Mr Feng
Mrs Kerr
Ms Lau

Name: ……………………………..………

Student Number: …………………………………

Teacher:……………………………………………

Year 12

HSC ASSESSMENT TASK 1

Term 4
2021

Time Allowed: 50 minutes

Mathematics Extension 2

General Instructions

- Write your answers in the Answer Booklet.
- Write using black or blue pen.
- Erasable pens are **not** to be used.
- Approved calculators may be used.
- Diagrams are not drawn to scale.
- All necessary working should be shown in questions **6** - **8**.
- Marks may be deducted for careless or untidy work.
- A reference sheet is provided.

Mark	**/30**
Rank	**/**
Highest Mark	**/30**

BLANK PAGE

Section I

Multiple Choice.

Each question worth 1 mark in this section

---

1 What is the value of $\mathrm{Im}(z)$ if $z = 4 - i\sqrt{3}$?

(A) $-i\sqrt{3}$

(B) $-\sqrt{3}$

(C) $\sqrt{3}$

(D) $i\sqrt{3}$

2 What is the conjugate of the complex number $\sqrt{2}i - 2$?

(A) $\sqrt{2}\,i + 2$

(B) $\sqrt{2} + 2i$

(C) $\sqrt{2} - 2i$

(D) $-\sqrt{2}\,i - 2$

3 What is the argument of ω given that $\omega = -4 + 3i$

(A) $\tan^{-1}\dfrac{3}{4}$

(B) $-\tan^{-1}\dfrac{3}{4}$

(C) $\tan^{-1}\dfrac{3}{4} + \dfrac{\pi}{2}$

(D) $\pi - \tan^{-1}\dfrac{3}{4}$

4 The complex numbers $p = 5 - 2i$ and $q = -8 - 7i$ are represented by the points P and Q on the Argand diagram. Which of the following complex numbers is represented by the vector $\overrightarrow{PQ}$?

(A) $-13 - 5i$

(B) $13 + 5i$

(C) $13 - 5i$

(D) $-13 + 5i$

5 Which of the following equations has the roots $1 + 2i$, $1 - 2i$ and -3?

(A) $z^3 + z^2 + z + 15 = 0$

(B) $z^3 - z^2 + z + 15 = 0$

(C) $z^3 + z^2 - z + 15 = 0$

(D) $z^3 - z^2 - z - 15 = 0$

End of Section I

Section II (25 marks)

Question 6 (8 marks)

(a) Given the complex numbers $z = \sqrt{3} - i$ and $\omega = -2 + 2i$.

(i) Write z in modulus and argument form. **1**

(ii) Hence, simplify $\dfrac{z^2}{\omega^4}$. Leave your answer in the form $a + ib$, where a and b are real. **3**

(b) (i) Find the two square roots of the complex number $-5 + 12i$. **2**

(ii) Hence, or otherwise, solve the equation $z^2 + (2 + i)z + (2 - 2i) = 0$. **2**

Question 7 (8 marks)

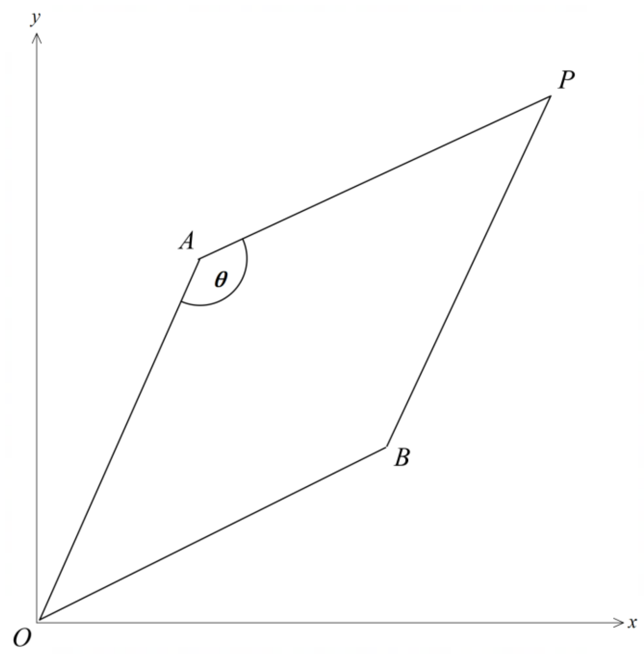
(a) Find the value of $\dfrac{e^{i\frac{\pi}{6}} - e^{-i\frac{\pi}{6}}}{3i}$. **2**

(b) Consider the equation $x^3 - 8x^2 + 25x - 26 = 0$.

(i) Show that $3 - 2i$ is a root of the equation. **1**

(ii) Find the other roots of the equation. **2**

(c) On the Argand diagram, the points O, A, B and P represent the complex numbers 0, $1+\sqrt{3}\,i$, $\sqrt{3}+i$ and z respectively. $OAPB$ forms a rhombus.



(i) Find z in the form of $a + ib$, where a and b are real numbers. **1**

(ii) An interior angle of the rhombus is marked as θ on the diagram. Find the value of θ. **2**

Question 8 (9 marks)

Given that ω is a non-real seventh root of -1 with the smallest positive argument:

(i) Find ω in polar form. **1**

(ii) Show that $1-\omega+\omega^2-\omega^3+\omega^4-\omega^5+\omega^6=0$. **1**

(iii) If $z=\cos\theta+i\sin\theta$, show that $z^n+z^{-n}=2\cos n\theta$. **1**

(iv) Hence, or otherwise, find the exact value of $\cos\frac{\pi}{7}\cos\frac{2\pi}{7}\cos\frac{3\pi}{7}$. **2**

(v) Show that $\alpha=\omega-\omega^2-\omega^4$ and $\beta=\omega^3+\omega^5-\omega^6$ are the roots of the equation $z^2-z+2=0$. **2**

(vi) Hence, find the exact value of $\sin\frac{\pi}{7}-\sin\frac{2\pi}{7}-\sin\frac{3\pi}{7}$. **2**

End of Task

BLANK PAGE

NSW Education Standards Authority

HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics Advanced
Mathematics Extension 1
Mathematics Extension 2

REFERENCE SHEET

Measurement

Length

$$l = \frac{\theta}{360} \times 2\pi r$$

Area

$$A = \frac{\theta}{360} \times \pi r^2$$

$$A = \frac{h}{2}(a + b)$$

Surface area

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

$$A = 4\pi r^2$$

Volume

$$V = \frac{1}{3}Ah$$

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

Functions

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

For $ax^3 + bx^2 + cx + d = 0$:

$$\alpha + \beta + \gamma = -\frac{b}{a}$$

$$\alpha\beta + \alpha\gamma + \beta\gamma = \frac{c}{a}$$

and $\alpha\beta\gamma = -\frac{d}{a}$

Relations

$$(x - h)^2 + (y - k)^2 = r^2$$

Financial Mathematics

$$A = P(1 + r)^n$$

Sequences and series

$$T_n = a + (n - 1)d$$

$$S_n = \frac{n}{2}[2a + (n - 1)d] = \frac{n}{2}(a + l)$$

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(1 - r^n)}{1 - r} = \frac{a(r^n - 1)}{r - 1}, \ r \neq 1$$

$$S = \frac{a}{1 - r}, \ |r| < 1$$

Logarithmic and Exponential Functions

$$\log_a a^x = x = a^{\log_a x}$$

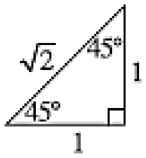
$$\log_a x = \frac{\log_b x}{\log_b a}$$

$$a^x = e^{x \ln a}$$

Trigonometric Functions

$$\sin A = \frac{\text{opp}}{\text{hyp}}, \quad \cos A = \frac{\text{adj}}{\text{hyp}}, \quad \tan A = \frac{\text{opp}}{\text{adj}}$$

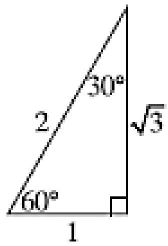
$$A = \frac{1}{2}ab\sin C$$



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

$$c^2 = a^2 + b^2 - 2ab\cos C$$

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$



$$l = r\theta$$

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

Trigonometric identities

$$\sec A = \frac{1}{\cos A}, \ \cos A \neq 0$$

$$\operatorname{cosec} A = \frac{1}{\sin A}, \ \sin A \neq 0$$

$$\cot A = \frac{\cos A}{\sin A}, \ \sin A \neq 0$$

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

Compound angles

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

$$\cos(A + B) = \cos A\cos B - \sin A\sin B$$

$$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A\tan B}$$

If $t = \tan\frac{A}{2}$ then $\sin A = \frac{2t}{1+t^2}$

$$\cos A = \frac{1-t^2}{1+t^2}$$

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

$$\cos A\cos B = \frac{1}{2}\left[\cos(A - B) + \cos(A + B)\right]$$

$$\sin A\sin B = \frac{1}{2}\left[\cos(A - B) - \cos(A + B)\right]$$

$$\sin A\cos B = \frac{1}{2}\left[\sin(A + B) + \sin(A - B)\right]$$

$$\cos A\sin B = \frac{1}{2}\left[\sin(A + B) - \sin(A - B)\right]$$

$$\sin^2 nx = \frac{1}{2}(1 - \cos 2nx)$$

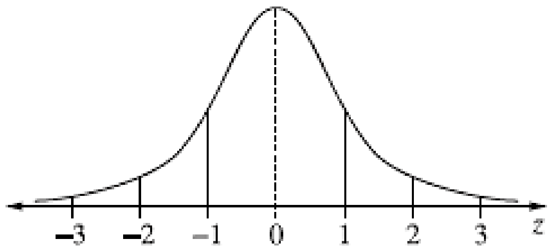
$$\cos^2 nx = \frac{1}{2}(1 + \cos 2nx)$$

Statistical Analysis

$$z = \frac{x - \mu}{\sigma}$$

An outlier is a score
less than $Q_1 - 1.5 \times IQR$
or
more than $Q_3 + 1.5 \times IQR$

Normal distribution



- approximately 68% of scores have z-scores between −1 and 1
- approximately 95% of scores have z-scores between −2 and 2
- approximately 99.7% of scores have z-scores between −3 and 3

$$E(X) = \mu$$

$$\operatorname{Var}(X) = E\left[(X - \mu)^2\right] = E\left(X^2\right) - \mu^2$$

Probability

$$P(A \cap B) = P(A)P(B)$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)}, \ P(B) \neq 0$$

Continuous random variables

$$P(X \leq r) = \int_a^r f(x)\,dx$$

$$P(a < X < b) = \int_a^b f(x)\,dx$$

Binomial distribution

$$P(X = r) = {}^nC_r p^r(1-p)^{n-r}$$

$$X \sim \operatorname{Bin}(n, p)$$

$$\Rightarrow \quad P(X = x) = \binom{n}{x}p^x(1-p)^{n-x}, \ x = 0, 1, \ldots, n$$

$$E(X) = np$$

$$\operatorname{Var}(X) = np(1-p)$$

Differential Calculus

Function	Derivative
$y = f(x)^n$	$\dfrac{dy}{dx} = nf'(x)[f(x)]^{n-1}$
$y = uv$	$\dfrac{dy}{dx} = u\dfrac{dv}{dx} + v\dfrac{du}{dx}$
$y = g(u)$ where $u = f(x)$	$\dfrac{dy}{dx} = \dfrac{dy}{du} \times \dfrac{du}{dx}$
$y = \dfrac{u}{v}$	$\dfrac{dy}{dx} = \dfrac{v\dfrac{du}{dx} - u\dfrac{dv}{dx}}{v^2}$
$y = \sin f(x)$	$\dfrac{dy}{dx} = f'(x)\cos f(x)$
$y = \cos f(x)$	$\dfrac{dy}{dx} = -f'(x)\sin f(x)$
$y = \tan f(x)$	$\dfrac{dy}{dx} = f'(x)\sec^2 f(x)$
$y = e^{f(x)}$	$\dfrac{dy}{dx} = f'(x)e^{f(x)}$
$y = \ln f(x)$	$\dfrac{dy}{dx} = \dfrac{f'(x)}{f(x)}$
$y = a^{f(x)}$	$\dfrac{dy}{dx} = (\ln a)f'(x)a^{f(x)}$
$y = \log_a f(x)$	$\dfrac{dy}{dx} = \dfrac{f'(x)}{(\ln a)f(x)}$
$y = \sin^{-1} f(x)$	$\dfrac{dy}{dx} = \dfrac{f'(x)}{\sqrt{1-[f(x)]^2}}$
$y = \cos^{-1} f(x)$	$\dfrac{dy}{dx} = -\dfrac{f'(x)}{\sqrt{1-[f(x)]^2}}$
$y = \tan^{-1} f(x)$	$\dfrac{dy}{dx} = \dfrac{f'(x)}{1+[f(x)]^2}$

Integral Calculus

$$\int f'(x)[f(x)]^n\,dx = \frac{1}{n+1}[f(x)]^{n+1} + c$$

where $n \neq -1$

$$\int f'(x)\sin f(x)\,dx = -\cos f(x) + c$$

$$\int f'(x)\cos f(x)\,dx = \sin f(x) + c$$

$$\int f'(x)\sec^2 f(x)\,dx = \tan f(x) + c$$

$$\int f'(x)e^{f(x)}\,dx = e^{f(x)} + c$$

$$\int \frac{f'(x)}{f(x)}\,dx = \ln|f(x)| + c$$

$$\int f'(x)a^{f(x)}\,dx = \frac{a^{f(x)}}{\ln a} + c$$

$$\int \frac{f'(x)}{\sqrt{a^2-[f(x)]^2}}\,dx = \sin^{-1}\frac{f(x)}{a} + c$$

$$\int \frac{f'(x)}{a^2+[f(x)]^2}\,dx = \frac{1}{a}\tan^{-1}\frac{f(x)}{a} + c$$

$$\int u\frac{dv}{dx}\,dx = uv - \int v\frac{du}{dx}\,dx$$

$$\int_a^b f(x)\,dx$$

$$\approx \frac{b-a}{2n}\left\{f(a) + f(b) + 2\left[f(x_1) + \cdots + f(x_{n-1})\right]\right\}$$

where $a = x_0$ and $b = x_n$

Combinatorics

$$^{n}P_{r} = \frac{n!}{(n-r)!}$$

$$\binom{n}{r} = {}^{n}C_{r} = \frac{n!}{r!\,(n-r)!}$$

$$(x+a)^n = x^n + \binom{n}{1}x^{n-1}a + \cdots + \binom{n}{r}x^{n-r}a^r + \cdots + a^n$$

Vectors

$$\left|\underset{\sim}{u}\right| = \left|x\underset{\sim}{i} + y\underset{\sim}{j}\right| = \sqrt{x^2 + y^2}$$

$$\underset{\sim}{u} \cdot \underset{\sim}{v} = \left|\underset{\sim}{u}\right|\left|\underset{\sim}{v}\right|\cos\theta = x_1x_2 + y_1y_2,$$

where $\underset{\sim}{u} = x_1\underset{\sim}{i} + y_1\underset{\sim}{j}$

and $\underset{\sim}{v} = x_2\underset{\sim}{i} + y_2\underset{\sim}{j}$

$$\underset{\sim}{r} = \underset{\sim}{a} + \lambda\underset{\sim}{b}$$

Complex Numbers

$$\begin{aligned} z = a + ib &= r(\cos\theta + i\sin\theta) \\ &= re^{i\theta} \end{aligned}$$

$$\begin{aligned} \left[r(\cos\theta + i\sin\theta)\right]^n &= r^n(\cos n\theta + i\sin n\theta) \\ &= r^n e^{in\theta} \end{aligned}$$

Mechanics

$$\frac{d^2x}{dt^2} = \frac{dv}{dt} = v\frac{dv}{dx} = \frac{d}{dx}\left(\frac{1}{2}v^2\right)$$

$$x = a\cos(nt + \alpha) + c$$

$$x = a\sin(nt + \alpha) + c$$

$$\ddot{x} = -n^2(x - c)$$

Multiple Choice Answer Sheet
Mathematics Extension 2 2021

Name:......
Teacher's Name:.......................................

Question 1

(A) ○ (B) ● (C) ○ (D) ○

Question 2

(A) ○ (B) ○ (C) ○ (D) ●

Question 3

(A) ○ (B) ○ (C) ○ (D) ●

Question 4

(A) ● (B) ○ (C) ○ (D) ○

Question 5

(A) ○ (B) ○ (C) ● (D) ○

Please turn the page

SECTION II
25 marks

Name:..

Teacher's Name:................................

Your responses should include relevant mathematical reasoning and/or calculations.
Extra writing space is provided at the end of each part in this Answer Booklet.

Question 6 (8 marks)

Part (a) **Marks**

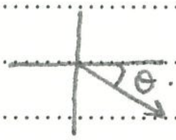
(i) **1**

$|z| = \sqrt{(\sqrt{3})^2 + (-1)^2}$

$= 2.$

$\tan\theta = \frac{-1}{\sqrt{3}}$

$\theta = -\frac{\pi}{6}.$



$\therefore z = 2\,\text{cis}(-\frac{\pi}{6}).$

1 mark.
Correct solution with indication of finding the argument.

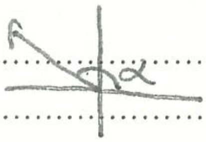
(ii) **3**

$|w| = \sqrt{(-2)^2 + (2)^2}$

$= 2\sqrt{2}.$

$\tan\alpha = \frac{2}{-2} = -1$

$\alpha = -\frac{\pi}{4}$



1 mark.
Find w in mod-arg form.

$w = 2\sqrt{2}\,\text{cis}\frac{3\pi}{4}$

$z^2 = (2\,\text{cis}(-\frac{\pi}{6}))^2$

$= 4\,\text{cis}(-\frac{\pi}{3})$ (De Moivres Theorem)

1 mark.
Apply De Moivres Theorem

$w^4 = (2\sqrt{2}\,\text{cis}\frac{3\pi}{4})^4$

$= 64\,\text{cis}\,3\pi$

$= 64\,\text{cis}\,\pi$

1 mark
Correct solutions.

$\frac{z^2}{w^4} = \frac{4}{64}\,\text{cis}(-\frac{\pi}{3} - \pi)$

$= \frac{1}{16}\,\text{cis}(-\frac{4\pi}{3})$

$= \frac{1}{16}\,\text{cis}\frac{2\pi}{3}$

$= \frac{1}{16}(\cos\frac{2\pi}{3} + i\sin\frac{2\pi}{3})$

$= -\frac{1}{32} + \frac{\sqrt{3}}{32}\,i$

Question 6 (continued)

Part (b) **Marks**

(i) **2**

$\sqrt{-5+12i} = \sqrt{4+12i-9}$ $6i \to 2, 3i$

$= \sqrt{2^2+2(3i)(2)+(3i)^2}$

$= \sqrt{(2+3i)^2}$ 1 mark.

$= \pm(2+3i)$ Separate $-5+12i$ as an expansion of a perfect square.

or

Generate the simultaneous equations.

1 mark.

Correct answers.

(ii) **2**

$\Delta = (2+i)^2 - 4(2-2i)$ 1 mark.

$= 4+4i+(-1)-8+8i$ Apply quadratic formula correctly.

$= -5+12i$

$z = \dfrac{-(2+i) \pm \sqrt{-5+12i}}{2}$ 1 mark.

Correct answers.

$z = \dfrac{-2-i+2+3i}{2}$ or $z = \dfrac{-2-i-2-3i}{2}$ (part (i)).

$\therefore z = i$ or $z = -2-2i$

Name:...

Question 7 (8 marks) Teacher's Name:...................................

Part (a) **Marks**

(i) 2

$$\frac{e^{i\frac{\pi}{6}} - e^{-i\frac{\pi}{6}}}{3i} = \frac{\cos\frac{\pi}{6} + i\sin\frac{\pi}{6} - (\cos(-\frac{\pi}{6}) + i\sin(-\frac{\pi}{6}))}{3i}$$

$$= \frac{2i\sin\frac{\pi}{6}}{3i}$$ 1

$$= \frac{1}{3}.$$ 1

$; \cos\frac{\pi}{6} + i\sin\frac{\pi}{6} - (\cos\frac{\pi}{6} - i\sin\frac{\pi}{6})$

$= \cos\frac{\pi}{6} + i\sin\frac{\pi}{6} - \cos\frac{\pi}{6} + i\sin\frac{\pi}{6}$

$= 2i\sin\frac{\pi}{6}$

Part (b)

(i) 1

Sub $x=3-2i$ into the equation:

$LHS = (3-2i)^3 - 8(3-2i)^2 + 25(3-2i) - 26$

$= 27 + 3(3)^2(-2i) + 3(3)(-2i)^2 + (-2i)^3 - 72 + 96i + 32 + 75 - 50i - 26$

$= 27 - 54i - 36 + 8i - 72 + 96i + 32 + 75 - 50i - 26$

$= 0. = RHS$

$\therefore x = 3-2i$ is a root.

(ii) 2

Since all the coefficients are real & $3-2i$ is a root

$\therefore 3+2i$ is also a root (Conjugate Root Theorem). 1

Let the roots be $3-2i$, $3+2i$ & α.

By the sum of roots:

$3-2i + (3+2i) + \alpha = 8.$

$\alpha = 2$

$\therefore$ The roots of the equation are $3-2i$, $3+2i$, 2. 1

Please turn the page

Question 7 (continued)
Part (c)

Marks

(i) 1

$z = 1+\sqrt{3}i + \sqrt{3}+i$

$= (1+\sqrt{3}) + (1+\sqrt{3})i.$

(ii) 2

$\arg(1+\sqrt{3}i) = \frac{\pi}{3}$ 

$\arg(\sqrt{3}+i) = \frac{\pi}{6}$ 

1

$\angle ADB = \arg(1+\sqrt{3}i) - \arg(\sqrt{3}+i)$

The other interior angle of the rhombus $= \frac{\pi}{3} - \frac{\pi}{6}$

$= \frac{\pi}{6}.$

$\therefore \theta = \pi - \frac{\pi}{6} = \frac{5\pi}{6}$ (cointerior angles in parallel lines). 1

Please turn the page

Name:..

Question 8 (9 marks)

Teacher's Name:..

Marks

(i) 1

$z^7 = -1$. 1 r/w

$z^7 = \text{cis}(\pi + 2k\pi)$.

$z = (\text{cis}(2k+1)\pi)^{\frac{1}{7}}$

$= \text{cis}\,\frac{2k+1}{7}\pi$ De Moives theorem

Let $k=0$.

$\therefore w = \text{cis}\,\frac{\pi}{7}$.

(ii) 1

$w^7 = -1$. 1 r/w

$(1+w^7) = 0$

$(1+w)(1-w+w^2-w^3+w^4-w^5+w^6) = 0$

Since w is non-real & $w \neq -1$.

$\therefore 1-w+w^2-w^3+w^4-w^5+w^6 = 0$.

(iii) 1

$z = \cos\theta + i\sin\theta$. $z^n = (\cos\theta + i\sin\theta)^n$

$= \cos n\theta + i\sin n\theta$. (De Moives theorem).

Similarly $z^{-n} = \cos(-n\theta) + i\sin(-n\theta)$

$= \cos n\theta - i\sin n\theta$

$\therefore z^n + z^{-n} = \cos n\theta + i\sin n\theta + \cos n\theta - i\sin n\theta$ 1 r/w

$= 2\cos n\theta$.

Please turn the page

Question 8 (continued)

(iv) 2

From part (iii): $w + w^{-1} = 2\cos\frac{\pi}{7}$ ①

$w^2 + w^{-2} = 2\cos\frac{2\pi}{7}$ ②

$w^3 + w^{-3} = 2\cos\frac{3\pi}{7}$ ③

$\therefore$ ①×③×②: $8\cos\frac{\pi}{7}\cos\frac{2\pi}{7}\cos\frac{3\pi}{7} = (w+w^{-1})(w+w^{-2})(w^3+w^{-3})$

$= (w^3 + w^{-1} + w^{1} + w^{-3})(w^3 + w^{-3})$

$= w^6 + 1 + w^{2} + w^{-4} + w^4 + w^{-2} + 1 + w^{-6}$

$= w^6 + 1 + w^2 - w^{-4}(w^7) + w^4 - w^{-2}(w^7) + 1 - (w^{-6})(w^7)$

since $w^7 = -1$.

$= w^6 + 1 + w^2 - w^3 + w^4 - w^5 + 1 - w$

$= 0 + 1$ (from (ii)).

$\therefore \cos\frac{\pi}{7}\cos\frac{2\pi}{7}\cos\frac{3\pi}{7} = \frac{1}{8}$

2	Correct
1	Use of fact from (iii) + attempt at expansion of RHS

(v) 2

$\alpha + \beta = w - w^2 - w^4 + w^3 + w^5 - w^6$

$= 1$ (since $1 - w + w^2 - w^3 + w^4 - w^5 + w^6 = 0$).

$\alpha\beta = (w - w^2 - w^4)(w^3 + w^5 - w^6)$

$= w^4 + w^6 - w^7 - w^5 - w^7 + w^8 - w^7 - w^9 + w^{10}$

$= w^4 + w^6 + 1 - w^5 + 1 + w(w^7) + 1 - w^2(w^7) + w^3(w^7)$ (since $w^7 = -1$)

$= w^4 + w^6 + 1 - w^5 + 1 - w + 1 + w^2 - w^3$

$= 0 + 1 + 1$ (part (ii))

$= 2$.

By the sum & product of roots, α & β are roots of the equation

$z^2 - z + 2 = 0$.

2	Correct
1	Sum of roots or product of roots correctly ascertained

Please turn the page

Question 8 (continued)

(vi) **2**

Now solve $z^2 - z + 2 = 0$

$z = \frac{1 \pm \sqrt{1-4(2)}}{2}$

$z = \frac{1+\sqrt{7}i}{2}$ or $z = \frac{1-\sqrt{7}i}{2}$.

$\alpha = w - w^2 - w^4$

$= cis\frac{\pi}{7} - cis\frac{2\pi}{7} - cis\frac{4\pi}{7}$. (De Moivres Theorem)

$Im(\alpha) = \sin\frac{\pi}{7} - \sin\frac{2\pi}{7} - \sin\frac{4\pi}{7}$

$= \sin\frac{\pi}{7} - \sin\frac{2\pi}{7} - \sin\frac{3\pi}{7}$

$y = \sin x$ is increasing for $0 < x < \frac{\pi}{2}$.

$\therefore \sin\frac{\pi}{7} - \sin\frac{2\pi}{7} - \sin\frac{3\pi}{7} < 0$.

$\therefore \sin\frac{\pi}{7} - \sin\frac{2\pi}{7} - \sin\frac{3\pi}{7} = Im(\alpha)$

$= -\frac{\sqrt{7}}{2}$.

2	correct.
1	part of process achieved.

End of Task

Section II extra writing space

If you use this space, clearly indicate which question you are answering.