STRUCTURED (100 Marks)

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

QUESTION 1

a) Find the simple expression for the algebraic function below. [CLO 1]

$$\frac{(4x^2y)(3x^4)}{6y}$$

(2 marks)

b) Simplify the following equations to their lowest terms. [CLO 1]

i) $m(1+n)-n(1+m)$ (2 marks)

ii) $\frac{2}{3}pq(\frac{1}{2}p^2+3)$ (3 marks)

c) Solve the following equation by using factorization method. [CLO 2]

$$x^2+7x-60=0$$

(5 marks)

d) Solve the following equation by using quadratic formula. [CLO 2]

$$(v-3)(4-v)=0$$

(4 marks)

e) Solve the following equation by using completing the square method. [CLO 2]

$$\frac{2m+4}{6m}=\frac{3m}{m+2}$$

(5 marks)

f) Solve the following simultaneous equations by using substitution method. [CLO 2]

$$2p-3q=6$$
$$9q+6p=3$$

(4 marks)

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

BA101 : ENGINEERING MATHEMATICS 1

DATE : 23 APRIL 2012 (MONDAY)
DURATION : 2 HOURS (2.30 PM – 4.30 PM)

This paper consists of **ELEVEN (11)** 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.)

QUESTION 2

(a) Find the value of $9.3\times10^{-1}\times2.0\times10^{-5}$ [CLO1] (5 marks)

(b) Find the lowest term for $\dfrac{\left(j^2k^{-1}l\right)^{11}}{jkl}$ [CLO 1] (4 marks)

(c) Simplify the expression $256^{2x-3}\times16^{1-x}$ [CLO 1] (4 marks)

(d) Find the value of the logarithm as shown below : [CLO 2]

$$\log_3\frac{1}{243}$$

(3 marks)

(e) Calculate the value of $\log_4 256-1+\log_4 2^4$ [CLO 2] (4 marks)

(f) Given that $\log_a 5=m$ and $\log_a 7=n$. Express $\log_a\left(\dfrac{875}{a}\right)$ in terms of m and n.

[CLO 2]

(5 marks)

QUESTION 3

(a) Find the value of the following trigonometric functions: [CLO 1]

i) sin (–186°) (1 marks)

ii) sec 218° (2 marks)

b) Find the values of θ for $\cos\theta=0.4694$ if $0^\circ\le\theta\le360^\circ$ [CLO 2]

(6 marks)

c) Given $\sin A=\dfrac{3}{5}$, $0^\circ\le A\le360^\circ$ and $\cos B=-\dfrac{12}{13}$, $90^\circ\le B\le360^\circ$.

Find the value of $\cos(A+B)$. [CLO 3]

(4 marks)

d) Solve the equation $3\cot^2 x+\operatorname{cosec} x-1=0$ for $0^\circ\le\theta\le360^\circ$ [CLO 3]

(5 marks)

e) Given, the length of $x=5$cm, $y=6$cm and angle $Z=47^\circ$ as shown in Figure 3(a). Find the: [CLO 2]

i) area of a triangle XYZ (3 marks)

ii) length of z. (4 marks)

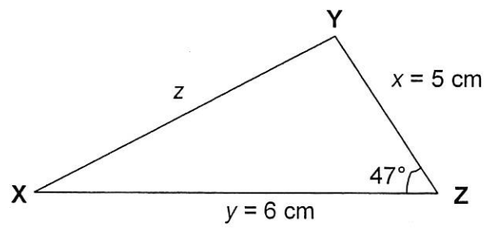


Figure 3 (a)

c) i) From Figure 4(c), find the values of a and b. [CLO 1]

(6 marks)

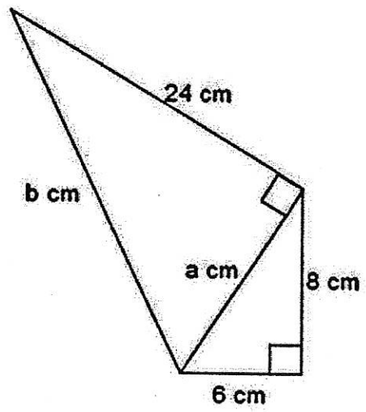


Figure 4(c)

ii) In Figure 4(d), z is the midpoint of XY. Find the length of XW. [CLO 1]

(7 marks)

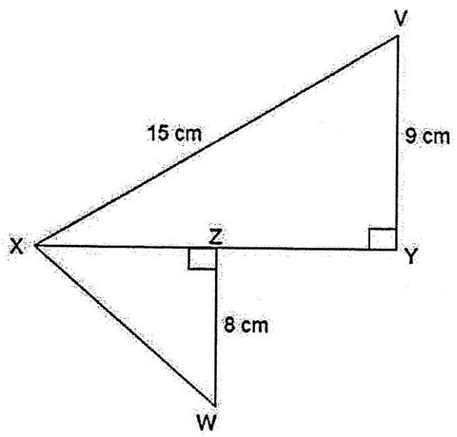


Figure 4(d)

QUESTION 4

a) In Figure 4(a), PQ is a straight line. [CLO 1]

Find the value of x.

(3 marks)

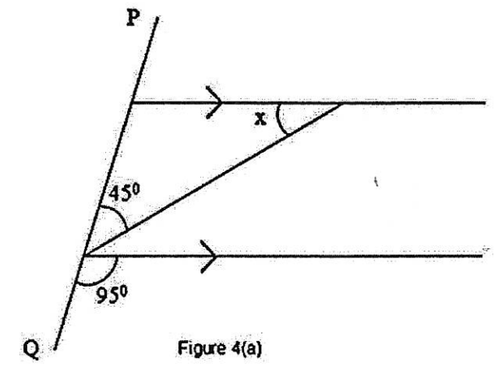


Figure 4(a)

b) In Figure 4(b), O is the centre of the circle and $\angle EOJ$ is 100^0. Determine the value of z. [CLO 1]

(4 marks)

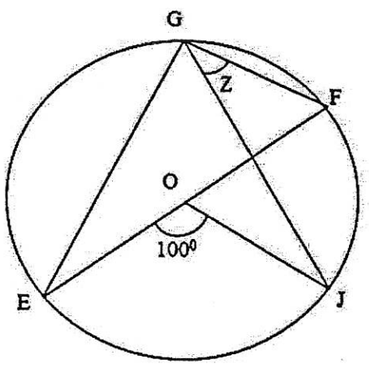


Figure 4(b)

QUESTION 5

(a) In Figure 5(a), PRSU is a rectangle. PQT and QTS are the quadrants of circle with radius of 10 cm. Find: [CLO 2]

i. the length of arc PT. (4 marks)

ii. the perimeter of the shaded region. (3 marks)

iii. the area of the shaded region. (4 marks)

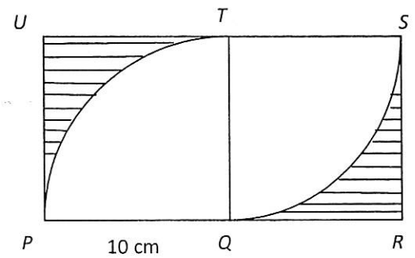


Figure 5(a)

Figure 5(a)

(b) The Figure 5(b) shows a cylinder in the middle of a cone. The radius of the cylinder is 1/3 of the radius of the cone.
If the cylinder is taken out from the cone, find the volume of the remaining solid. [CLO 3]

(7 marks)

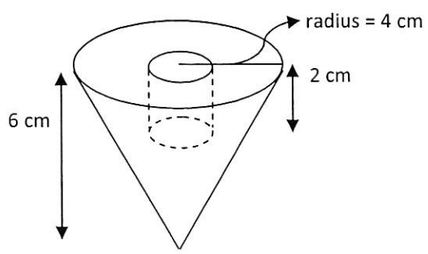


Figure 5(b)

d) Figure 4(e) shows a triangle ABC, with AB = 30cm, $\angle BAC = 35°$ and $\angle ABC = 90°$. BD is an arc of a circle with center at A. [CLO 2]
Find the area of the shaded region. (5 marks)

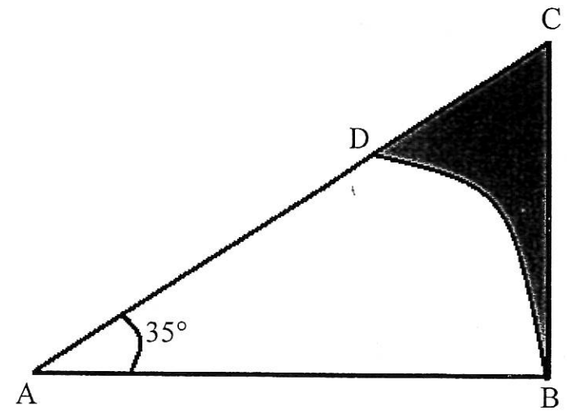


Figure 4 (e)

QUESTION 6

(a) i. Sketch a graph for each of the following coordinates. [CLO1]

a) A(0 , 4) B(2, 0) (2 marks)

b) M(5, 0) N(0, -4) (2 marks)

ii. Find the gradient and distance between point A(3 , 2) and point B(5, -10) (5 marks)

(b) i. Complete Table 6(b) by using the equation below [CLO 1] (3 marks)

$y = 2x^2 - x - 3$

X	-2	-1	0	1	2	3	4	4.5	5
Y	7	0	-3		3		25		42

Table 6(b)

ii. Draw the graph of $y = 2x^2 - x - 3$ for $-2 \le x \le 5$ [CLO2] (3 marks)

iii. From the graph, find the value of y when x = 2.8 and the value of x when y = 18 [CLO2] (2 marks)

(c) Sketch the graph of the following functions: [CLO 2]

i. $y = 8 - 3x^3$ (3 marks)

ii. $y = -\frac{5}{x}$ (2 marks)

(d) Sketch the graph for the function $y = 2(x^3 + 3)$ [CLO 2] (3 marks)

(c) Figure 5(c) shows a container with a rectangle ABCD as its base. Given that the volume of the water in the container is 54 cm^3, calculate the: [CLO2]

i. value of *t*. (3 marks)

ii. perimeter of the solid. (4 marks)

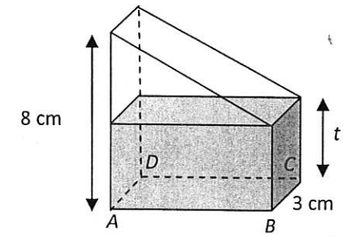


Figure 5(c)

FORMULA SHEET FOR ENGINEERING MATHEMATICS (BA101)

INDICES AND LOGARITHM

Basic of Index and Logarithm

1. $y = a^x \leftrightarrow x = \log_a y$

Rules of Index

1. $a^m \times a^n = a^{m+n}$
2. $\frac{a^m}{a^n} = a^{m-n}$
3. $(a^m)^n = a^{mn}$
4. $(ab)^n = a^n b^n$
5. $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$, $b \neq 0$
6. $a^{-n} = \frac{1}{a^n}$, $a \neq 0$
7. $a^{\frac{m}{n}} = \sqrt[n]{a^m}$

Rules of Logarithm

1. $\log_a MN = \log_a M + \log_a N$
2. $\log_a \frac{M}{N} = \log_a M - \log_a N$
3. $\log_a N^P = P \log_a N$

FORMULA OF TRIANGLE

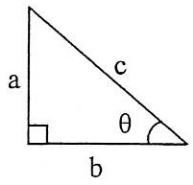
Sine Rules $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine Rules $a^2 = b^2 + c^2 - 2bc \cos A$

Area of Triangle $= \frac{1}{2}$ a b sin C

TRIGONOMETRY

Pythagoras' Theorem



$c^2 = a^2 + b^2$

Trigonometric Identities

$\tan\theta = \frac{\sin\theta}{\cos\theta}$

$\cos^2\theta + \sin^2\theta = 1$

$1 + \tan^2\theta = \sec^2\theta$

$1 + \cot^2\theta = \operatorname{cosec}^2\theta$

Compound-angle

$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$

$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$

$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$

Double-angle

$\sin 2A = 2 \sin A \cos A$

$\cos 2A = \cos^2 A - \sin^2 A$
$= 1 - 2\sin^2 A$
$= 2\cos^2 A - 1$

$\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$

MEASUREMENT

Arc Length of a Circle

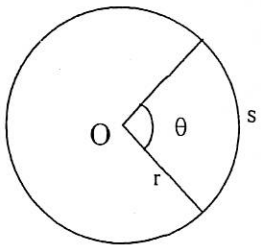
$s = r\theta$

Area of a Sector

$A = \frac{1}{2} r^2 \theta$

Area of a Segment

$A = \frac{1}{2} r^2 \theta - \frac{1}{2} r^2 \sin\theta$



SURFACE AREA AND VOLUME

Cylinder : $A = 2\pi rh + 2\pi r^2$
$V = \pi r^2 h$

Cone : $A = \pi rs + \pi r^2$
$V = \frac{1}{3}\pi r^2 h$

Sphere : $A = 4\pi r^2$
$V = \frac{4}{3}\pi r^3$

Pyramid : A = area of four triangles + area of base

V = (1/3) x (area of base) x (height)

GRAPH

$y = ax^2 + bx + c$, $a \neq 0$

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$y = mx + c$

Mid point $= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

Distance $= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Vertex, $x = -\frac{b}{2a}$

SOLVING QUADRATIC EQUATION

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

2. $\left(x + \frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 + c = 0$