



امتحان دبلوم التعليم العام

لكلية الحرس السلطاني العماني التقنية (ثنائية اللغة)

الفصل الدراسي الأول - الدور الأول - العام الدراسي ١٤٤٧/١٤٤٦ هـ - ٢٠٢٤ / ٢٠٢٥ م

تنبيه:
- المادة: الرياضيات.
- الأسئلة في (١٣) صفحة.
- زمن الإجابة: ثلاث ساعات.
- الإجابة في الورقة نفسها.

تعليمات مهمة:

- يجب الحضور إلى قاعة الامتحان قبل عشر دقائق على الأقل من بدء زمن الامتحان.
- يجب إحضار أصل ما يثبت الهوية وإبرازها للعاملين بالامتحانات.
- يجب الالتزام بالزي (الدشداشة البيضاء والمصر أو الكمة للذكور) والزي المدرسي للطالبات ، ويستثنى من ذلك الدارسون من غير العمانيين بشرط الالتزام بالذوق العام، ويمنع على جميع المتقدمات ارتداء النقاب داخل المركز وقاعات الامتحان.
- يحظر على الممتحنين اصطحاب الهواتف النقالة وأجهزة النداء الآلي وآلات التصوير والحواسيب الشخصية والساعات الرقمية الذكية والآلات الحاسبة ذات الصفة التخزينية والمجلات والصحف والكتب الدراسية والدفاتر والمذكرات والحقائب اليدوية والآلات الحادة أو الأسلحة أياً كان نوعها وأي شيء له علاقة بالامتحان.
- يجب على الممتحن الامتثال لإجراءات التفتيش داخل المركز طوال أيام الامتحان.
- يجب على الممتحن التأكد من استلام دفتر امتحانه، مغلفاً بغلاف بلاستيكي شفاف وغير ممزق ، وهو مسؤول عنه حتى يسلمه لمراقبي اللجنة بعد الانتهاء من الإجابة.
- يجب الالتزام بضوابط إدارة امتحانات دبلوم التعليم العام وما في مستواه وأية مخالفة لهذه الضوابط تعرضك للتدابير والإجراءات والعقوبات المنصوص عليها بالقرار الوزاري رقم ٥٨٨ / ٢٠١٥.
- يقوم المتقدم بالإجابة عن أسئلة الامتحان المقالية بقلم الحبر (الأزرق أو الأسود).
- يقوم المتقدم بالإجابة عن أسئلة الاختيار من متعدد بتظليل الشكل (▭) وفق النموذج الآتي:

س – عاصمة سلطنة عمان هي:

▭ القاهرة ▭ الدوحة

■ مسقط ▭ أبوظبي

ملاحظة: يتم تظليل الشكل (■) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ■ **غير صحيح** ▭ ◉ ◔ ✗ ✓

مُسَوَّدَة، لا يتم تصحيحها

Do not write in this space

Do not write in this space

Do not write in this space

1. List of formulae is given in the last page.
2. Write all answers in the space provided in this question paper show all your work.
3. Non-programmable calculators are allowed.

1) The quadratic equation $ax^2 + bx + c = 0$ has a root $(1 + 5i)$

(Shade in the bubble ⬭ next to the other root)

⬭ $1 + 5i$ ⬭ $-1 + 5i$

⬭ $1 - 5i$ ⬭ $-1 - 5i$ [1]

2) (Shade in the bubble ⬭ next to the value of $3\sin^2\alpha + 3\cos^2\alpha$)

⬭ 1 ⬭ 3

⬭ 6 ⬭ 9 [1]

3) Given a sinusoidal function $y = 5\sin(4\pi t + \frac{\pi}{3})$

Find the:

- Amplitude
- Angular velocity
- Periodic time
- Frequency

[4]

Do not write in this space

4) $A = \begin{pmatrix} 5 & -1 \\ 0 & 3 \end{pmatrix}$, $B = \begin{pmatrix} -6 & 3 \\ 0 & 6 \end{pmatrix}$

Determine the single matrix for $2A + B$

[4]

5) $\log_a x + \log_a y - 5 = 0$

(Shade in the bubble ⬭ next to the value of $\log_a xy$)

⬭ – 5 ⬭ 0

⬭ 5 ⬭ 10 [1]

6) The complex numbers $z_1 = -2 + 2i$, $z_2 = 7 - i$

Find a simplified expression for $z_1 + z_2^*$

[3]

Do not write in this space

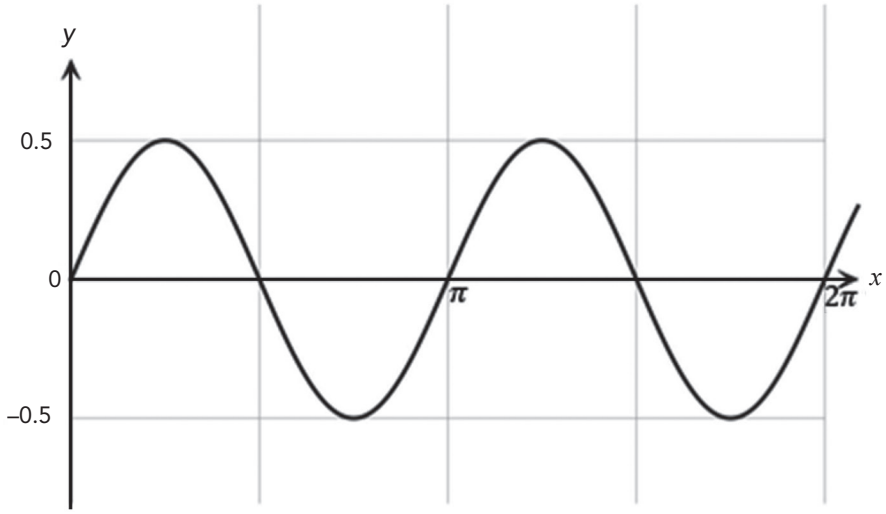
Do not write in this space

Do not write in this space

7) Simplify $(3x^3 + 12) - (2x + 10) + 3(1 - x^3)$

[3]

8) The sketch below shows the graph of a sinusoidal function



(Shade in the bubble ⬭ next to the function that represents the graph)

⬭ $y = \frac{1}{2} \sin 2x$ ⬭ $y = \frac{1}{2} \cos 2x$

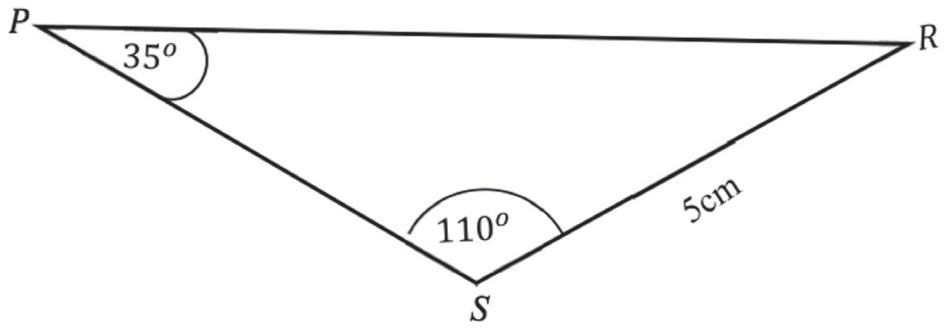
⬭ $y = \frac{1}{2} \sin x$ ⬭ $y = \frac{1}{2} \cos x$ [1]

Do not write in this space

Do not write in this space

9) The diagram below shows a triangle PSR

$|\angle PSR| = 110°$, $|\angle SPR| = 35°$ and $|SR| = 5cm$



Find $|PR|$ (correct the answer to 3 decimal places) .

[4]

10) The two vectors $\boldsymbol{a}$ and $\boldsymbol{b}$ are given by $\boldsymbol{a} = \begin{pmatrix} 4 \\ -3 \end{pmatrix}$ and $\boldsymbol{b} = \begin{pmatrix} 6 \\ 2 \end{pmatrix}$

Find $5\boldsymbol{a} - 3\boldsymbol{b}$

[4]

Do not write in this space

Do not write in this space

11) The matrix $A = \begin{pmatrix} 6 & 2 \\ 11 & 4 \end{pmatrix}$, $|A| = 2$

(Shade in the bubble ⬭ next to A^{-1})

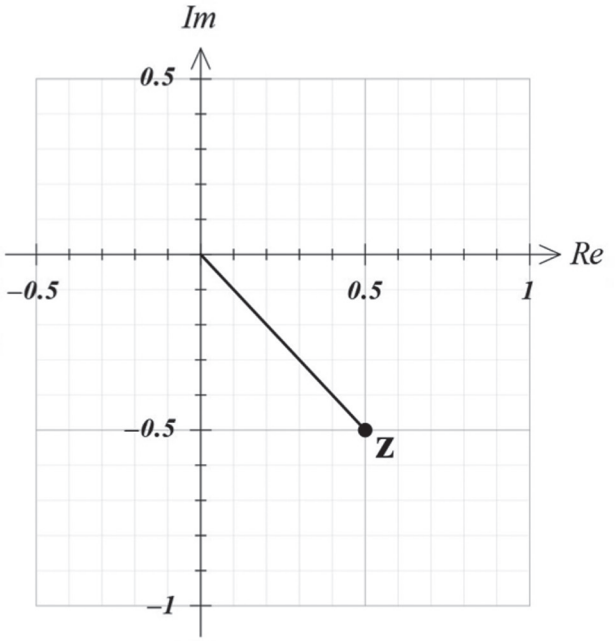
⬭ $\begin{pmatrix} 3 & 1 \\ \frac{11}{2} & 2 \end{pmatrix}$

⬭ $\begin{pmatrix} 2 & -1 \\ -\frac{11}{2} & 3 \end{pmatrix}$

⬭ $\begin{pmatrix} -3 & \frac{11}{2} \\ 2 & -1 \end{pmatrix}$

⬭ $\begin{pmatrix} 2 & 1 \\ \frac{11}{2} & 3 \end{pmatrix}$ [1]

12) Given the Argand diagram of the complex number z



(Shade in the bubble ⬭ next to the complex number 2z)

⬭ 1 – i

⬭ –1 + i

⬭ $\frac{1}{2} - \frac{1}{2}$ i

⬭ $-\frac{1}{2} + \frac{1}{2}$ i [1]

Do not write in this space

13) Solve the equation $e^{x+1} = 5$

(Round the answer to 3 significant figures)

[3]

14) $(8 - ai) + (b - 3i) = 6 - i$

Find the values of a and b

[4]

Do not write in this space

Do not write in this space

Do not write in this space

15) If $2x^3 - x^2 + 25$ is divided by $(x - 3)$

(Shade in the bubble ⬭ next to the value of the remainder)

⬭ –38 ⬭ – 20

⬭ 22 ⬭ 70 [1]

16) Divide $5x^3 + 16x^2 - 17x - 4$ by $(5x + 1)$

[4]

Do not write in this space

17) If $\tan^2\theta = 3$

(Shade in the bubble ▭ next to the value of $2\sec^2\theta$)

▭ 4 ▭ 8

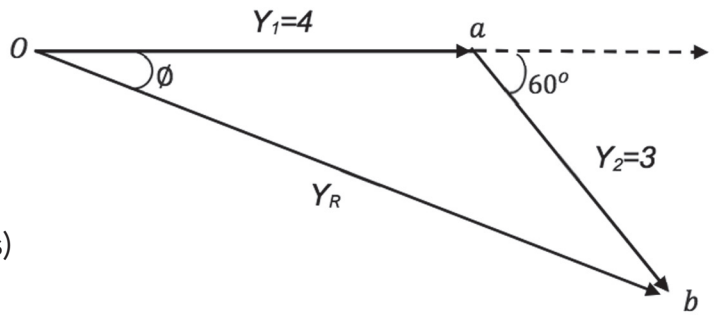
▭ 10 ▭ 20

[1]

18) If $y_1 = 4\sin\omega t$ and $y_2 = 3\sin(\omega t - \frac{\pi}{3})$

Obtain an expression for the resultant $y_R = y_1 + y_2$ by calculation.

(Round the answer to 3 decimal places)



[6]

Do not write in this space

Do not write in this space

Do not write in this space

19) $A = \begin{pmatrix} 5 & -2 \\ 2 & 6 \end{pmatrix}$, $B = \begin{pmatrix} 1 \\ 4 \end{pmatrix}$

(Shade in the bubble ⬭ next to $A \,.\, B$)

⬭ $\begin{pmatrix} 5 & -2 \\ 8 & 24 \end{pmatrix}$ ⬭ $\begin{pmatrix} 13 \\ 22 \end{pmatrix}$

⬭ $\begin{pmatrix} 5 & -2 \\ 8 & 6 \end{pmatrix}$ ⬭ $\begin{pmatrix} -3 \\ 26 \end{pmatrix}$ [1]

20) $z = \frac{1}{2 - i}$

(Shade in the bubble ⬭ next to z in the form $x + iy$)

⬭ $\frac{2}{5} + \frac{1}{5}i$ ⬭ $\frac{2}{5} - \frac{1}{5}i$

⬭ $\frac{2}{3} + \frac{1}{3}i$ ⬭ $\frac{2}{3} - \frac{1}{3}i$ [1]

21) Solve the inequality $4^{2x-3} < 18$

(Round the answer to 3 decimal places)

[4]

Do not write in this space

22) (Shade in the bubble ⬭ next to simplest form of $\cos(A - \frac{\pi}{6}) - \cos(A + \frac{\pi}{6})$)

⬭ $\sin A$ ⬭ $-\sin A$

⬭ $-\sqrt{3}$ ⬭ 0 [1]

23) Solve the equation $\sin 2x = \cos x$ for $0° \leq x \leq 180°$

[5]

Do not write in this space

Do not write in this space

Do not write in this space

24) For points U, V with position vectors $\boldsymbol{u} = \begin{pmatrix} 8 \\ 1 \end{pmatrix}$, $\boldsymbol{v} = \begin{pmatrix} x \\ 11 \end{pmatrix}$

The mid-point of UV is $\begin{pmatrix} 3 \\ 6 \end{pmatrix}$

(Shade in the bubble ⬭ next to the value of x)

⬭ – 5 ⬭ – 2

⬭ 2 ⬭ 5 [1]

25) Simplify in polar form $3(\cos\frac{3\pi}{10} - i\sin\frac{3\pi}{10}) \times 2(\cos\frac{\pi}{2} + i\sin\frac{\pi}{2})$

in the domain $-\pi < \theta \leq \pi$

[3]

Do not write in this space

26) The magnitude of the vector $\begin{pmatrix} u-1 \\ 6 \\ 2 \end{pmatrix}$ is 7

Find the value of u

[4]

Do not write in this space

Do not write in this space

Do not write in this space

27) Simultaneous equations given by

$-3x + y + a = 0$

$3x - 3y - 5 = 0$

By using determinants, find the value of (a) when $y = 2$

[3]

(End of Examination]

Do not write in this space

Do not write in this space

Formulae

1. $\log_a xy = \log_a x + \log_a y$
2. $\log_a \frac{x}{y} = \log_a x - \log_a y$
3. $\log_a x^k = k \log_a x$
4. $|a_1\mathbf{i} + a_2\mathbf{j}| = \sqrt{a_1^2 + a_2^2}$
5. Quadratic Formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
6. Sine Rule: $\frac{a}{\sin A} = \frac{b}{\text{Sin } B} = \frac{c}{\text{Sin } C}$
7. Cosine Rule: $a^2 = b^2 + c^2 - 2bc\cos A$
8. General Sinusoidal expression: $y = A\sin(\omega t \pm \alpha)$ Where A = amplitude, ω = angular velocity in radians per second, t = time in seconds, α = angle of lead or lag Periodic Time $= \frac{1}{f} = \frac{2\pi}{\omega}$ s
9. $\sin^2 A + \cos^2 A = 1$

   $\sec^2 A \equiv 1 + \tan^2 A$

   $\text{cosec}^2 A \equiv 1 + \cot^2 A$

10. Compound Angles:

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

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

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

Do not write in this space

Do not write in this space

11. Double Angles:

$$\sin 2A \equiv 2\sin A\cos A$$

$$\cos 2A \equiv \cos^2 A - \sin^2 A$$

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

$$\cos 2A \equiv 2\cos^2 A - 1$$

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

12. Reciprocal Functions:

$$\sec A \equiv \frac{1}{\cos A}$$

$$\operatorname{cosec} A \equiv \frac{1}{\sin A}$$

$$\cot A \equiv \frac{1}{\tan A} \equiv \frac{\cos A}{\sin A}$$

13. Arc length: $L = r\theta$

14. Sector Area: $A = \frac{1}{2}r^2\theta$

Do not write in this space

مُسَوَّدَة

Do not write in this space

Do not write in this space

Do not write in this space

مُسَوَّدَة

Do not write in this space

مُسَوَّدَة

Do not write in this space

Do not write in this space

Royal Guard of Oman Technical College, Mathematics
First Semester -First Session
Academic Year 2024/2025

Answer scheme

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
1	AO1 L	6-5	257	☐ 1+5i ☐ −1 + 5i ■ 1 − 5i ☐ −1 − 5i		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
2	AO1 L	3-2	Booklet 10	☐ 1 ☐ 6 ■ 3 ☐ 9		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [4]	More information
3	AO1 L	3-6	Booklet 39	i. 5	1	
				ii. 4π radians per second	1	
				iii. $\frac{1}{2}$ second	1	
				iv. 2 Hz	1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [4]	More information
4	AO1 L	5-1	booklet 53-54	$2\begin{pmatrix}5 & -1\\0 & 3\end{pmatrix}+\begin{pmatrix}-6 & 3\\0 & 6\end{pmatrix}$		
				$=\begin{pmatrix}10 & -2\\0 & 6\end{pmatrix}+\begin{pmatrix}-6 & 3\\0 & 6\end{pmatrix}$	1+1	1 mark for each two correct elements in the first matrix.
				$=\begin{pmatrix}4 & 1\\0 & 12\end{pmatrix}$	1+1	1 mark for each two correct elements.

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
5	AO1 L	2-1	42	☐ -5 ☐ 0 ■ 5 ☐ 10		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [3]	More information
6	AO1 L	6-3	250	$z_2^* = 7 + i$	1	
				$z_1 + z_2^* = (-2 + 2i) + (7 + i)$		
				$= 5 + 3i$	1+1	1 mark for each correct part.

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [3]	More information
7	AO1 M	1-1	Booklet 2	$= 3x^3 + 12 - 2x - 10 + 3 - 3x^3$	1	1 mark for distribution (-1) to the bracket.
				$= -2x + 5$	1+1	1 mark for each correct term.

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
8	AO1 M	3-6	Booklet 34	■ $y = \frac{1}{2}\sin 2x$ ☐ $y = \frac{1}{2}\cos 2x$ ☐ $y = \frac{1}{2}\sin x$ ☐ $y = \frac{1}{2}\cos x$		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [4]	More information
9	AO1 M	3-4	Booklet 19	$\frac{\lvert PR\rvert}{\sin 110^o} = \frac{5}{\sin 35^o}$	1+1	1 mark for each correct side.
				$\lvert PR\rvert = \frac{5}{\sin 35^o} \times \sin 110^o$	1	
				≈ 8.192 cm	1	Whether 8.192 is rounded or not, the student gets 1mark.

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [4]	More information
10	AO1 M	4-2	180	$5\begin{pmatrix}4\\-3\end{pmatrix}-3\begin{pmatrix}6\\2\end{pmatrix}$		1 mark for each correct vector.
				$=\begin{pmatrix}20\\-15\end{pmatrix}-\begin{pmatrix}18\\6\end{pmatrix}$	1+1	
				$=\begin{pmatrix}2\\-21\end{pmatrix}$	1+1	1 mark each correct element.

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More Information
11	AO1 M	5-3	booklet 69	☐ $\begin{pmatrix} 3 & 1 \\ \frac{11}{2} & 2 \end{pmatrix}$ ■ $\begin{pmatrix} 2 & -1 \\ -\frac{11}{2} & 3 \end{pmatrix}$ ☐ $\begin{pmatrix} -3 & \frac{11}{2} \\ 2 & -1 \end{pmatrix}$ ☐ $\begin{pmatrix} 2 & 1 \\ \frac{11}{2} & 3 \end{pmatrix}$		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
12	AO1 M	6-2	244	■ $1-i$ □ $-1+i$ □ $\frac{1}{2}-\frac{1}{2}i$ □ $-\frac{1}{2}+\frac{1}{2}i$		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [3]	More information
13	AO1 H	2-3	50	$\ln e^{x+1} = \ln 5$	1	
				$x + 1 = \ln 5$	1	
				$x = -1 + \ln 5$		
				$x = 0.609$	1	
				Another solution		
				$\log e^{x+1} = \log 5$	1	
				$(x + 1)\log e = \log 5$	1	
				$x + 1 = \frac{\log 5}{\log e}$		
				$x = 0.609$	1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [4]	More information
14	AO1 H	6-1	251	$(8 - ai) + (b - 3i) = 6 - i$		
				$8 + b = 6$	1	
				$b = -2$	1	1 mark only if he writes the value of (b) directly.
				$-a - 3 = -1$	1	
				$a = -2$	1	1 mark only if he writes the value of (a) directly.

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
15	AO2 L	1-4	13 + 15	☐ −38 ☐ −20 ☐ 22 ■ 70		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [4]	More information
16	AO2 L	1-3	13	$5x+1 \overline{)\, 5x^3+16x^2-17x-4}$ x^2+3x-4 $5x^3+x^2$ $15x^2-17x-4$ $15x^2+3x$ $-20x-4$ $-20x-4$ 0	1+1+1 1	1 mark for each correct term. If the student Finds x^2+3x-4 by calculator he gets 1 mark.

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
17	AO2 M	3-13	80	☐ 4 ☐ 10 ☒ 8 ☐ 20		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [6]	More information
18	3-7	AO2 L	booklet 47-46	Using the cosine rule: $y_R{}^2 = 4^2 + 3^2 - 2(4)(3)\cos 120^o$		
				$= 37$ units	1	
				$y_R \approx 6.083$	1	
				Using the sine rule: $\frac{\sin \emptyset}{3} = \frac{\sin 120^o}{6.083}$	1	
				$\sin \emptyset = \frac{3 \sin 120^o}{6.083}$		
				≈ 0.427	1	
				$\emptyset \approx 25.28^o \quad or \quad 0.441\, rads$	1	
				$y_R = 6.08 \sin(\omega t - 25.28^o)$ $or\ y_R = 6.08 \sin(\omega t - 0.441)$	1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [6]	More information
18	3-7	AO2 L	booklet 47-46	**Another solution:** The horizontal component $= 4 + 3\cos 60^o$		
				$= 5.5$ units	1	
				The vertical component $= 3\sin 60^o = \frac{3\sqrt{3}}{2}$		
				$= 2.598$ units	1	
				Using Pythagoras theorem: $y_R{}^2 = (2.598)^2 + (5.5)^2$ $y_R{}^2 = 37$ $y_R = 6.083$	1	
				$\tan \emptyset = \frac{2.598}{5.5} \approx 0.472$	1	
				$\emptyset = 25.284^o$	1	
				$y_R = 6.08\sin(\omega t - 25.284^o)$ $or\ y_R = 6.08\sin(\omega t - 0.441)$	1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
19	AO2 L	5-2	Booklet 57	☐ $\begin{pmatrix}5 & -2\\8 & 24\end{pmatrix}$ ☐ $\begin{pmatrix}5 & -2\\8 & 6\end{pmatrix}$ ☐ $\begin{pmatrix}13\\22\end{pmatrix}$ ■ $\begin{pmatrix}-3\\26\end{pmatrix}$		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
20	AO2 L	6-3	253	■ $\frac{2}{5}+\frac{1}{5}i$ □ $\frac{2}{3}+\frac{1}{3}i$ □ $\frac{2}{5}-\frac{1}{5}i$ □ $\frac{2}{3}-\frac{1}{3}i$		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [4]	More information
21	AO2 M	2-3	53	Take logarithms of both sides: $\ln 4^{2x-3} < \ln 18$	1	In this step, if a student took the logarithms to one side only, he gets 0 mark.
				$(2x-3)\ln 4 < \ln 18$	1	
				$2x-3 < \frac{\ln 18}{\ln 4}$ or $2x-3 < 2.085$	1	
				$2x < \frac{\ln 18}{\ln 4} + 3$ or $2x < 2.085 + 3$		
				$x < 2.543$	1	If a student solves the equation correctly by taking log of both sides, he gets full mark.

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
22	AO2 M	3-8	68	■ $\sin A$ □ $-\sqrt{3}$ □ $-\sin A$ □ 0		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [5]	More information
23	AO2 M	3-9	72	$2\sin x\cos x = \cos x$		
				$2\sin x\cos x - \cos x = 0$		
				$\cos x\,(2\sin x - 1) = 0$	1	
				$\cos x = 0$ or $2\sin x - 1 = 0$	1	
				$x = \cos^{-1}(0)$		
				$x = 90^o$	1	
				$\sin x = \frac{1}{2}$ hence $x = \sin^{-1}\left(\frac{1}{2}\right)$		
				$x = 30^o$	1	
				and $x = 180^o - 30^o$		
				$= 150^o$	1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
24	AO2 M	4-3	197	☐ −5 ☐ 2 ■ −2 ☐ 3	1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [3]	More information
25	AO2 M	6-6	262	Assume: $z_1 = 3\left(\cos\frac{3\pi}{10} - i\sin\frac{3\pi}{10}\right)$, $z_2 = 2\left(\cos\frac{\pi}{2} + i\sin\frac{\pi}{2}\right)$		
				$\lvert z_1 z_2\rvert = 3 \times 2 = 6$	1	
				$\arg z_1 z_2 = \frac{-3\pi}{10} + \frac{\pi}{2} = \frac{\pi}{5}$	1	
				$\therefore z_1 z_2 = 6\left(\cos\frac{\pi}{5} + i\sin\frac{\pi}{5}\right)$	1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [4]	More information
26	AO2 H	4-4	194	Magnitude $= \sqrt{(u-1)^2 + (6)^2 + (2)^2}$		
				$7^2 = (u-1)^2 + (6)^2 + (2)^2$	1	
				$49 = u^2 - 2u + 1 + 40$		
				$u^2 - 2u - 8 = 0$	1	
				$(u+2)(u-4) = 0$		
				$u = -2$	1	
				$u = 4$	1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [3]	More information
27	AO2 H	5-5	booklet 65	$\frac{-y}{\begin{vmatrix}-3 & a\\ 3 & -5\end{vmatrix}} = \frac{1}{\begin{vmatrix}-3 & 1\\ 3 & -3\end{vmatrix}}$ $\frac{-2}{\begin{vmatrix}-3 & a\\ 3 & -5\end{vmatrix}} = \frac{1}{\begin{vmatrix}-3 & 1\\ 3 & -3\end{vmatrix}}$	1	1 mark for correct determinates in both sides.
				$\frac{-2}{15-3a} = \frac{1}{9-3}$	1	
				$-12 = 15 - 3a$		
				$3a = 27$		
				$a = 9$	1	

سلطنة عمان
وزارة التربية والتعليم

مركز القياس والتقويم التربوي
The Center for Educational Assessment and Measurement (CEAM)

امتحان دبلوم التعليم العام
لكلية الحرس السلطاني العماني التقنية (ثنائية اللغة)
الفصل الدراسي الأول - الدور الثاني - للعام الدراسي ١٤٤٦ /١٤٤٧ هـ - ٢٠٢٤ / ٢٠٢٥ م

تنبيه:
- المادة: الرياضيات.
- الأسئلة في (١٢) صفحة.
- زمن الإجابة: ثلاث ساعات.
- الإجابة في الورقة نفسها.

تعليمات مهمة:

- يجب الحضور إلى قاعة الامتحان قبل عشر دقائق على الأقل من بدء زمن الامتحان.
- يجب إحضار أصل ما يثبت الهوية وإبرازها للعاملين بالامتحانات.
- يجب الالتزام بالزي (الدشداشة البيضاء والمصر أو الكمة للذكور) والزي المدرسي للطالبات ، ويستثنى من ذلك الدارسون من غير العمانيين بشرط الالتزام بالذوق العام، ويمنع على جميع المتقدمات ارتداء النقاب داخل المركز وقاعات الامتحان.
- يحظر على الممتحنين اصطحاب الهواتف النقالة وأجهزة النداء الآلي وآلات التصوير والحواسيب الشخصية والساعات الرقمية الذكية والآلات الحاسبة ذات الصفة التخزينية والمجلات والصحف والكتب الدراسية والدفاتر والمذكرات والحقائب اليدوية والآلات الحادة أو الأسلحة أياً كان نوعها وأي شيء له علاقة بالامتحان.
- يجب على الممتحن الامتثال لإجراءات التفتيش داخل المركز طوال أيام الامتحان.
- يجب على الممتحن التأكد من استلام دفتر امتحانه، مغلفاً بغلاف بلاستيكي شفاف وغير ممزق ، وهو مسؤول عنه حتى يسلمه لمراقبي اللجنة بعد الانتهاء من الإجابة.
- يجب الالتزام بضوابط إدارة امتحانات دبلوم التعليم العام وما في مستواه وأية مخالفة لهذه الضوابط تعرضك للتدابير والإجراءات والعقوبات المنصوص عليها بالقرار الوزاري رقم ٥٨٨ / ٢٠١٥.
- يقوم المتقدم بالإجابة عن أسئلة الامتحان المقالية بقلم الحبر (الأزرق أو الأسود).
- يقوم المتقدم بالإجابة عن أسئلة الاختيار من متعدد بتظليل الشكل (▭) وفق النموذج الآتي:

س – عاصمة سلطنة عمان هي:

▭ القاهرة ▭ الدوحة

■ مسقط ▭ أبوظبي

ملاحظة: يتم تظليل الشكل (■) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ■ **غير صحيح** ▭ ◉ ◒ ☒ ☑

مُسَوَّدَة، لا يتم تصحيحها

Do not write in this space

Do not write in this space

Do not write in this space

Instructions:

1. List of formulae is given in the last page.
2. Write all answers in the space provided in this question paper show all your work.
3. Non-programmable calculators are allowed.

1) $\log x = 6$, $\log y = 2$

(Shade in the bubble ⬭ next to the value of $\log \frac{x}{y}$)

⬭ 2 ⬭ 3

⬭ 4 ⬭ 8 [1]

2) (Shade in the bubble ⬭ next to the value of $\frac{2\pi}{3}$ in degrees)

⬭ 360° ⬭ 270°

⬭ 240° ⬭ 120° [1]

3) $\tan\theta = \frac{1}{3}$

Find the exact value of $\tan 2\theta$

[4]

Do not write in this space

4) $A = \begin{pmatrix} 6 & 9 \\ -3 & 7 \end{pmatrix}$ and $B = \begin{pmatrix} 3 & 5 \\ -3 & 1 \end{pmatrix}$

Find $7A - B$

[4]

5) $z = 8 - 6i$

(Shade in the bubble ⬭ next to the value of $|z|$)

⬭ $\sqrt{14}$ ⬭ $\sqrt{28}$

⬭ 10 ⬭ 100 [1]

6) $z_1 = 5 - i$, $z_2 = 1 + 2i$

Find a simplified expression for $z_1 + 2z_2$

[3]

Do not write in this space

Do not write in this space

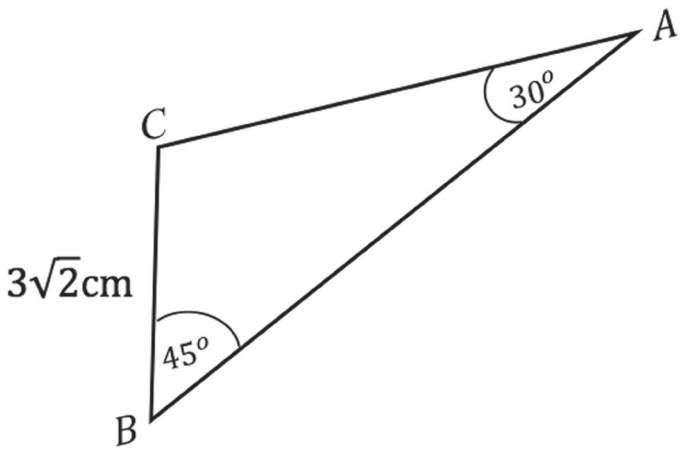
Do not write in this space

7) Simplify: $(x^2 + 3x) - 3(2x - 5x^2)$

[3]

8) The diagram below shows a tringle ABC

$|\angle ABC| = 45°$, $|\angle CAB| = 30°$ and $|BC| = 3\sqrt{2}$ cm



(Shade in the bubble ▭ next to $|CA|$ in cm)

▭ 1.5 ▭ 3

▭ 3.5 ▭ 6 [1]

Do not write in this space

9) Solve the equation $\cos\theta = \frac{1}{\sqrt{2}}$ for $\theta \in \mathrm{R}$ where $0° < \theta < 360°$

[4]

10) Simplify the vectors $(3\mathbf{i} - 12\mathbf{j} + 6\mathbf{k}) + 2(2\mathbf{i} + 5\mathbf{j} + 7\mathbf{k})$

[4]

Do not write in this space

Do not write in this space

Do not write in this space

11) $\begin{pmatrix} 2 & 3 \\ 5 & 1 \end{pmatrix} \times B = B \times \begin{pmatrix} 2 & 3 \\ 5 & 1 \end{pmatrix}$

(Shade in the bubble ⬭ next to the matrix B)

⬭ $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ ⬭ $\begin{pmatrix} 3 & -2 \\ -1 & 5 \end{pmatrix}$

⬭ $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ ⬭ $\begin{pmatrix} 1 & -3 \\ -5 & 2 \end{pmatrix}$ [1]

12) $z_1 = \frac{1}{2} - \frac{\sqrt{3}}{2}\,i$

(Shade in the bubble ⬭ next to the value of $\arg z$)

⬭ $\frac{\pi}{3}$ ⬭ $\frac{2\pi}{3}$

⬭ $\frac{4\pi}{3}$ ⬭ $\frac{5\pi}{3}$ [1]

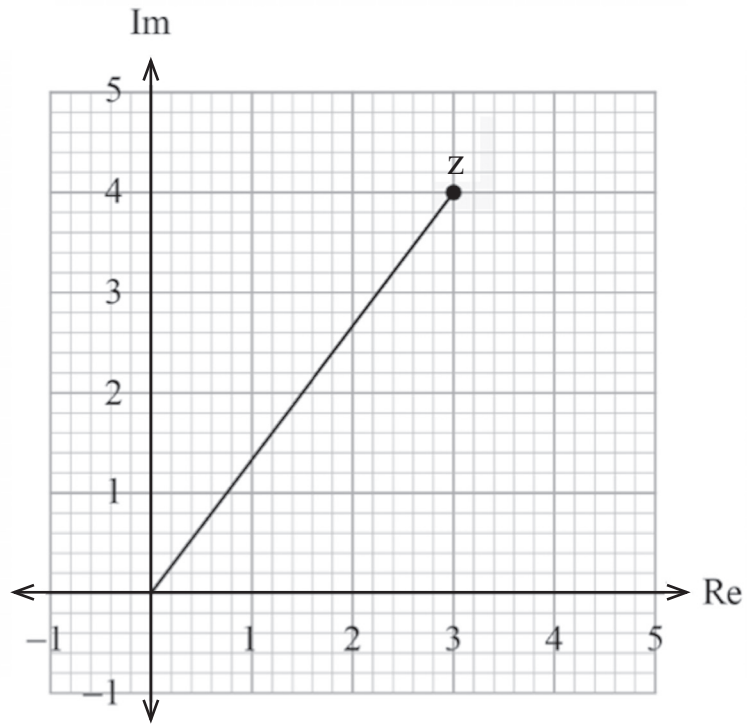
13) $\log x = a$

Find $\log 10x + \log x^3$ in terms of a

[3]

Do not write in this space

14) The Argand diagram below shows the complex number z



Find z^2

[4]

15) (Shade in the bubble ◯ next to the factor of $2x^4 + x^3 - 5x^2 + x + 1$)

◯ $x - 2$ ◯ $x - 1$

◯ $x + 2$ ◯ $x + 1$ [1]

Do not write in this space

Do not write in this space

Do not write in this space

16) Multiply $(4x^2 + 5x - 1)$ by $(x^3 - x)$

[4]

17) (Shade in the bubble ⬭ next to the simplification of $\frac{4\cos 60°}{\cos^2 x}$)

⬭ $\frac{2}{1 + \sin^2 x}$ ⬭ $\frac{2}{\cos x}$

⬭ $2\cos^2 x$ ⬭ $2(\tan^2 x + 1)$ [1]

18) Write $\sqrt{3}\cos\theta + 3\sin\theta$ in the form $r\sin(\theta + \alpha)$
where θ is in degrees.

[6]

Do not write in this space

19) $A = \begin{pmatrix} 3 & 0 \\ 3 & 5 \end{pmatrix}$, $A + B = \begin{pmatrix} 4 & 2 \\ 0 & 9 \end{pmatrix}$

(Shade in the bubble ⬭ next to matrix B)

⬭ $\begin{pmatrix} 7 & 2 \\ 3 & 14 \end{pmatrix}$ ⬭ $\begin{pmatrix} -1 & -2 \\ 3 & -4 \end{pmatrix}$

⬭ $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ ⬭ $\begin{pmatrix} 1 & 2 \\ -3 & 4 \end{pmatrix}$ [1]

20) $z_1 = 2e^{\frac{\pi}{3}i}$, $z_2 = 6e^{\frac{2\pi}{5}i}$

(Shade in the bubble ⬭ next to complex number $z_1\ z_2$ in polar form)

⬭ $12\left(\cos\frac{11\pi}{15} + i\sin\frac{11\pi}{15}\right)$ ⬭ $12\left(\cos\frac{11\pi}{15} - i\sin\frac{11\pi}{15}\right)$

⬭ $8\left(\cos\frac{11\pi}{15} + i\sin\frac{11\pi}{15}\right)$ ⬭ $8\left(\cos\frac{11\pi}{15} - i\sin\frac{11\pi}{15}\right)$ [1]

21) Solve the inequality $2 \times 7^{t-1} < 26$

(Round your answer to 3 decimal places).

[4]

Do not write in this space

Do not write in this space

Do not write in this space

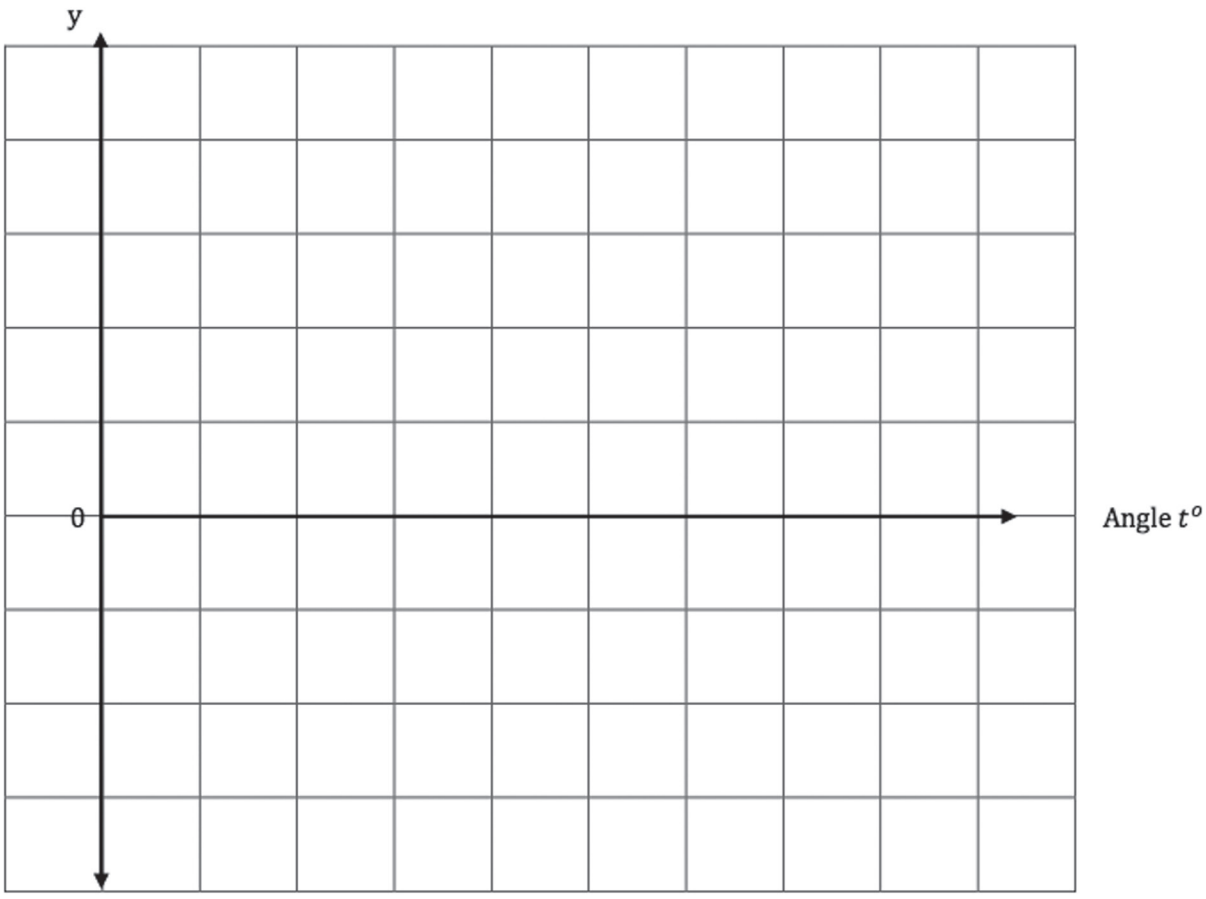
22) (Shade in the bubble ⬭ next to the simplification of $\sin(A - \pi) - 3\cos(A + \frac{3\pi}{2})$)

⬭ $4 \sin A$ ⬭ $2 \sin A$

⬭ $-2 \sin A$ ⬭ $-4 \sin A$ [1]

23) $y = 3\cos(2t)$

Sketch y in one complete wavelength showing the relevant details (Amplitude, period, maximum and minimum values).

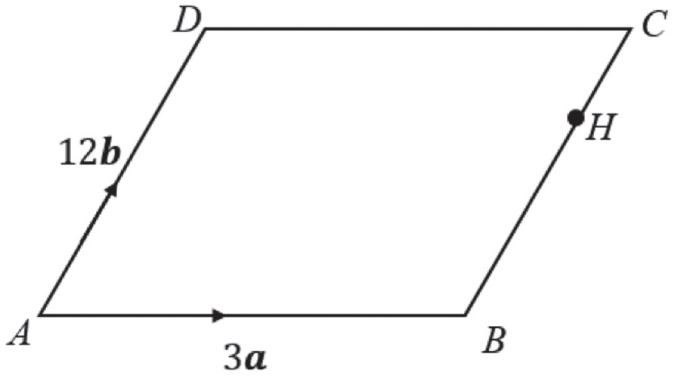


[5]

Do not write in this space

24) The figure below shows the parallelogram $ABCD$

$\overrightarrow{AD} = 12\boldsymbol{b}$, $\overrightarrow{AB} = 3\boldsymbol{a}$



The point H divides BC in the ratio 2 : 1

(Shade in the bubble ⬭ next to the value of $\overrightarrow{AH}$)

⬭ $2\boldsymbol{a} + 4\boldsymbol{b}$ ⬭ $2\boldsymbol{a} + 8\boldsymbol{b}$

⬭ $3\boldsymbol{a} + 8\boldsymbol{b}$ ⬭ $3\boldsymbol{a} + 12\boldsymbol{b}$ [1]

25) $z_1 = 3\left(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}\right)$, $z_2 = 5e^{\frac{\pi}{12}i}$

Find $\frac{z_1}{z_2}$ in exponential form.

[3]

Do not write in this space

Do not write in this space

Do not write in this space

26) The points A and B have position vectors $\begin{pmatrix} c \\ 5 \end{pmatrix}$ and $\begin{pmatrix} 9 \\ 13 \end{pmatrix}$, respectively.

Given that the magnitude of $\overrightarrow{AB}$ is 10

Find the values of c

[4]

Do not write in this space

27) Solve the simultaneous equations:

$2p + q = 19$

$3p - q = 21$

by using matrices.

[3]

[End of Examination]

Do not write in this space

Do not write in this space

Do not write in this space

Formulae

1. $\log_a xy = \log_a x + \log_a y$
2. $\log_a \frac{x}{y} = \log_a x - \log_a y$
3. $\log_a x^k = k \log_a x$
4. $|a_1\mathbf{i} + a_2\mathbf{j}| = \sqrt{a_1^2 + a_2^2}$
5. Quadratic Formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
6. Sine Rule: $\frac{a}{\sin A} = \frac{b}{\text{Sin } B} = \frac{c}{\text{Sin } C}$
7. Cosine Rule: $a^2 = b^2 + c^2 - 2bc \cos A$
8. General Sinusoidal expression: $y = A\sin(\omega t \pm \alpha)$ Where A = amplitude,

   ω = angular velocity in radians per second, t = time in seconds,

   α = angle of lead or lag Periodic Time $= \frac{1}{f} = \frac{2\pi}{\omega}$ s

9. $\sin^2 A + \cos^2 A = 1$

   $\sec^2 A \equiv 1 + \tan^2 A$

   $\text{cosec}^2 A \equiv 1 + \cot^2 A$

10. Compound Angles:

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

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

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

Do not write in this space

11. Double Angles:

$$\sin 2A \equiv 2\sin A\cos A$$

$$\cos 2A \equiv \cos^2 A - \sin^2 A$$

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

$$\cos 2A \equiv 2\cos^2 A - 1$$

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

12. Reciprocal Functions:

$$\sec A \equiv \frac{1}{\cos A}$$

$$\operatorname{cosec} A \equiv \frac{1}{\sin A}$$

$$\cot A \equiv \frac{1}{\tan A} \equiv \frac{\cos A}{\sin A}$$

13. Arc length: $L = r\theta$

14. Sector Area: $A = \frac{1}{2}r^2\theta$

Do not write in this space

Do not write in this space

Do not write in this space

مُسَوَّدَة

Do not write in this space

مُسَوَّدَة

Do not write in this space

Do not write in this space

Royal Guard of Oman Technical College, Mathematics

First Semester-Second Session

Academic Year 2024/2025

Answer scheme

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
1	AO1 L	2-1	38	☐ 2 ☐ 3 ■ 4 ☐ 8		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
2	AO1 L	3-1	Booklet 5	☐ 360^o ☐ 270^o ☐ 240^o ■ 120^o		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [4]	More information
3	AO1 L	3-9	72	$\tan 2\theta = \frac{2\tan\theta}{1-\tan^2\theta}$		If the student uses the calculator without any steps, gets 1 mark. 1mark for correct substitution in the numerator. 1mark for correct substitution in the denominator. If this step isn't written and the result is correct, get 2 marks. 1mark for correct numerator. 1mark for correct denominator.
				$= \frac{2 \times \frac{1}{3}}{1-\left(\frac{1}{3}\right)^2}$	1+1	
				$= \frac{\frac{2}{3}}{\frac{8}{9}}$		
				$= \frac{3}{4}$	1+1	
				Another solution: $\tan\theta = \frac{1}{3}$		
				$\theta = \tan^{-1}\left(\frac{1}{3}\right) \approx 18.4^o$	1+1	
				$2\theta = 2 \times 18.4^o = 36.9^o$	1	
				$\tan 36.9^o \approx 0.75$	1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [4]	More information
4	AO1 L	5-1	Booklet 54	$7A - B = 7\begin{pmatrix} 6 & 9 \\ -3 & 7 \end{pmatrix} - \begin{pmatrix} 3 & 5 \\ -3 & 1 \end{pmatrix}$		
				$= \begin{pmatrix} 42 & 63 \\ -21 & 49 \end{pmatrix} - \begin{pmatrix} 3 & 5 \\ -3 & 1 \end{pmatrix}$	1+1	1mark for each two correct elements.
				$= \begin{pmatrix} 39 & 58 \\ -18 & 48 \end{pmatrix}$	1+1	1mark for each two correct elements.

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
5	AO1 L	6-1	249	☐ $\sqrt{14}$ ☐ $\sqrt{28}$ ■ 10 ☐ 100		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [3]	More information
6	AO1 L	6-3	250	$z_1 + 2\,z_2 = (5 - i) + 2(1 + 2i)$		1 mark for multiplying 2 by the bracket. If this step isn't written and the result is correct, get 2 marks.
				$= 5 - i + 2 + 4i$	1	
				$= (5 + 2) + (-i + 4i)$	1	
				$= 7 + 3i$	1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [3]	More information
7	AO1 M	1-1	Booklet 2	$= x^2 + 3x - 6x + 15x^2$	1	1 mark for multiply 3 by the bracket.
				$= (x^2 + 15x^2) + (3x - 6x)$	1	If this step isn't written and the result is correct, get 2 marks.
				$= 16x^2 - 3x$	1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
8	AO1 M	3-4	Booklet 20	☐ 1.5 ☐ 3.5 ☐ 3 ■ 6		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [4]	More information
9	AO1 M	3-2	Booklet 10	$\theta = \cos^{-1}\frac{1}{\sqrt{2}}$	1	
				$= 45^o$ (reference angle)	1	
				cos positive in the 1st and 4th quadrants.	1	
				In the 1st quadrant: $\theta = 45^o$		
				In the 4th quadrant: $\theta = 360^o - 45^o$		
				$= 315^o$	1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [4]	More information
10	AO1 M	4-2	179	$(3\mathbf{i} - 12\mathbf{j} + 6\mathbf{k}) + 2(2\mathbf{i} + 5\mathbf{j} + 7\mathbf{k})$		1mark for each correct term.
				$= (3\mathbf{i} - 12\mathbf{j} + 6\mathbf{k}) + (4\mathbf{i} + 10\mathbf{j} + 14\mathbf{k})$	1	
				$= 7\mathbf{i} - 2\mathbf{j} + 20\mathbf{k}$	1+1+1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
11	AO1 M	5-2	Booklet 57	■ $\begin{pmatrix}1 & 0\\0 & 1\end{pmatrix}$ ☐ $\begin{pmatrix}3 & -2\\-1 & 5\end{pmatrix}$ ☐ $\begin{pmatrix}0 & 1\\1 & 0\end{pmatrix}$ ☐ $\begin{pmatrix}1 & -3\\-5 & 2\end{pmatrix}$		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
12	AO1 M	6-1	249	☐ $\frac{\pi}{3}$ ☐ $\frac{2\pi}{3}$ ☐ $\frac{4\pi}{3}$ ■ $\frac{5\pi}{3}$		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [3]	More information
13	AO1 H	2-1	38	$= \log 10 + \log x + 3 \log x$	1+1	1mark for $\log x + \log 10$ 1mark for $3 \log x$
				$= 1 + a + 3a$ $= 1 + 4a$	1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [4]	More information
14	AO1 H	6-2	250	$z = 3 + 4\mathrm{i}$	1	
				$z^2 = (3 + 4\mathrm{i})^2 = (3 + 4\mathrm{i})(3 + 4\mathrm{i})$		
				$z^2 = 9 + 12\mathrm{i} + 12\mathrm{i} + 16\mathrm{i}^2$	1	
				$z^2 = 9 + 24\mathrm{i} + 16\,(-1)$	1	
				$z^2 = 9 + 24\mathrm{i} - 16$		
				$z^2 = -7 + 24\mathrm{i}$	1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
15	AO2 L	1-4	14	☐ $x-2$ ■ $x-1$ ☐ $x+2$ ☐ $x+1$		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [4]	More information
16	AO2 L	1-2	Booklet 3	$(4x^2+5x-1)(x^3-x)$		1mark for each two correct terms.
				$=4x^5-4x^3+5x^4-5x^2-x^3+x$	1+1+1	
				$=4x^5+5x^4-5x^3-5x^2+x$	1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
17	AO2 L	3-13	79	☐ $\frac{2}{1+\sin^2 x}$ ☐ $\frac{2}{\cos x}$ ☐ $2\cos^2 x$ ■ $2(\tan^2 x + 1)$		

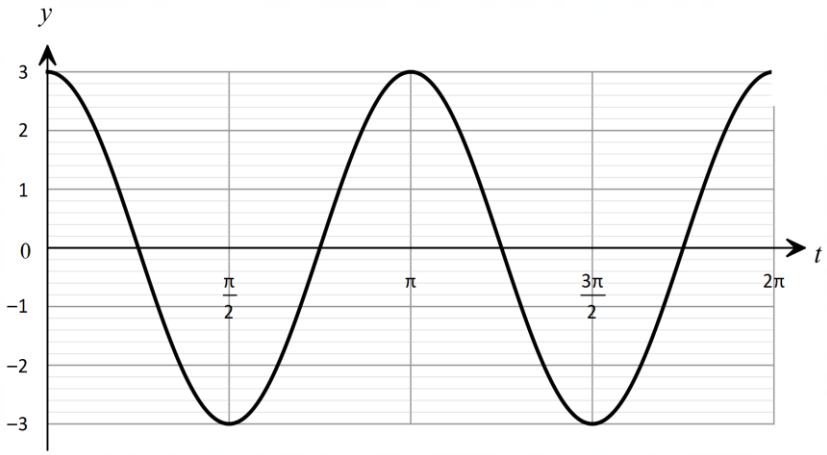
Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [6]	More information
18	AO2 L	3-10	74	$\sqrt{3}\cos\theta + 3\sin\theta \equiv r\sin(\theta + \alpha)$		
				$\sqrt{3}\cos\theta + 3\sin\theta \equiv r\sin\theta\cos\alpha + r\cos\theta\sin\alpha$	1	
				$r\sin\alpha = \sqrt{3}\quad,\ r\cos\alpha = 3$	1	
				$\tan\alpha \equiv \frac{r\sin\alpha}{r\cos\alpha} = \frac{\sqrt{3}}{3}$	1	
				$\alpha = \tan^{-1}\left(\frac{\sqrt{3}}{3}\right)$		
				$= 30^o$	1	
				$r = \sqrt{3+9}$		
				$= \sqrt{12} = 2\sqrt{3}$	1	
				$\sqrt{3}\cos\theta + 3\sin\theta \equiv 2\sqrt{3}\sin(\theta + 30^o)$	1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
19	AO2 L	5-1	Booklet 56	☐ $\begin{pmatrix}7 & 2\\3 & 14\end{pmatrix}$ ☐ $\begin{pmatrix}-1 & -2\\3 & -4\end{pmatrix}$ ☐ $\begin{pmatrix}1 & 2\\3 & 4\end{pmatrix}$ ■ $\begin{pmatrix}1 & 2\\-3 & 4\end{pmatrix}$		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
20	AO2 L	6-6	260	■ $12\left(\cos\frac{11\pi}{15}+i\sin\frac{11\pi}{15}\right)$ ☐ $12\left(\cos\frac{11\pi}{15}-i\sin\frac{11\pi}{15}\right)$ ☐ $8\left(\cos\frac{11\pi}{15}+i\sin\frac{11\pi}{15}\right)$ ☐ $8\left(\cos\frac{11\pi}{15}-i\sin\frac{11\pi}{15}\right)$		

Item #	Assessment Object/ Level of demand	Learning Aims	Page	Answer	Marks [4]	More information
21	AO2 M	2-3	53	$7^{t-1} < 13$	1	If the student solves the inequality correctly by taking log for any base of both sides, he gets full marks.
				Take the logarithms of both sides: $\ln 7^{t-1} < \ln 13$	1	
				$(t-1)\ln 7 < \ln 13$	1	
				$t - 1 < \dfrac{\ln 13}{\ln 7}$		
				$t < \dfrac{\ln 13}{\ln 7} + 1$		
				$t < 2.318$	1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
22	AO2 M	3-8	69	☐ $4\sin A$ ☐ $2\sin A$ ☐ $-2\sin A$ ■ $-4\sin A$		

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [5]	More information
23	AO2 M	3-6	Booklet 34		5	If the sketch shows: - correct amplitude, get 1 mark. - correct period, get 1 mark. - correct maximum values, get 1 mark. - correct minimum values, get 1 mark. - correct curve in one wavelength, get 1 mark.

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [1]	More information
24	AO2 M	4-2	186	☐ $2a + 4b$ ■ $3a + 8b$ ☐ $2a + 8b$ ☐ $3a + 12b$		

Item #	Assessment Object/ Level of demand	Learning Aims	Page	Answer	Marks [3]	More information
25	AO2 M	6-6	262	$\left\|\frac{z_1}{z_2}\right\| = \frac{3}{5}$	1	
				$\arg\frac{z_1}{z_2} = \frac{\pi}{4} - \frac{\pi}{12}$		
				$= \frac{\pi}{6}$	1	
				$\therefore \frac{z_1}{z_2} = \frac{3}{5}\ e^{\frac{\pi}{6}\mathrm{i}}$	1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [4]	More information
26	AO2 H	4-4	195	$\overrightarrow{AB} = \begin{pmatrix} 9 \\ 13 \end{pmatrix} - \begin{pmatrix} c \\ 5 \end{pmatrix}$		
				$= \begin{pmatrix} 9-c \\ 8 \end{pmatrix}$	1	
				$\sqrt{(9-c)^2 + (8)^2} = 10$	1	
				$(9-c)^2 + 64 = 100$		
				$(9-c)^2 = 100 - 64$		
				$(9-c)^2 = 36$		
				$9 - c = \pm 6$		
				$c = 3 \quad , \quad c = 15$	1+1	

Item #	Assessment Object/ Level of demand	Learning Aims	page	Answer	Marks [3]	More information
27	AO2 H	5-4	Booklet 73	$2p + q = 19$ $3p - q = 21$		
				$\begin{pmatrix} 2 & 1 \\ 3 & -1 \end{pmatrix} \begin{pmatrix} p \\ q \end{pmatrix} = \begin{pmatrix} 19 \\ 21 \end{pmatrix}$	1	
				The inverse of $\begin{pmatrix} 2 & 1 \\ 3 & -1 \end{pmatrix}$ is $\begin{pmatrix} \frac{1}{5} & \frac{1}{5} \\ \frac{3}{5} & \frac{-2}{5} \end{pmatrix}$	1	
				$\begin{pmatrix} p \\ q \end{pmatrix} = \begin{pmatrix} \frac{1}{5} & \frac{1}{5} \\ \frac{3}{5} & \frac{-2}{5} \end{pmatrix} \times \begin{pmatrix} 19 \\ 21 \end{pmatrix}$		
				$\begin{pmatrix} p \\ q \end{pmatrix} = \begin{pmatrix} \frac{19}{5} + \frac{21}{5} \\ \frac{57}{5} - \frac{42}{5} \end{pmatrix} = \begin{pmatrix} \frac{40}{5} \\ \frac{15}{5} \end{pmatrix}$		
				$\begin{pmatrix} p \\ q \end{pmatrix} = \begin{pmatrix} 8 \\ 3 \end{pmatrix}$		
				$p = 8\ , q = 3$	1	

