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University Examinations 2012/2013

FIRST YEAR, SECOND SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN ACTUARIAL SCIENCE, BACHELOR OF SCIENCE IN STATISTICS AND BACHELOR OF SCIENCE IN MATHEMATICS AND COMPUTER SCIENCE

SMA 2102/STA 2105: CALCULUS 11/CALCULUS FOR STATISTICS II

DATE: APRIL 2013   **TIME: 2 HOURS**

INSTRUCTIONS: *Answer question **one** and any other **two** questions*

QUESTION ONE (30 MARKS)

a) Given that $x = 2at^2$ and $y = 4at$ determine $\frac{dy}{dx}$. (2 Marks)

b) Find the slope of the tangent to the circle $x^2 + y^2 = 25$ at the point (-3, -4). (2 Marks)

c) i) Prove that $\int \frac{dx}{a^2 - x^2} = \sin^{-1}\left(\frac{x}{a}\right) + c$. (4 Marks)

   ii) Find $\int \frac{dx}{25x^2 + 4}$ (3 Marks)

   iii) Evaluate $\int_0^\pi \sin 8x \sin 3x \, dx$ (5 Marks)

d) find $\int \frac{3x^2 - 2x - 7}{x^2 - x - 2} dx$ (5 Marks)

e) The region bounded by the graph of $f(x) = -x^2 + x$ and x-axis is revolved about the x-axis. Determine the volume of the resulting solid. (5 Marks)

f) use the trapezoidal rule with n=10 to approximate

$$\int_1^2 \frac{1}{x} dx$$

(4 Marks)

QUESTION TWO (20 MARKS)

a) Find

   i. $\int x(3 - 4x^2)^2 \, dx$. (3 Marks)

   ii. $\int \frac{x}{(x+1)^2} dx$ (3 Marks)

iii. $\int \frac{x^2+x+1}{2x^3+3x^2+6x+5} dx$ (4 Marks)

b)   i)   prove that $\int (ax+b)^x \, dx = \frac{(ax+b)^{n+1}}{a(n+1)} + c$ hence find $\int (4x+9)^{20} \, dx$. (6 Marks)

     ii)   Evaluate $\int_0^{\pi/2} x \sin x \, dx$ (4 Marks)

QUESTION THREE (20 MARKS)

a)   Given that $x^2 y + y^2 = x^3$, determine $\frac{dy}{dx}$.   (3 Marks)

b)   find the integrals

     i. $\int \frac{x^5+x-1}{x^4-x^3} dx$ (5 Marks)

     ii. $\int \frac{x^3-10x^2+26+3}{(x+3)(x-1)^3} dx$ (6 Marks)

c)   Determine the area of the region bounded by the graphs of $y = x^2 + 2$ and $y = x$ for $0 \le x \le 1$.   (6 Marks)

QUESTION FOUR (20 MARKS)

a)   Integrate;

     i. $\int lnx^2 \, dx$ (3 Marks)

     ii. $\int x^2 lnx \, dx$ (6 Marks)

     iii. $\int x^2 e^x \, dx$ (6 Marks)

b)   Evaluate $\int_0^{\pi/6} \sec^4 x \tan x \, dx$ (5 Marks)

QUESTION FIVE (20 MARKS)

a)   Evaluate $\int_0^6 \frac{dx}{1+x^2}$ using h =1 by;

     i.   Trapezoidal Rule   (4 Marks)

     ii.   Simpson's $\frac{1}{3}$ Rule.   (4 Marks)

     iii.   Simpson's $\frac{3}{8}$ Rule.   (4 Marks)

b)   Find the surface area generated by the loop of the curve $x = t^2, y = t - \frac{t^3}{3}$ about the axis.   (8 Marks)