

**Examination in MA0001 Mathematical methods A—Appendix**

Friday 17 December 2004

Permitted aids: Any written and printed material. One calculator.

Mark one answer for each problem on the form overleaf. You will score one point for each right answer and zero points for each wrong answer. Multiple answers will score zero.

Note: There is text on both sides of the sheet. All problems have five alternative answers.

**Problem 1.** Find the integral  $\int \frac{5 dx}{(2x+1)(x-2)}$ .

- (a)  $\frac{5}{2} \ln |2x + 1| + 5 \ln |x - 2| + C$   
 (b)  $\ln |(x - 2)/(2x + 1)| + C$   
 (c)  $-10/(2x + 1)^2 - 5/(x - 2)^2 + C$   
 (d)  $4/(2x + 1)^2 - 1/(x - 2)^2 + C$   
 (e)  $\frac{5}{2} \ln |2x + 1| \ln |x - 2| + C$

**Problem 2.** Evaluate the limit

$$\lim_{x \rightarrow 0} \frac{\int_0^x (e^{t^2} - 1) dt}{x^3}.$$

- (a) 0    (b) 2/3    (c) 1/3    (d) 1    (e)  $\infty$

**Problem 3.** An ant colony has size  $(t + 100) \ln(t + 2)$ , where  $t$  is the number of days passed since a starting day. Find an approximate value for the instantaneous rate of change (in number of ants per day) for the size of the colony when  $t = 8$ .

- (a) 13    (b) 240    (c) 11    (d) 0.10    (e) 250

**Problem 4.** Evaluate the limit

$$\lim_{x \rightarrow 0} \left( \frac{1}{x} - \frac{1}{e^x - 1} \right).$$

- (a) 0    (b)  $-\infty$     (c) 1/2    (d) 1/3    (e) 1

**Problem 5.** A function  $f$  is defined by  $f(t) = \ln(2 + e^{3t})$  for all  $t$ . Find  $f'(t)$ .

- (a)  $3/(2e^{-3t} + 1)$     (b)  $3 \ln(2 + 3e^{3t})$     (c)  $1/(2 + 3e^{3t})$     (d)  $1/(2e^{-3t} + 1)$     (e)  $1/(2 + e^{3t})$

**Problem 6.** 25 g of polonium-210 is decaying exponentially. After 50 days 19.5 g of polonium-210 is left. Find an approximate value of the half-life of polonium-210.

- (a) 130 days    (b) 1 h 30 min    (c) 140 days    (d) 120 days    (e) 110 days

**Problem 7.** What is the Taylor polynomial of degree 3 about 0 for  $\sin x$ ?

- (a)  $x - \frac{1}{6}x^3$     (b)  $x - \frac{1}{2}x^2 + \frac{1}{6}x^3$     (c)  $x - \frac{1}{2}x^2 + \frac{1}{3}x^3$     (d)  $x + \frac{1}{2}x^2 + \frac{1}{6}x^3$     (e)  $x + \frac{1}{2}x^2 + \frac{1}{3}x^3$

**Problem 8.** A function  $f$  is defined by  $f(x) = 5(x+2)^3$  for all  $x$ . Let  $f^{-1}$  be the inverse function of  $f$ . What is  $f^{-1}(5)$  equal to?

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

**Problem 9.** It is decided that the number of animals that can be hunted in an animal population is  $10S^{0.75} - S$ , where  $S$  is the population size. Approximately at which population size is the hunting yield maximal?

- (a) 110 (b) 320 (c) 1100 (d) 0.24 (e) 3200

**Problem 10.** Which formula is correct for all  $a$  and  $b$ ?

- (a)  $(a - b)^{-1} = a^{-1} - b^{-1}$   
 (b)  $(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$   
 (c)  $\frac{1}{a} - \frac{1}{b} = \frac{1}{a-b}$   
 (d)  $(a - b)^3 = a^3 - a^2b + ab^2 - b^3$   
 (e)  $(a - b)^3 = a^3 - b^3$

**Problem 11.** Find the integral  $\int 10x(x^2 - 1)^4 dx$ .

- (a)  $x^2(\frac{1}{3}x^3 - x)^5 + C$  (b)  $x^3(x^2 - 1)^5 + C$  (c)  $x^2(x^2 - 1)^5 + C$  (d)  $x^3(\frac{1}{3}x^3 - x)^5 + C$   
 (e)  $(x^2 - 1)^5 + C$

**Problem 12.** Let  $f$  be a function such that the rate of secretion of a biochemical compound is  $f'(t) = 0.01e^{-0.01t}$  and the total amount excreted by time  $t$  (in minutes) is  $f(t)$ . At time  $t = 0$  0 units are excreted. Approximately how many units are excreted in 10 minutes (that is, up to  $t = 10$ )?

- (a) 1.1 (b) 0.0090 (c) 1.9 (d) 0.095 (e) 0.90

Problem	a	b	c	d	e
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Studentnummer	Student number
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Studieprogram	Study program
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Inspektør	Inspector
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