

SECTION A

STRUCTURED (50 marks)**INSTRUCTION:**

This section consists of 3 structured questions. Answer **TWO (2)** questions only.

QUESTION 1

- a) Simplify the following expression to the lowest terms. [CLO 1: C1]
- i. $\frac{3n^2 + 6n}{9n^3 - 3n}$ (2 marks)
- ii. $\frac{4q^2 + 6q}{2q}$ (2 marks)
- iii. $\frac{d-3}{4} - \frac{d+2}{6}$ (6 marks)
- b) If $\frac{s}{3} + 1 = \frac{s}{9}$, find the value of s . [CLO1: C1]
(5 marks)
- c) Find the value of 'z' in the following quadratic equation by factorisation. [CLO1: C1]
(5 marks)
- $$z^2 - 7z + 16 = 4$$
- d) Use the elimination method to find the value of 'x' and 'y'. [CLO 1 : C3]
(5 marks)
- $$\begin{aligned} 3x - y &= 7 \\ 3x - 6y &= -3 \end{aligned}$$

POLITEKNIK
Jabatan Pengajian Politeknik

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

MATHEMATICS, SCIENCE & COMPUTER DEPARTMENT

FINAL EXAMINATION
JUNE 2012 SESSIONS

BA101: ENGINEERING MATHEMATICS 1

DATE: 17 NOVEMBER 2012 (SATURDAY)
DURATION: 2 HOURS (11.15 AM – 1.15 PM)

This paper consists of **ELEVEN (11)** pages including the front page
SECTION A: Structured (3 questions – answer two only)
SECTION B: Structured (3 questions – answer two only)

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BY THE CHIEF INVIGILATOR

(The CLO stated is only for references only)

QUESTION 3

- a) Given $\sin\theta = \frac{8}{17}$ with $0^\circ < \theta < 90^\circ$. Without using the calculator, find the values of the following. [CLO1: C1]

- i. $\cos\theta$ (2 marks)
- ii. $\tan\theta$ (2 marks)
- iii. $\operatorname{cosec}\theta$ (2 marks)
- iv. $\sec\theta$ (2 marks)
- v. $\cot\theta$ (2 marks)

- b) Find θ value of $0^\circ < \theta < 360^\circ$ which satisfy the following trigonometric equations. [CLO1: C1]

- i. $\tan\theta = 0.4245$ (4 marks)
- ii. $\sin\theta = -0.7431$ (4 marks)

- c) From the right angled triangle below, find : [CLO1: C1]

- i. $\sin\theta$ (3 marks)
- ii. $\cos\theta$ (2 marks)
- iii. $\tan\theta$ (2 marks)

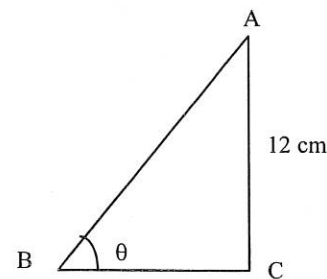


Figure 3(a)

QUESTION 2

- a) Find the values of the following expressions, express your answers in standard form. [CLO1: C1]

- i. $3.5 \times 10^{-6} + 6 \times 10^{-5}$ (2 marks)
- ii. 0.65×0.24 (2 marks)

- b) Simplify each of the following. [CLO1: C1]

- i. $2^{x+2} \times 2^{x+1}$ (2 marks)
- ii. $6^{\frac{1}{2}x} \div 6^{\frac{1}{4}x}$ (2 marks)

- c) Simplify the expression below. [CLO1: C1]

$$27^x \times 9^{-6x} \times 9^{2x-7} \quad (4 \text{ marks})$$

- d) Find the values of the following logarithm. [CLO1: C1]

- i. $9 \log_{\frac{1}{3}} \frac{1}{3}$ (2 marks)
- ii. $\log_{\sqrt{6}} 6^{\frac{1}{2}}$ (2 marks)

- e) Given that $\log_2 3 = 1.585$ and $\log_2 5 = 2.322$, find the value of

$$\log_4 135 \quad \begin{array}{l} \text{[CLO1: C1]} \\ \text{(4 marks)} \end{array}$$

- f) Solve the following logarithmic equation. [CLO1: C1]

$$\log_4 (y - 2) + 3 \log_2 8 = 10 \quad (5 \text{ marks})$$

c)

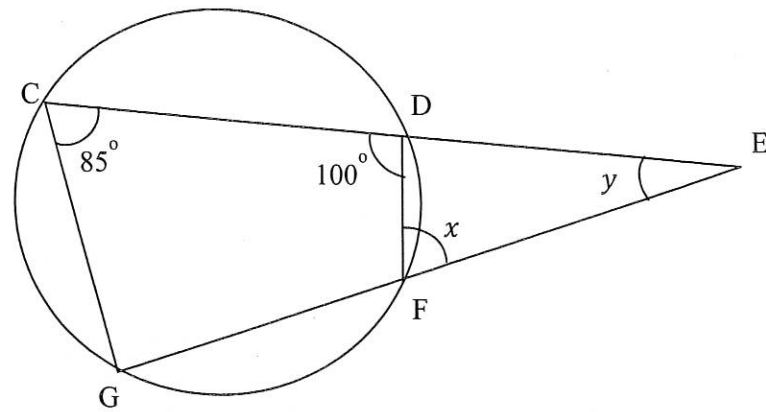


Figure 4(c)

From Figure 4(c), calculate value of:

[CLO 2: C2]

- i. x (1 mark)
- ii. y (3 marks)

d)

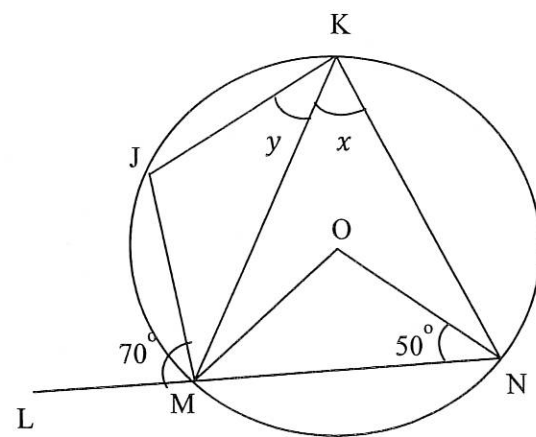


Figure 4(d)

From Figure 4(d), JKMN is a circle at center O , LMN is a straight line.

Find the value of:

[CLO 2:C2]

- i. x (3 marks)
- ii. y (2 marks)

SECTION B

STRUCTURED (50 marks)

INSTRUCTION:

This section consists of 3 structured questions. Answer **TWO (2)** questions only.

QUESTION 4

a)

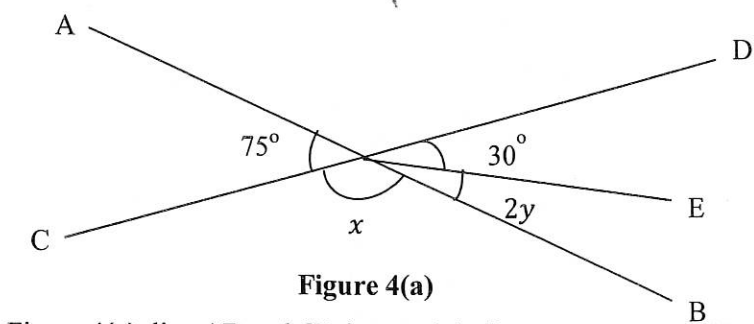


Figure 4(a)

From Figure 4(a), line AB and CD is a straight line.

[CLO 2:C1]

- i. Find the value of x (2 marks)
- ii. Find the value of y (3 marks)

(b)

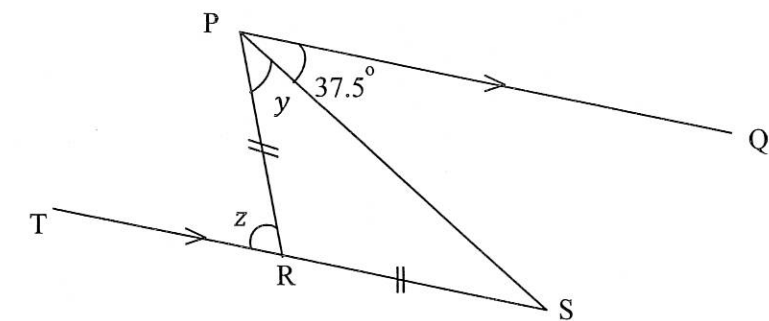


Figure 4(b)

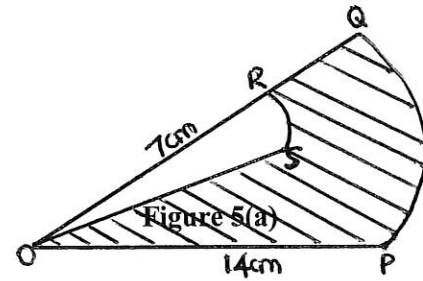
From Figure 4(b) above, TRS is a straight line. Calculate the value of:

[CLO 2:C2]

- i. y (1 mark)
- ii. z (3 marks)

QUESTION 5

a)



In the Figure 5(a), PQ and RS are two arcs from the same circle with its centre O . Given that $\angle ROS = 20^\circ$ and $\angle POQ = 60^\circ$.

- i. Find the perimeter of a sector POQ. [CLO2: C1] (5 marks)
- ii. Calculate the area of the shaded region. [CLO2: C3] (7 marks)

b)

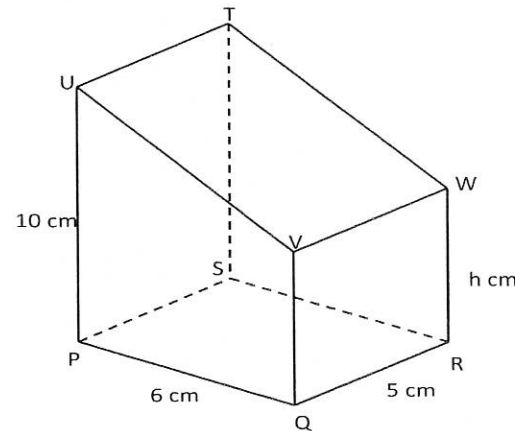


Figure 5(b)

Figure 5(b) shows a right-prism PGRSTUVW with trapezium PQVU as its uniform cross-section. Given that the volume of the prism is 210cm^3 , calculate the value of h .

[CLO2: C2] (6 marks)

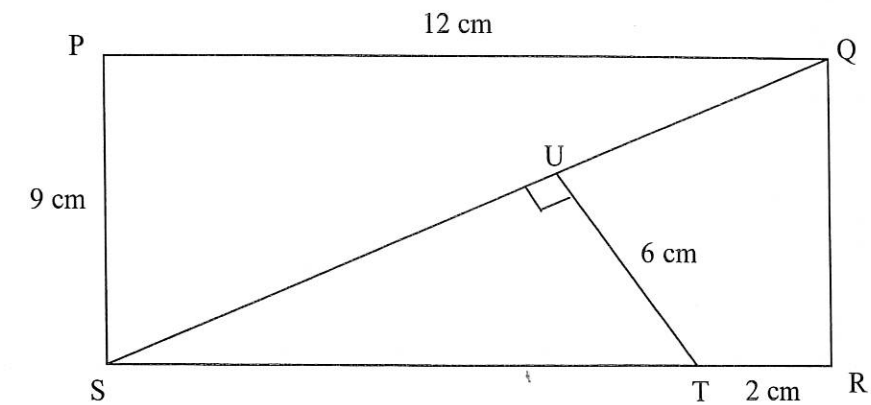


Figure 4(e)

- e) From Figure 4(e), PQRS is a rectangle and TUS is a right-angled triangle. Find the length of QU. [CLO 2:C3] (7 marks)

QUESTION 6

- a) One straight line connects point A(-3,6) and point B(7,-3). From that straight line, find:
- i. the gradient of the straight line AB. [CLO2: C1] (2 marks)
 - ii. the distance of AB. [CLO2: C1] (2 marks)
 - iii. the y-interception. [CLO2: C1] (2 marks)
 - iv. the equation of the straight line AB. [CLO2: C1] (2 marks)
- b) The straight lines A and B have the equation $y = 5x - 6$ and $y = -2x + 3$ respectively. Find the intersection of A and B using the graphical method for $-3 \leq x \leq 3$. [CLO 2:C3] (8 marks)
- c) i. Complete the following table by using the given equation. [CLO 1 : C1] (4 marks)

x	-2	0	2	4	6	8
y			-3			21

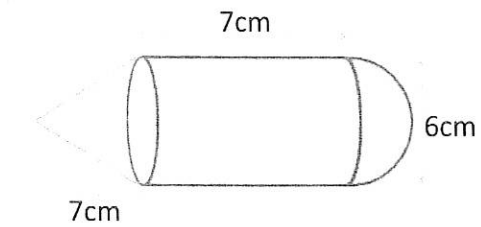
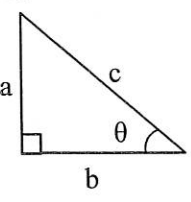
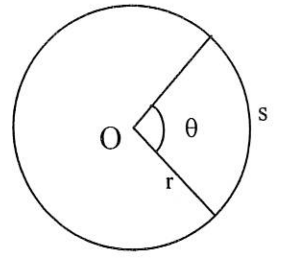


Figure 5(c)

- c) Figure 5(c) shows a composite solid consisting of a cone, a cylinder and a hemisphere. Calculate the volume of the solid. [CLO2: C2] (7 marks)

<p>INDICES AND LOGARITHM</p> <p><u>Basic of Index and Logarithm</u> 1. $y = a^x \leftrightarrow x = \log_a y$</p> <p><u>Rules of Index</u></p> <p>1. $a^m \times a^n = a^{m+n}$ 5. $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}, b \neq 0$ 2. $\frac{a^m}{a^n} = a^{m-n}$ 6. $a^{-n} = \frac{1}{a^n}, a \neq 0$ 3. $(a^m)^n = a^{mn}$ 7. $a^{\frac{m}{n}} = \sqrt[n]{a^m}$ 4. $(ab)^n = a^n b^n$</p> <p><u>Rules of Logarithm</u></p> <p>1. $\log_a MN = \log_a M + \log_a N$ 2. $\log_a \frac{M}{N} = \log_a M - \log_a N$ 3. $\log_a N^p = p \log_a N$</p> <p>FORMULA OF TRIANGLE</p> <p>Sine Rules $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$</p> <p>Cosine Rules $a^2 = b^2 + c^2 - 2bc \cos A$</p> <p>Area of Triangle = $\frac{1}{2} ab \sin C$</p> <p>TRIGONOMETRY</p> <p><u>Pythagoras' Theorem</u> <u>Trigonometric Identities</u></p> <div style="display: flex; align-items: center;">  <div> <p>$\tan \theta = \frac{\sin \theta}{\cos \theta}$</p> <p>$\cos^2 \theta + \sin^2 \theta = 1$</p> <p>$1 + \tan^2 \theta = \sec^2 \theta$</p> <p>$1 + \cot^2 \theta = \text{cosec}^2 \theta$</p> <p>$c^2 = a^2 + b^2$</p> </div> </div> <p><u>Compound-angle</u> $\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$ $\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$ $\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$</p> <p><u>Double-angle</u> $\sin 2A = 2 \sin A \cos A$ $\cos 2A = \cos^2 A - \sin^2 A$ $= 1 - 2 \sin^2 A$ $= 2 \cos^2 A - 1$ $\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$</p>	<p>MEASUREMENT</p> <p>Arc Length of a Circle $s = r\theta$</p> <p>Area of a Sector $A = \frac{1}{2} r^2 \theta$</p> <p>Area of a Segment $A = \frac{1}{2} r^2 \theta - \frac{1}{2} r^2 \sin \theta$</p>  <p>SURFACE AREA AND VOLUME</p> <p>Cylinder : $A = 2\pi rh + 2\pi r^2$ $V = \pi r^2 h$</p> <p>Cone : $A = \pi rs + \pi r^2$ $V = \frac{1}{3} \pi r^2 h$</p> <p>Sphere : $A = 4\pi r^2$ $V = \frac{4}{3} \pi r^3$</p> <p>Pyramid : A = area of four triangles + area of base $V = (1/3) \times (\text{area of base}) \times (\text{height})$</p> <p>GRAPH</p> <p>$y = ax^2 + bx + c, a \neq 0$</p> <p>$m = \frac{y_2 - y_1}{x_2 - x_1}$</p> <p>$y = mx + c$</p> <p>Mid point = $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$</p> <p>Distance = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$</p> <p>Vertex, $x = -\frac{b}{2a}$</p> <p>SOLVING QUADRATIC EQUATION</p> <p>1. $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$</p> <p>2. $\left(x + \frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 + c = 0$</p>
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- ii. Draw the graph of the function $y = x^2 - 6x + 5$ for the range of $-2 \leq x \leq 8$.
 [CLO 2 : C3]
 (5 marks)