KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN MATEMATIK,SAINS DAN KOMPUTER

PEPERIKSAAN AKHIR

**SESI I : 2024/2025**

# DBM10143 : CALCULUS AND ALGEBRA

**TARIKH : 06 DISEMBER 2024**
**MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)**

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Kertas ini mengandungi **LAPAN (8)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

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**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

**INSTRUCTION:**

This section consists of **FOUR (4)** questions. Answer **ALL** questions.

***ARAHAN:***

*Bahagian ini mengandungi **EMPAT (4)** soalan. Jawab **SEMUA** soalan.*

**QUESTION 1**

***SOALAN 1***

CLO1 (a) Convert the following numbering systems into hexadecimal number system.

*Tukarkan sistem nombor berikut kepada sistem nombor asas enam belas.*

i. $2077_8$

[5 marks]

[*5 markah*]

ii. $1011101101_2$

[5 marks]

[*5 markah*]

CLO1 (b) Identify the following values in binary arithmetic operations.

*Kenal pasti nilai yang berikut dalam operasi aritmetik asas dua.*

i. $(111111_2 - 1011_2) + (1011001_2 - 111000_2)$

[5 marks]

[*5 markah*]

ii. $(1010010_2 + 1010_2) \times 101_2$

[5 marks]

[*5 markah*]

iii. $(11011_2 \times 11_2) - (11011_2 + 11_2)$

[5 marks]

[*5 markah*]

**QUESTION 2**

***SOALAN 2***

CLO1 (a) Figure 2(a) shows a circle with center O. Identify the values for the following:

*Rajah 2(a) menunjukkan sebuah bulatan berpusat O. Kenal pasti nilai bagi yang berikut:*

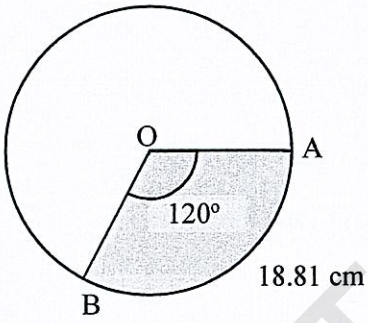



Figure 2(a) / *Rajah 2(a)*

i. Length OA if arc length of AB is 18.81 cm.

*Panjang OA jika panjang lengkok AB adalah 18.81 cm.*

[5 marks]

[*5 markah*]

ii. The circumference of the circle.

*Lilitan bulatan.*

[2 marks]

[*2 markah*]

CLO1 (b) Based on the Figure 2(b), identify the values for the following:

*Berdasarkan Rajah 2(b), kenal pasti nilai bagi yang berikut:*

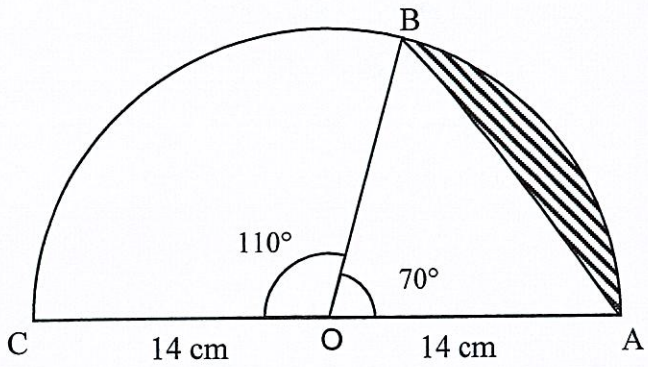



Figure 2(b) / *Rajah 2(b)*

i. The arc length of the BC

*Panjang lengkok BC*

[4 marks]

[*4 markah*]

ii. Area of segment OAB

*Luas kawasan segmen OAB*

[4 marks]

[*4 markah*]

CLO1 (c) i. Figure 2 (c)(i) shows a cone with a radius of 7 cm. Identify the height of the cone if the volume is 667.06 $cm^3$.

*Rajah 2 (c)(i) menunjukkan sebuah kon dengan jejari 7 cm. Kenal pasti ketinggian kon jika isipadu kon ialah 667.06 $cm^3$.*

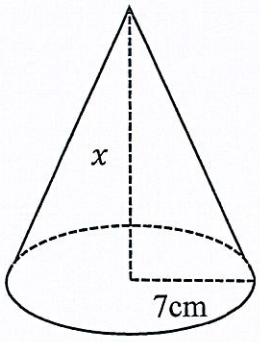



Figure 2(c)(i) / *Rajah 2(c)(i)*

[3 marks]

[*3 markah*]

ii. A ball with radius of 5 cm is located in a cylinder container filled with water as shown in Figure 2(c)(ii). Identify the volume of water that remains in the container once the ball is taken out.

*Sebiji bola dengan radius 5 cm terletak di dalam bekas silinder yang berisi air seperti yang ditunjukkan dalam Rajah 2(c)(ii). Kenal pasti isipadu air yang tinggal di dalam bekas sebaik sahaja bola dikeluarkan.*

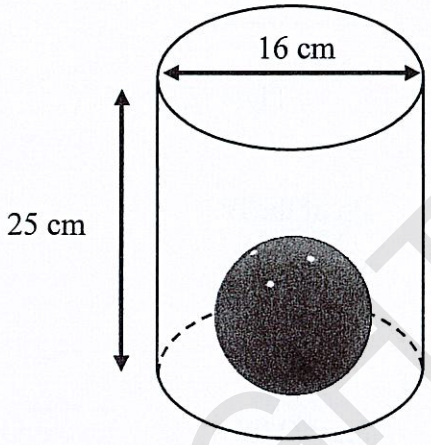



Figure 2(c)(ii) / *Rajah 2(c)(ii)*

[7 marks]

[*7 markah*]

**QUESTION 3**

***SOALAN 3***

CLO1 (a) Given two vectors, $\vec{A}$ and $\vec{B}$ with components $\vec{A} = 12i + 6j$ and $\vec{B} = -2i + 5j$. Express the values for the following:

*Diberi dua vektor, $\vec{A}$ dan $\vec{B}$ dengan komponen $\vec{A} = 12i + 6j$ dan $\vec{B} = -2i + 5j$. Nyatakan nilai yang berikut:*

i. $-2\vec{A} + 4\vec{B}$

[3 marks]

[*3 markah*]

ii. $\overrightarrow{AB}$

[3 marks]

[*3 markah*]

iii. $\hat{B}$

[4 marks]

[*4 markah*]

CLO1 (b) Given two vectors, $\vec{M} = 2i + 3j + 5k$ and $\vec{N} = i - 2j + 4k$ . Express:

*Diberi dua vektor, $\vec{M} = 2i + 3j + 5k$ dan $\vec{N} = i - 2j + 4k$ . Nyatakan:*

i. Angle between vectors $\vec{M}$ and $\vec{N}$.

*Sudut di antara vektor $\vec{M}$ dan $\vec{N}$.*

[9 marks]

[*9 markah*]

ii. Area of the triangle formed by two vectors $\vec{M}$ and $\vec{N}$.

*Luas segitiga yang dibentuk oleh dua vektor $\vec{M}$ dan $\vec{N}$.*

[6 marks]

[*6 markah*]

**QUESTION 4**

***SOALAN 4***

CLO1 (a) Express the derivative for each of the following function:

*Nyatakan pembezaan bagi setiap fungsi yang berikut:*

i. $y = x^3 + \frac{5x^2}{2} + 24$

[2 marks]

[*2 markah*]

ii. $y = (4x - 7)^{-4}$

[3 marks]

[*3 markah*]

iii. $y = \frac{x+2}{x^2-2}$

[5 marks]

[*5 markah*]

CLO1 (b) Express the following indefinite integrals:

*Nyatakan kamiran tak tentu bagi yang berikut:*

i. $\int -2x + 8x^5 + 3\, dx$

[3 marks]

[*3 markah*]

ii. $\int \sqrt{x} - 6x^2\, dx$

[3 marks]

[*3 markah*]

iii. $\int \frac{-3}{(-2x+8)^4}\, dx$

[4 marks]

[*4 markah*]

CLO1 (c) Identify the value of $\int_{-1}^{1} x^5 + 7x^2\, dx$.

*Kenal pasti nilai bagi* $\int_{-1}^{1} x^5 + 7x^2\, dx$.

[5 marks]

[*5 markah*]

**SOALAN TAMAT**

# FORMULA SHEET FOR DBM10143: CALCULUS AND ALGEBRA

## VECTOR & SCALAR

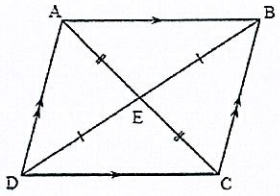
1. ***Magnitude Vector;*** $|\vec{A}| = \sqrt{a^2 + b^2 + c^2}$
2. ***Unit Vector;*** $\hat{u} = \frac{\overline{u}}{|u|}$
3. ***Cos θ*** $= \frac{\overline{A} \bullet \overline{B}}{|A||B|}$
4. ***Scalar Product;***

   $\vec{A} \bullet \vec{B} = a_1a_2 + b_1b_2 + c_1c_2$

5. ***Vector Product;***

   $$\vec{A} \times \vec{B} = \begin{vmatrix} i & j & k \\ a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \end{vmatrix}$$

**Formula number 6 & 7, refers to the same diagram*




6. ***Area of parallelogram ABCD;***

   $A = |\overrightarrow{AB} \times \overrightarrow{BC}|$

7. ***Area of triangle ABC;***

   $A = \frac{1}{2}|\overrightarrow{AB} \times \overrightarrow{BC}|$

## GEOMETRY

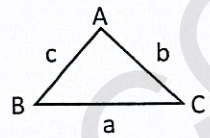
### Radian to Degree

$\theta = value\ in\ radian \times \frac{180^\circ}{\pi}$

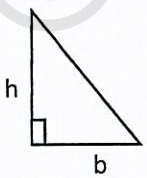
### Degree to Radian

$\theta = value\ in\ degree \times \frac{\pi}{180^\circ}$

### Formula of triangle




$Area\ of\ triangle = \frac{1}{2}ab\sin c$



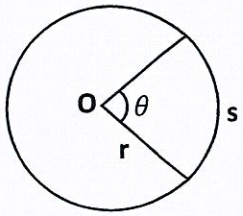

$Area\ of\ right\ angle\ triangle = \frac{1}{2}bh$

### Circumference

$circumference = 2\pi r$

### Arc Length

$s = r\theta \qquad (\theta\ in\ radian)$




### Area of Circle

$A = \pi r^2$

### Area of Sector

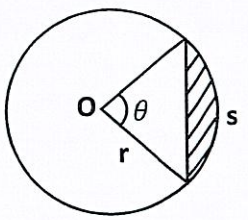
$A = \frac{1}{2}r^2\theta \qquad (\theta\ in\ radian)$

### Area of Segment

$A = \frac{1}{2}r^2(\theta_1 - sin\theta_2)$

*or*

$A = \frac{1}{2}r^2\theta_1 - \frac{1}{2}r^2 sin\theta_2$

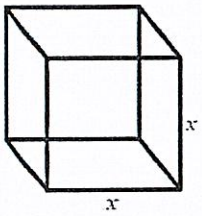



$\theta_1$ *must be in radian*

$\theta_2$ *must be in degree*

## Surface area and Volume

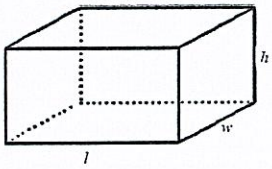
### *Cube*




$A = 6x^2$

$V = x^3$

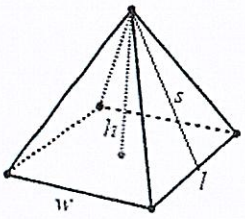
### *Cuboid*




$A = 2(wh + lw + lh)$

$V = lwh$

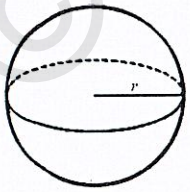
### *Pyramid*




$A = wl + ls + ws$

$V = \frac{1}{3} \times wl \times h$

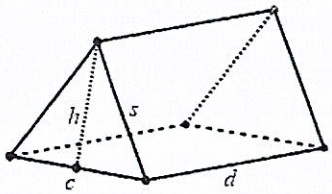
### *Sphere*




$A = 4\pi r^2$

$V = \frac{4}{3}\pi r^3$

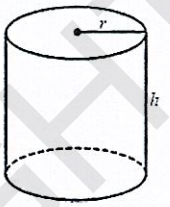
### *Prism*




$A = ch + cd + 2sd$

$V = \frac{1}{2} \times ch \times d$

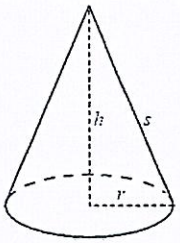
### *Cylinder*




$A = 2\pi rh + 2\pi r^2$

$V = \pi r^2 h$

### *Cone*




$A = \pi rs + \pi r^2$

$V = \frac{1}{3}\pi r^2 h$

## DIFFERENTIATION

| | | | |
|---|---|---|---|
| 1. | $\frac{d}{dx}(k) = 0, k \text{ is constant}$ | 2. | $\frac{d}{dx}(ax^n) = anx^{n-1}$ [Power Rule] |
| 3. | $\frac{d}{dx}(ax+b)^n = n(ax+b)^{n-1} \times \frac{d}{dx}(ax+b)$ [Composite Rule] | | |
| 4. | $\frac{d}{dx}\big(f(x) \pm g(x)\big) = f'(x) \pm g'(x)$ | 5. | $\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$ [Product Rule] |
| 6. | $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$ [Quotient Rule] | 7. | $\frac{dy}{dx} = \frac{du}{dx} \times \frac{dy}{du}$ [Chain Rule] |

## INTEGRATION

| | | | |
|---|---|---|---|
| 1. | $\int ax^n dx = \frac{ax^{n+1}}{n+1} + c;\ \{n \neq -1\}$ | 2. | $\int (ax+b)^n dx = \frac{(ax+b)^{n+1}}{(a)(n+1)} + c;\ \{n \neq -1\}$ |
| 3. | $\int k\ dx = kx + c, k \text{ is constant}$ | 4. | $\int_a^b f(x)dx = F(b) - F(a)$ |