POLITEKNIK
Jabatan Pengajian Politeknik

EXAMINATION AND EVALUATION DIVISION
DEPARTMENT OF POLYTECHNIC EDUCATION
(MINISTRY OF HIGHER EDUCATION)

MATHEMATICS, SCIENCE & COMPUTER DEPARTMENT

FINAL EXAMINATION

DECEMBER 2011 SESSION

BA201 : ENGINEERING MATHEMATICS 2

DATE : 24 APRIL 2012 (TUESDAY)
DURATION : 2 HOURS (2.30 PM – 4.30 PM)

This paper consists of **NINE (9)** pages including the front page and appendix.

This paper consists of **SIX (6)** questions. Answer **FOUR (4)** questions only

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DO NOT OPEN THIS QUESTION PAPER UNTIL INSTRUCTED BY THE CHIEF INVIGILATOR

(CLO stated at the end of each question is referring to the learning outcome of the topic assessed. The CLO stated is only for lectures' references.)

INSTRUCTION :

This paper consists of **SIX (6)** questions. Answer **FOUR (4)** questions only

QUESTION 1

(a) Solve each of the following complex number in the form of a+b*i*. [CLO1]

i. $2i(6-5i)$

(2 marks)

ii. $(-5+3i)+(11+2i)$

(2 marks)

iii. $(12+13i)-(-10+2i)$

(2 marks)

(b) Given that $z=-2+3i$ and $w=7-5i$, find the modulus and the argument for each of the following: [CLO1]

i. z

(5 marks)

ii. zw

(7 marks)

(c) If $z_1 = 10 \angle 115°$ and $z_2 = -6+10\,i$ are complex numbers, solve and convert the followings:
[CLO1]

i. z_1 in exponential form.

(2marks)

ii. $z_1 + z_2$ in Cartesian form.

(5 marks)

QUESTION 2

a) Differentiate the following equations. [CLO2]

i. $y = 3x^5 + 6\sqrt{x}$

(3 marks)

ii. $y = \dfrac{2}{(6x-7)^4}$

(3 marks)

iii. $y = \cos^5(3x-2)$

(3 marks)

iv. $y = \dfrac{e^{5x}}{4x+7}$

(4 marks)

b) Find $\dfrac{dy}{dx}$ from the following parametric equation. [CLO2]

$y = 3t^2 + t^4$, $x = 15t^2 + 10t$

(5 marks)

c) Find the second order differentiation from the equation given below. [CLO2]

$y = (6-2x^3)^4$

(7 marks)

QUESTION 3

(a) Determine the gradient of $y = 5x^2 + 2$ at point P, where $x = -1.6$

[CLO 2] (2 marks)

(b) Find the coordinates of the turning points for the following curves. Determine whether each of the turning point is a maximum or minimum point. [CLO 2]

i) $y = x^2 - 5x + 2$ (4 marks)

ii) $y = 4x^3 + 3x^2 - 5$ (8 marks)

(c) Find the coordinates of the stationary points of the curve $y = 2 + 6x - x^2$. Then determine their nature and sketch the graph. [CLO 2] (11 marks)

QUESTION 4

i. The surface area of a cube is expanding at a constant rate of $20\ cm^2 / s$. [CLO2]

a) Find the rate of change of length, $\frac{dL}{dt}$ when the total surface area is $300\ cm^2$.

(11 marks)

b) Find the rate of change of volume, $\frac{dV}{dt}$.

(8 marks)

ii. A particle P is moving along a straight line. P moves a distance of s meters from a fixed point O. After t seconds, the distance travelled is given by $s = 18t^2 - t^3$. Find: [CLO2]

a) velocity, v of P after 4 seconds

(4 marks)

b) acceleration, a of P after 4 seconds

(2 marks)

QUESTION 5

(a) Integrate the followings with respect to *x:* [CLO3]

i. $\int \frac{3}{2} x^2 dx$

(2 marks)

ii. $\int (3x-5)dx$

(2 marks)

iii. $\int 2(x+3)^3 dx$

(5 marks)

iv. $\int \frac{x}{x^2-5} dx$

(4 marks)

v. $\int e^x (1+e^{2x}) dx$

(4 marks)

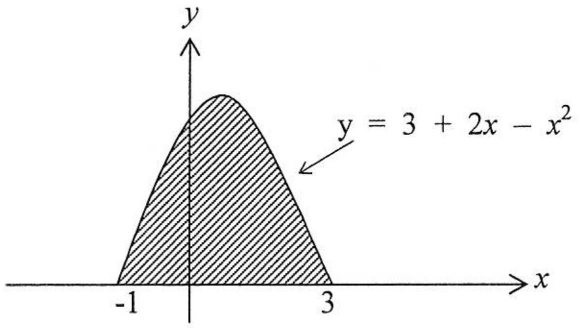
(b) Evaluate $\int_1^2 2x \sin x^2 dx$ using an appropriate substitution. [CLO3]

(8 marks)

QUESTION 6

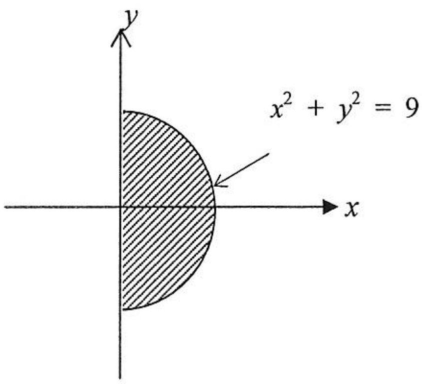
a) The diagram shows an enclosed region between the curve $y = 3 + 2x - x^2$ and x-axis. Calculate the area of the enclosed region. [CLO3]

(4 marks)

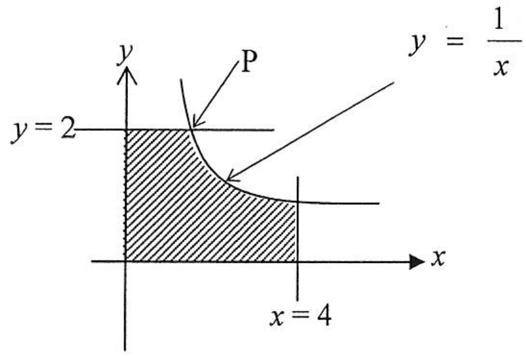


b) The following diagram shows the graph of $x^2 + y^2 = 9$. Calculate the volume of revolution when the shaded region is rotated 360° about y-axis. [CLO3]

(6 marks)



c) The following diagram shows a region enclosed by a curve $y = \frac{1}{x}$, the lines $x = 4$ and $y = 2$, and the coordinate axes. [CLO3]



Find:

i. The x-coordinate of P

(2 marks)

ii. The volume of revolution when this enclosed region is revolved completely about x-axis.

(7 marks)

d) A particle moves in a straight line. At time t seconds after passing through a fixed point with an initial velocity, 5m/s, its acceleration, a m/s^2 is given by $a = 12 - 8t$.

[CLO3]

i. Express the velocity equation of the particle in terms of t

(3 marks)

ii. Find the maximum velocity of the particle

(3 marks)

FORMULA SHEET FOR ENGINEERING MATHEMATICS 2 (BA201)

BASICS OF DIFFERENTIATION

1. $\frac{d}{dx}(x^n) = nx^{n-1}$	2. $\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$	3. $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$
4. $\frac{d}{dx}(\ln x) = \frac{1}{x}$	5. $\frac{d}{dx}(a^x) = a^x \ln a$	6. $\frac{d}{dx}(e^x) = e^x$
7. $\frac{d}{dx}(\sin x) = \cos x$	8. $\frac{d}{dx}(\cos x) = -\sin x$	9. $\frac{d}{dx}(\tan x) = \sec^2 x$
10. $\frac{d}{dx}(\cot x) = -\cos ec^2 x$	11. $\frac{d}{dx}(\sec x) = \sec x.\tan x$	12. $\frac{d}{dx}(\cos ec\, x) = -\cos ec\, x.\cot x$

BASICS OF INTEGRATION

1. $\int x^n\, dx = \frac{x^{n+1}}{n+1} + c\ \{n \neq -1\}$	2. $\int \frac{1}{x}\, dx = \ln x + c$	3. $\int e^x\, dx = e^x + c$
4. $\int a^x\, dx = \frac{a^x}{\ln a} + c$	5. $\int \sin x\, dx = -\cos x + c$	6. $\int \cos x\, dx = \sin x + c$
7. $\int \sec^2 x\, dx = \tan x + c$		

AREA UNDER A CURVE

1. $A_x = \int_a^b y\, dx$	2. $A_y = \int_a^b x\, dy$

VOLUME UNDER A CURVE

1. $V_x = \pi\int_a^b y^2\, dx$	2. $V_y = \pi\int_a^b x^2\, dy$

THE ROOTS OF QUADRATIC EQUATION

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

TRIGONOMETRY IDENTITIES

1. $\sin^2\theta + \cos^2\theta = 1$	2. $\sec^2\theta = 1 + \tan^2\theta$	3. $\cos ec^2\theta = 1 + \cot^2\theta$
4. $\sin 2\theta = 2\sin\theta\cos\theta$	5. $\cos 2\theta = \cos^2\theta - \sin^2\theta$ $= 1 - 2\sin^2\theta$ $= 2\cos^2\theta - 1$	6. $\tan 2\theta = \frac{2\tan\theta}{1 - \tan^2\theta}$
7. $a\sin\theta + b\cos\theta = R\sin(\theta + \alpha)$	8. $a\sin\theta - b\cos\theta = R\sin(\theta - \alpha)$	9. $a\cos\theta + b\sin\theta = R\cos(\theta - \alpha)$
10. $a\cos\theta - b\sin\theta = R\cos(\theta + \alpha)$		