Examination in MA0001 Mathematical methods A—Appendix
Monday 8 December 2003

Permitted aids: Any written and printed material. 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.

Problem 1. Find an approximate value of $\int_{-3}^{3} \sqrt{9-x^2}\,dx$.

(a) 16.3 **(b)** 15.6 **(c)** 14.1 **(d)** 0

Problem 2. Evaluate $\lim_{x\to 0} \frac{e^x-1}{\sin(2x)}$.

(a) 1 **(b)** 1/2 **(c)** 0 **(d)** ∞

Problem 3. What is the Taylor polynomial of degree 4 about 0 for $\ln(1+x)$?

(a) $x - \frac{1}{2}x^2 + \frac{1}{3}x^3 - \frac{1}{4}x^4$

(b) $x - \frac{1}{2}x^2 + \frac{1}{6}x^3 - \frac{1}{24}x^4$

(c) $x + \frac{1}{2}x^2 + \frac{1}{3}x^3 + \frac{1}{4}x^4$

(d) $x + \frac{1}{2}x^2 + \frac{1}{6}x^3 + \frac{1}{24}x^4$

Problem 4. Give an approximate value of $\int_{-1}^{1} \frac{x+1}{\sqrt{x^2+2x+2}}\,dx$.

(a) 1.44 **(b)** the integral diverges **(c)** 1.64 **(d)** 1.24

Problem 5. The instantaneous growth rate of a microbe population is $30te^{2t}$, where t is time in days. Find an approximate value of the total growth (cumulative change) during the first three days.

(a) 4 540 **(b)** 13 600 **(c)** 27 200 **(d)** 15 100

Problem 6. Evaluate the limit $\lim_{x\to -1} \frac{x^{1/3}+1}{x+1}$.

(a) 1/3 **(b)** 0 **(c)** ∞ **(d)** 1

Problem 7. The half-life of radioactive cobalt is 5.27 years. It decays exponentially. A nuclear accident has left the level of cobalt radiation in a certain region at 100 times the level acceptable for human habitation. Approximately how many years will it be before the region is again habitable?

(a) 25 **(b)** 35 **(c)** 10 **(d)** 20

Problem 8. The function f is defined by $f(x) = \sqrt{(x^2-4)\sqrt{2x+1}}$ for all $x \geq 2$. Find $f'(x)$. (Hint: Logarithmic differentiation may be applied.)

(a) $\left(\frac{x}{x^2-4} + \frac{1}{8x+4}\right)\sqrt{(x^2-4)\sqrt{2x+1}}$

(b) $\left(\frac{x}{x^2-4} + \frac{1}{4x+2}\right)\sqrt{(x^2-4)\sqrt{2x+1}}$

(c) $\frac{9x^2+4x-4}{4\sqrt{x^2-4}(2x+1)^{3/4}}$

(d) $\frac{3x^2+x-4}{\sqrt{(x^2-4)(2x+1)^{3/2}}}$

Problem 9. The function f is defined by $f(t) = 3(e^t - \ln t)^5$ for all $t > 0$. Find $f'(t)$.

(a) $15(e^t-\ln t)^4e^t/t$ **(b)** $15(e^t-1/t)^4$ **(c)** $\frac{1}{2}(e^t-\ln t)^6(e^t-1/t)$ **(d)** $15(e^t-\ln t)^4(e^t-1/t)$

Problem 10. Let x be the quantity of a substance, $0 \leq x \leq 100$. The rate of a chemical reaction is $12x(100 - x)$. What is the maximal rate that can be obtained?

(a) 30 000 **(b)** 24 000 **(c)** 50 **(d)** 1200

Problem 11. A laboratory uses a step-by-step procedure to produce a substance. Let the yield following step n be a_n (in kilograms). The yield following step $n + 1$ is given recursively by $a_{n+1} = \frac{2a_n}{0.6+a_n}$. The laboratory starts with 0.1 kg of the substance. Give an approximate value of the long-term yield (following many reiterations of the steps).

(a) 1.2 kg **(b)** 1.4 kg **(c)** 2.6 kg **(d)** 3.3 kg

Problem 12. A population of squirrels grows 5% per year (each year the population is 5% larger than the preceding year). Approximately how long will it take for the population to double?

(a) 12 years **(b)** 14 years **(c)** 10 years **(d)** 20 years

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

Studentnummer Student number

Studieprogram Study program

Inspektør Inspector