MA123 Exam 1

20 September 2006

Problem	Answer
1	*a* *b* *c* *d* *e*
2	*a* *b* *c* *d* *e*
3	*a* *b* *c* *d* *e*
4	*a* *b* *c* *d* *e*
5	*a* *b* *c* *d* *e*
6	*a* *b* *c* *d* *e*
7	*a* *b* *c* *d* *e*
8	*a* *b* *c* *d* *e*
9	*a* *b* *c* *d* *e*
10	*a* *b* *c* *d* *e*
11	*a* *b* *c* *d* *e*
12	*a* *b* *c* *d* *e*
13	*a* *b* *c* *d* *e*
14	*a* *b* *c* *d* *e*
15	*a* *b* *c* *d* *e*

Instructions. Circle your answer in ink on the page containing the problem and on the cover sheet. After the exam begins, you may not ask a question about the exam. Be sure you have all pages (containing 15 problems) before you begin. You may use the following formula for the derivative of a quadratic function. If

$$p(x) = Ax^2 + Bx + C$$

then

$$p'(x) = 2Ax + B$$

1. If $h(x) = \sqrt{x^2+1}$ and $g(x) = 2x - 1$ then $h(g(x)) =$

   (a) $4x$
   (b) $\sqrt{4x^2 - 4x + 2}$
   (c) $2\sqrt{x^2+1} - 1$
   (d) $\sqrt{4x^2 - 4x + 2}$
   (e) $2x^2 - 1$

2. If $u(t) = t + 7$ then $u(v(x)) = x$ if $v(x) =$

   (a) $x + 7$
   (b) 1
   (c) $x - 7$
   (d) 0
   (e) x

3. The inequality $x^2 + x - 2 > 0$ is equivalent to

   (a) $x < -2$ or $x > 1$
   (b) $-2 < x$ and $x < 1$
   (c) $x = -2$ or $x = 1$
   (d) $x < -\sqrt{2}$ or $x > 1$
   (e) $x = -\sqrt{2}$ and $x = 1$

4. Suppose $F(x) = \sqrt{x^2 - 2x - 3}$. What is the largest value of A such that $F(x)$ is defined on the interval $[-5, A]$?

   (a) -4
   (b) -3
   (c) -2
   (d) -1
   (e) 0

5. An equation of a line through the points $(3, 5)$ and $(8, 7)$ in the (s, t) plane is

   (a) $s = 6 + 5(t - 5)$
   (b) $t = 6 + 5(s - 5)$
   (c) $2t = 6 + 5(s - 5)$
   (d) $2s = 6 + 5(t - 5)$
   (e) $s = 5 + 6(t - 5)$

6. If $f(t) = 1/t$ then

$$\frac{f(t+h) - f(t)}{h} =$$

   (a) $1/(h^2)$
   (b) $1/(t(t + h))$
   (c) $(-1)/(t(t + h))$
   (d) $1/(t(t - h))$
   (e) $-1/(t(t - h))$

7. A train travels from A to B to C. The distance from A to B is 30 miles and the distance from B to C is 80 miles. The train leaves A at 10:00 AM and arrives at C at 3:00 PM. The average speed from A to B was 30 miles per hour. What was the average speed from B to C in miles per hour?

   (a) 20
   (b) 25
   (c) 30
   (d) 35
   (e) 40

8. If $g(x) = |x - 7|$ what is the average rate of change of $g(x)$ with respect to x as x changes from -3 to 3?

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

9. If $g(s) = 3s^2 + s - 2$ what is the value of $g(s)$ when the instantaneous rate of change of $g(s)$ with respect to s equals 1?

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

10. Suppose $g(s) = s^2 + 1$. Find a point of the graph of $t = g(s)$ such that the tangent line to the graph is parallel to the line with equation $t = s$.

(a) $(0, 1)$
(b) $\left(\frac{1}{2}, \frac{5}{4}\right)$
(c) $(1, 2)$
(d) $\left(\frac{3}{2}, \frac{13}{4}\right)$
(e) $(2, 5)$

11. Suppose $f(t) = t^3 + 1$. Find a value A greater than 0 such that the average rate of change of $f(t)$ from 0 to A equals 2.

(a) 1
(b) $\sqrt{2}$
(c) $\sqrt{3}$
(d) 2
(e) $\sqrt{5}$

12. Suppose

$$f(t) = \begin{cases} (-t)^2 & \text{if} \quad t < 1 \\ t^3 & \text{if} \quad t \geq 1 \end{cases}$$

Find the limit

$$\lim_{t \to 1} f(t)$$

(a) -2
(b) -1
(c) 1
(d) 2
(e) The limit does not exist

13. Suppose

$$f(t) = \begin{cases} t & \text{if} \quad t \leq 3 \\ A + \frac{t}{2} & \text{if} \quad t > 3 \end{cases}$$

Find a value of A such that the function $f(t)$ is continuous for all t.

(a) 1/2
(b) 1
(c) 3/2
(d) 2
(e) 5/2

14. Find the limit

$$\lim_{t \to 0^+} \frac{\sqrt{t^3}}{\sqrt{t}}$$

(a) 0
(b) 1
(c) 2
(d) 3
(e) The limit does not exist

15. Suppose the total cost, $C(q)$, of producing a quantity q of a product equals a fixed cost of \$1000 plus \$3 times the quantity produced. So total cost in dollars is

$$C(q) = 1000 + 3q$$

The average cost per unit quantity, $A(q)$, equals the total cost, $C(q)$, divided by the quantity produced, q. Find the limiting value of the average cost per unit as q tends to 0 from the right. In other words find

$$\lim_{q \to 0^+} A(q)$$

(a) 0
(b) 3
(c) 1000
(d) 1003
(e) The limit does not exist