ANSWERS.

(VI) (3 pts)

The limit of Riemann sums for a function on the interval $[0, 5]$ is given by

$$\lim_{\Delta \to 0} \sum_{k=1}^{n} (2 x_k^* + f(x_k^*))\, \Delta x_k \qquad \text{on } [0, 5].$$

Express the limit as a definite integral.

(a) $\int (2 + f(x))\, dx$; (b) $\int_0^5 (2 + f(x))\, dx$; (c) $\int_0^5 x\,(2 + f(x))\, dx$;

(d) $\int_0^5 (2x + f(x))\, dx$; (e) $\int (2x + f(x))\, dx$; (f) NONE OF THE PREVIOUS ANSWERS.

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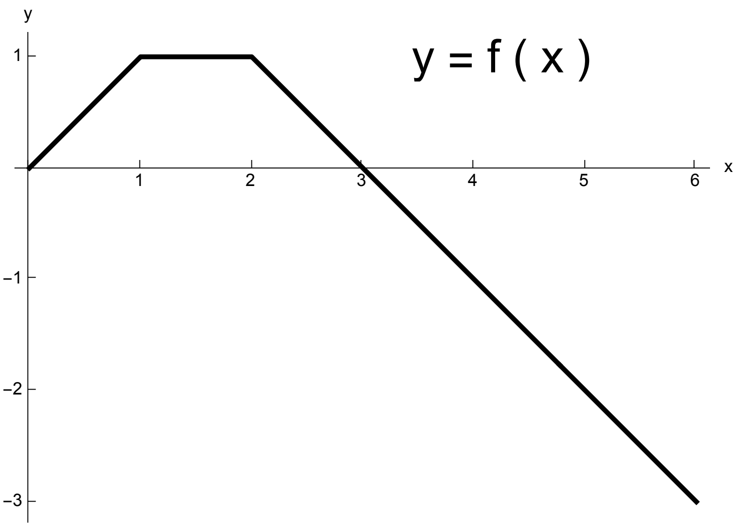
6. (12 pts)
The graph of a function f is shown in the figure below.



Approximate the net area bounded by the graph of f and the x - axis on the interval $[0, 6]$ using a midpoint Riemann sum with $n = 3$.

Complete the following steps :

STEP 1 : Calculate Δx and the grid points $x_0, x_1, \ldots, x_n$.

STEP 2 : Illustrate the midpoint Riemann sum by sketching the appropriate rectangles in the figure above.

STEP 3 : Calculate the midpoint Riemann sum. Show your work !