MATH 151, FALL 2005
COMMON EXAM III - VERSION A

NAME (print): _____

INSTRUCTOR: _____

SECTION NUMBER: _____

UIN: _____

DIRECTIONS:

1. The use of a calculator, laptop or computer is prohibited.
2. In Part 1 (Problems 1-13), mark the correct choice on your ScanTron form No. 815-E using a No. 2 pencil. *For your own records, also record your choices on your exam!* ScanTrons will be collected from all examinees after 90 minutes and will not be returned.
3. In Part 2 (Problems 14-18), present your solutions in the space provided. *Show all your work* neatly and concisely and *clearly indicate your final answer*. You will be graded not merely on the final answer, but also on the quality and correctness of the work leading up to it.
4. Be sure to *write your name, section number and version letter of the exam on the ScanTron form.*

THE AGGIE CODE OF HONOR

"An Aggie does not lie, cheat or steal, or tolerate those who do."

Signature: _____

DO NOT WRITE BELOW!

Question	Points Awarded	Points
1-13		52
14		14
15		8
16		10
17		6
18		10
		100

PART I

1. (4 pts) $\sin^{-1}(\sqrt{3}/2) =$

   (a) π

   (b) $\frac{\pi}{3}$

   (c) $\frac{\pi}{6}$

   (d) $\frac{\pi}{8}$

   (e) 0

2. (4 pts) Which of the following is an anti-derivative of the function $g(x) = 4x^3 + xe^{(x^2)}$?

   (a) $12x^2 + (2x^2 + 1)e^{(x^2)}$

   (b) $12x^2 + e^{(x^2)}$

   (c) $x^4 + \frac{e^{(x^2)}}{2}$

   (d) $x^4 + e^{(x^2)}$

   (e) $x^4 + 2e^{(x^2)}$

Exam continues on next page

3. (4 pts) If $y = x^x$, then $\dfrac{dy}{dx} =$

(a) x^x

(b) $1 + \ln(x)$

(c) $x^x \ln(x)$

(d) $x^{x-1}(1 + \ln(x))$

(e) $x^x(1 + \ln(x))$

4. (4 pts) $\lim\limits_{x \to 0} \dfrac{\ln(1-x) + x + \dfrac{x^2}{2}}{x^3} =$

(a) -3

(b) $-\dfrac{1}{3}$

(c) $\dfrac{1}{3}$

(d) 1

(e) 3

Exam continues on next page

5. (4 pts) The acceleration of a particle is given by $\mathbf{a}(t) = \langle 1, 2t \rangle$. The initial velocity of the particle is $\mathbf{v}(0) = \langle 0, 1 \rangle$ and its initial position is $\mathbf{r}(0) = \langle -1, 1 \rangle$. Find the position $\mathbf{r}(t)$ of the particle at time $t = 1$.

(a) $\langle 1\,,\, -1 \rangle$

(b) $\langle 1/2\,,\, 7/3 \rangle$

(c) $\langle -1/2\,,\, 7/3 \rangle$

(d) $\langle 1/2\,,\, 3 \rangle$

(e) $\langle -1/2\,,\, 3 \rangle$

6. (4 pts) If $g(x) = \sin^{-1}(x)$, then $g''(1/2) =$

(a) $-\dfrac{8}{25}$

(b) $-\dfrac{16}{25}$

(c) 0

(d) $\dfrac{4\sqrt{3}}{9}$

(e) $\dfrac{2\sqrt{3}}{9}$

Exam continues on next page

7. (4 pts) The inflection points of $g(x) = \frac{2}{3}(2x^6 - 5x^4)$ occur at

   (a) only $x = -1$ and $x = 1$
   (b) $x = -1$, $x = 0$ and $x = 1$
   (c) only $x = -\sqrt{5/3}$ and $x = \sqrt{5/3}$
   (d) $x = -\sqrt{5/3}$, $x = 0$ and $x = \sqrt{5/3}$
   (e) only $x = 0$ and $x = 1$

8. (4 pts) If f is a differentiable function such that $f(1) = 5$ and $f(3) = 8$, then the Mean Value Theorem implies that there is a number c with $1 < c < 3$ such that

   (a) $f(c) = 3/2$
   (b) $f'(c) = 3/2$
   (c) $f(c) = 6$
   (d) $f'(c) = 6$
   (e) $f'(c) = 0$

Exam continues on next page

Consider the function $f(x) = x^3 - 12x + 5$ in both problem #9 and problem #10.

9. (4 pts) Find the absolute <u>minimum</u> value of $f(x)$ on the interval $[-5, 3]$.

   (a) -60
   (b) -11
   (c) -4
   (d) 21
   (e) 42

10. (4 pts) Find the absolute <u>maximum</u> value of $f(x)$ on the interval $[-5, 3]$.

    (a) -60
    (b) -11
    (c) -4
    (d) 21
    (e) 42

Exam continues on next page

11. (4 pts) Which formula gives the area under the curve $y = 1 + x^3$ above the x-axis between $x = 2$ and $x = 6$?

(a) $\lim_{n\to\infty} \frac{4}{n} \sum_{i=1}^{n} \left[1 + \left(\frac{4i}{n}\right)^3\right]$

(b) $\frac{4}{n} \sum_{i=1}^{n} \left[1 + \left(\frac{4i}{n}\right)^3\right]$

(c) $\lim_{n\to\infty} \frac{4}{n} \sum_{i=1}^{n} \left[1 + \left(2 + \frac{4i}{n}\right)^3\right]$

(d) $\frac{4}{n} \sum_{i=1}^{n} \left[1 + \left(2 + \frac{4i}{n}\right)^3\right]$

(e) $\lim_{n\to\infty} \frac{1}{n} \sum_{i=1}^{n} \left[1 + \left(2 + \frac{i}{n}\right)^3\right]$

12. (4 pts) A bacteria culture starts with 1000 bacteria and the growth rate is proportional to the number of bacteria. After 2 hours the population is 9000. Find the number of bacteria after 3 hours.

(a) $18,000$

(b) $27,000$

(c) $36,000$

(d) $54,000$

(e) $81,000$

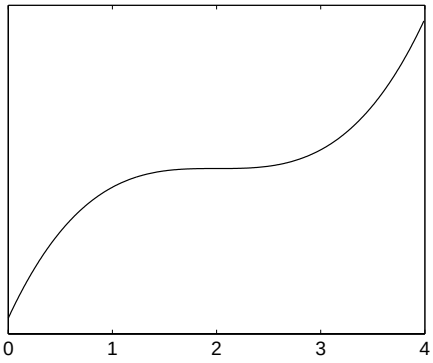
Exam continues on next page

13. (4 pts) The function $f(x)$ has the following properties:

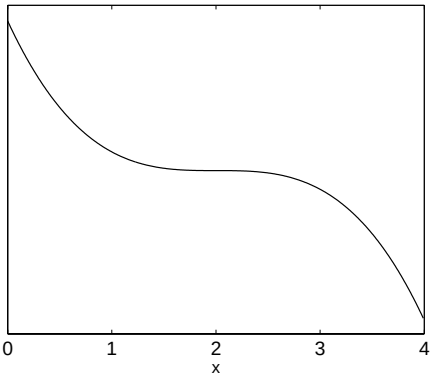
(i) $f'(x) > 0$ for $x \in (1, 3)$
(ii) $f'(x) < 0$ for $x \in (0, 1) \cup (3, 4)$
(iii) $f''(x) > 0$ for $x \in (0, 2)$
(iv) $f''(x) < 0$ for $x \in (2, 4)$

Which of the following could be the graph of $y = f(x)$?

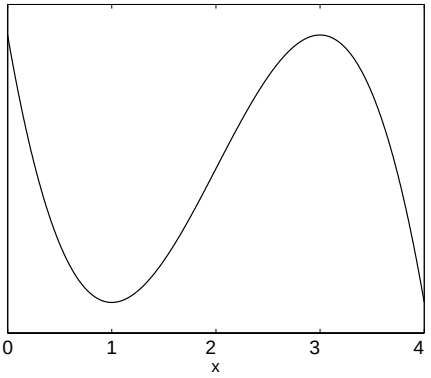
(a)



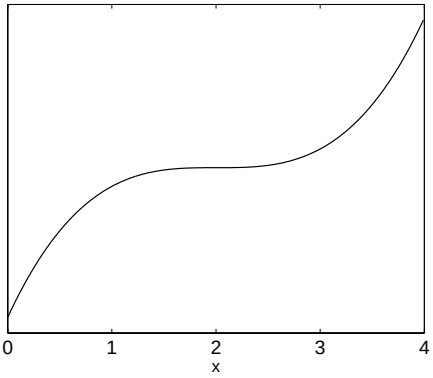
(b)



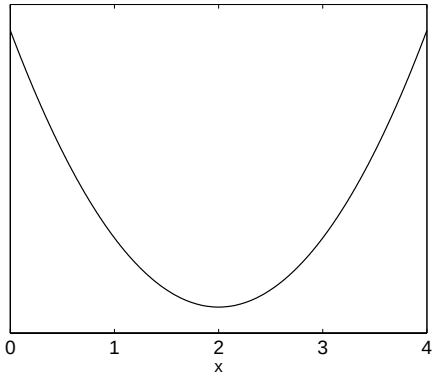
(c)



(d)



(e)



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PART II

14. Find $\dfrac{dy}{dx}$ for the following functions. Don't simplify!

(a) (5 pts) $y = \ln(\ln(1 + \sqrt{x}\,))$

(b) (5 pts) $y = \tan^{-1}(\sqrt{x^5 + 4}\,)$

(c) (4 pts) $y = (x + x^2\,)^{\tan(x)}$

Exam continues on next page

15. (8 pts) A car's brakes are applied when the car is moving at 88 ft/sec. The brakes provide a constant deceleration of 40 ft/sec^2 . How far does the car travel before coming to a stop?

Exam continues on next page

16. (10 pts) An open-topped rectangular box is to have a volume of $36000\,\text{cm}^3$. If its bottom is a rectangle whose length is twice its width, what dimensions would minimize the total area of the box?

Exam continues on next page

17. (6 pts) Find $\lim_{x \to 0} (\cos(2x))^{1/x^2}$.

Exam continues on next page

18. Consider the function $f(x) = x^3 - 3x^2 + 3$.

(a) (3 pts) Find all critical points of $f(x)$.

(b) (4 pts) Classify the critical points of $f(x)$. *Clearly justify your answer!.*

(c) (3 pts) Find the point(s) of inflection of $f(x)$. *Clearly justify your answer!.*

End of exam