

**MATH 151, SPRING 2011
COMMON EXAM III - VERSION A**

LAST NAME, First name (print): _____

INSTRUCTOR: _____

SECTION NUMBER: _____

UIN: _____

SEAT NUMBER: _____

DIRECTIONS:

1. The use of a calculator, laptop, or computer is prohibited.
2. In Part 1 (Problems 1-12), mark the correct choice on your ScanTron using a No. 2 pencil. *For your own records, also record your choices on your exam!*
3. In Part 2 (Problems 13-17), 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 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
1-12		48
13		12
14		15
15		8
16		9
17		8
TOTAL		100

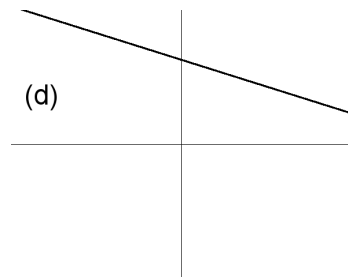
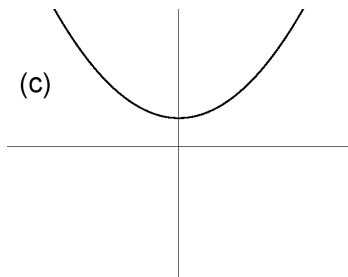
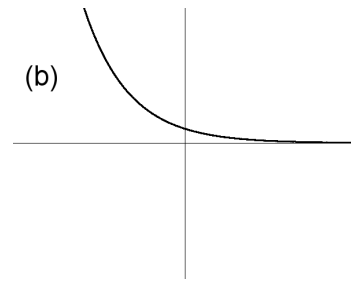
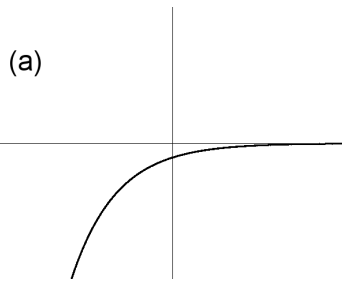
1. Find the limit: $\lim_{x \rightarrow 0} \frac{e^x - \cos x - 2x}{x^2 - 2x}$.

- (a) 1
- (b) $-\frac{1}{2}$
- (c) 0
- (d) $\frac{1}{2}$
- (e) Limit does not exist

2. Solve the equation $\ln x + \ln(x + 1) = \ln(x + 4)$ for x .

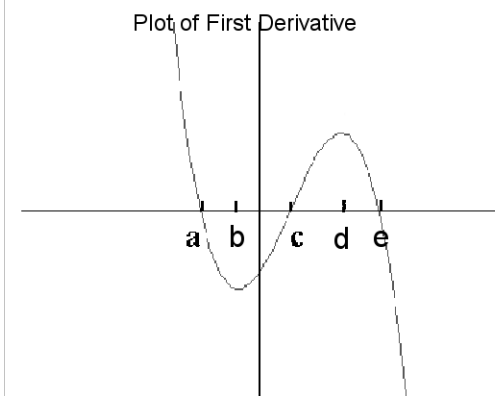
- (a) $x = 0$ and $x = 3$
- (b) $x = 4$ only
- (c) $x = 2$ and $x = -2$
- (d) $x = 3$ only
- (e) $x = 2$ only

3. Which graph of f below has the property that the derivative (f') is always positive and decreasing?



- (e) None of these graphs

For questions 4-5, the graph of the FIRST DERIVATIVE of a function f is shown below:



4. On which interval(s) is the ORIGINAL FUNCTION f decreasing?

- (a) $(-\infty, b) \cup (d, \infty)$
- (b) $(a, c) \cup (e, \infty)$
- (c) (c, ∞)
- (d) (b, d)
- (e) None of these

5. At what value(s) of x does the ORIGINAL FUNCTION f have a local minimum?

- (a) $x = a$, $x = c$, and $x = e$
- (b) $x = c$ only
- (c) $x = a$ and $x = e$
- (d) $x = b$ only
- (e) $x = b$ and $x = d$

6. Find the value of $\log_4 \left(\frac{1}{8} \right)$.

- (a) $-\frac{1}{32}$
- (b) $-\frac{2}{3}$
- (c) $-\frac{1}{2}$
- (d) -2
- (e) $-\frac{3}{2}$

7. A bacteria culture starts with 200 bacteria and triples in size every half hour. Assuming exponential growth, how many bacteria are there after 45 minutes (ignore any appropriate rounding)?

- (a) $600\sqrt{3}$
- (b) 750
- (c) $400\sqrt{2}$
- (d) $1200 \ln\left(\frac{3}{2}\right)$
- (e) $800 \ln 3$

8. Find the value of $\cos(\tan^{-1} 4)$.

- (a) $\frac{1}{\sqrt{17}}$
- (b) $\frac{4}{\sqrt{17}}$
- (c) $\frac{1}{\sqrt{15}}$
- (d) $\frac{4}{\sqrt{15}}$
- (e) $\frac{\sqrt{15}}{4}$

9. Find the absolute maximum and absolute minimum values of the function $f(x) = x^3 - 3x + 1$ on the interval $[-1, 3]$.

- (a) minimum value = -4 , maximum value = 20
- (b) minimum value = -1 , maximum value = 3
- (c) minimum value = -1 , maximum value = 19
- (d) minimum value = 3 , maximum value = 19
- (e) minimum value = -8 , maximum value = 10

10. Which of the following is an antiderivative of $f(x) = \ln x$?

- (a) $\frac{1}{2}(\ln x)^2$
- (b) e^x
- (c) $\frac{1}{x}$
- (d) $x \ln x + x$
- (e) $x \ln x - x$

11. If $f(x) = 5^x$, what is $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$?

- (a) $x5^{x-1}$
- (b) $(\ln 5)5^x$
- (c) Does not exist
- (d) 5^x
- (e) $\frac{5^x}{x}$

12. The acceleration of a car is given by $a(t) = 3t + 2$ (in ft/sec²). If the car is at rest at time $t = 0$, what is the car's velocity when $t = 2$?

- (a) $\frac{13}{4}$ ft/sec
- (b) 8 ft/sec
- (c) 12 ft/sec
- (d) $\frac{9}{2}$ ft/sec
- (e) 10 ft/sec

PART II WORK OUT

Directions: Present your solutions in the space provided. *Show all your work* neatly and concisely and *Box 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.

13. (6 points each)

(a) Find and simplify the derivative of $f(x) = x \arctan x - \frac{1}{2} \ln(1 + x^2)$.

(b) If $g(x) = \ln |3x + 2 + e^{4x}|$, find $g'(0)$.

14. The derivative of a function f is given by $f'(x) = (x - 2)e^{3x}$.

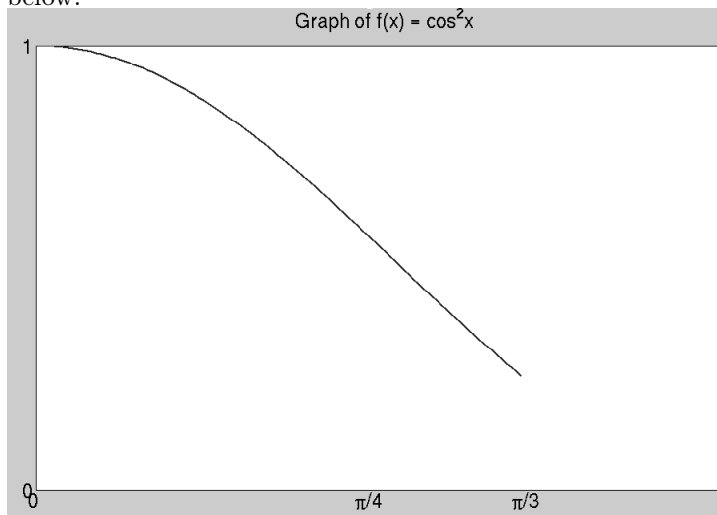
(a) (4 points) Find the intervals where the original function f is increasing or decreasing.

(b) (3 points) List and classify (as max or min) the x -coordinates of all local extrema of the original function f .

(c) (8 points) Find the intervals where the original function f is concave upward or concave downward.

15. (8 points) A rectangular container with no top and a square bottom is to have a volume of 8 ft^3 . Material for the sides costs \$1 per ft^2 and material for the bottom costs \$4 per ft^2 . Find the dimensions that will minimize the cost of the container. Clearly show that your answer is indeed a minimum.

16. (9 points) The region that lies under the graph of $f(x) = \cos^2 x$ from $x = 0$ to $x = \frac{\pi}{3}$ is shown below:



- (a) Using sigma notation, write an expression to approximate the area under the graph of $y = f(x)$ with rectangles using a partition $P = \left\{0, \frac{\pi}{4}, \frac{\pi}{3}\right\}$ with x_i^* being the right endpoint of each subinterval.
- (b) Evaluate the rectangle area expression in part (a). Your answer does not have to be simplified, but all trig expressions which can be evaluated must be.
- (c) On the graph above, sketch the approximating rectangles.

17. (8 points) Find the limit: $\lim_{x \rightarrow 0} (\cos x)^{1/x^2}$.