

سلطنة عمان
وزارة التربية والتعليم



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

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

الفصل الدراسي الأول - الدور الأول

للعام الدراسي ١٤٤٧/١٤٤٦ هـ - ٢٠٢٤ / ٢٠٢٥ م

تنبيه:
- المادة: الرياضيات المتقدمة.
- 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

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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) (Shade in the bubble ⬭ next to the value of $\log 100$)

⬭ 2 ⬭ 5

⬭ 10 ⬭ 20

[1]

2) $\ln a = 3$ and $\ln b = 2$

Find the value of $\ln\left(\frac{a^4}{b}\right)$

[4]

3) (Shade in the bubble ⬭ next to the exact expression of $\frac{2\tan 30^\circ}{1 - \tan^2 30^\circ}$)

⬭ $\tan 15^\circ$ ⬭ $\tan 30^\circ$

⬭ $\tan 45^\circ$ ⬭ $\tan 60^\circ$

[1]

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4) Without using a calculator, find the exact value of $\sec\left(\frac{\pi}{4}\right)$

[3]

5) $f(x) = 4\sin(2x+1)$

(Shade in the bubble ⬭ next to $f'(x)$)

⬭ $8\cos(2x+1)$ ⬭ $4\cos(2x+1)$

⬭ $-4\cos(2x+1)$ ⬭ $-8\cos(2x+1)$

[1]

6) $y = \tan(5x) - 3x^7$

Find $\frac{dy}{dx}$

[3]

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7) Given a discrete random variable X

(Shade in the bubble ⬭ next to the correct probability distribution table)

⬭

x	1	2	3
$\mathbf{P}(X = x)$	0.6	0.2	0.3

⬭

x	1	2	3
$\mathbf{P}(X = x)$	0.5	0.2	0.3

⬭

x	1	2	3
$\mathbf{P}(X = x)$	0.1	0.3	0.1

⬭

x	1	2	3
$\mathbf{P}(X = x)$	0.3	0.4	0.1

[1]

8) The equation of the curve is $y = e^{0.3x}$

Find the gradient of the curve at the point $(0, 1)$.

[3]

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9) (Shade in the bubble ⬭ next the exact value of $\cos 105^\circ$)

⬭ $\frac{1+\sqrt{3}}{2}$ ⬭ $\frac{1+\sqrt{3}}{2\sqrt{2}}$

⬭ $\frac{1-\sqrt{3}}{2\sqrt{2}}$ ⬭ $\frac{1-\sqrt{3}}{2}$

[1]

10) Describe the range of $f(x)=4\operatorname{cosec} x$

[4]

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11) $f(x) = 3\ln(x^2+5)$

(Shade in the bubble ⬭ next to the value of $f'(2)$)

⬭ $\frac{1}{9}$ ⬭ $\frac{1}{3}$

⬭ $\frac{4}{9}$ ⬭ $\frac{4}{3}$

[1]

12) The random variable X has the distribution shown below

x	1	2	3	4	5	6
$\mathbf{P}(X = x)$	0.1	0.3	0.2	0.1	0.2	0.1

Find $P(1 \le X < 5)$

[5]

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13) Given $\cos\theta - \sqrt{3}\sin\theta \equiv r\cos(\theta+\alpha)$,where α is in degrees.

Find the value of α

[3]

14) $f(x) = \dfrac{e^{2x}}{x}$

Find $f'(x)$.

[4]

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15) Solve the equation $e^{3x} - 6 = 1$

[4]

16) $\cos A = \frac{3}{5}$, where $0 < A < \frac{\pi}{2}$

(Shade in the bubble ⬭ next to the value of $\sin 2A$)

⬭ $\frac{12}{25}$ ⬭ $\frac{16}{25}$

⬭ $\frac{18}{25}$ ⬭ $\frac{24}{25}$

[1]

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17) The equation of the curve is $x^2 + y = 8x$

Find the coordinates of the stationary point.

[5]

18) The random variable X has the probability distribution shown below

x	0	1	2
$\mathbf{P}(X = x)$	0.1	0.6	0.3

Find $\mathrm{E}(X^2)$.

[3]

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19) The discrete random variable C has the probability distribution given by:

$$\mathrm{P}(C=c)=\begin{cases} ck & , \text{ for } c = 1,2,5 \\ 0 & , \text{ otherwise} \end{cases}$$

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

⬭ $\frac{1}{8}$ ⬭ $\frac{1}{7}$

⬭ 7 ⬭ 8

[1]

20) Solve the inequality $5^{x+2} < 7$

[3]

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21) Given $\log_{x+1} 16 = 4$

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

⬭ 1 ⬭ 2

⬭ 3 ⬭ 4

[1]

22) Solve $\cot(x - 50^\circ) = \sqrt{3}$, where $0^\circ \le x \le 360^\circ$

[6]

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23) (Shade in the bubble ⬭ next to the simplest form of $\sin x \cos x \sec x \cot x$)

⬭ $\sin x$ ⬭ $\cos x$

⬭ $\sin x \tan x$ ⬭ $\cos x \cot x$

[1]

24) $f(x) = 4\tan^{-1}(x^2 - 3)$

(Shade in the bubble ⬭ next to the equation of the tangent at $(0, -5)$)

⬭ $y = 0$ ⬭ $y = 2x - 5$

⬭ $y = -5$ ⬭ $y = 4x - 5$

[1]

25) The probability distribution of the random variable X is given by

x	a	$6 - a$	8
$\mathbf{P}(X = x)$	0.55	0.35	0.1

where $E(X) = 3.3$

Find the value of a

[2]

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26) (Shade in the bubble ⬭ next to the value of $\log\left(\log 10^{10^{3x}}\right)$)

⬭ $3x$ ⬭ 10^{3x}

⬭ $30x$ ⬭ 10^{30x}

[1]

27) Prove $\sin x + \cot^2 x \sin x \equiv \operatorname{cosec} x$

[3]

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28) The equation of the curve is $f(x) = 2x \ln(5x)$

Find the x-coordinate of the point where the gradient is 4

[3]

[End of Examination]

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Formulae Sheet

Log. & Exponential Functions

- $\log xy = \log x + \log y$
- $\log \frac{x}{y} = \log x - \log y$
- $\log x^k = k \log x$
- $y = a^x \rightarrow \log_a y = x$
- $\log_a xy = \log_a x + \log_a y$
- $\log_a \frac{x}{y} = \log_a x - \log_a y$
- $\log_a x^k = k \log_a x$
- $\log_a a = 1 \quad , \quad \log_a 1 = 0$
- $y = e^x \Longrightarrow \frac{\mathrm{d}y}{\mathrm{d}x} = e^x = y$
- $y = e^{ax} \Longrightarrow \frac{\mathrm{d}y}{\mathrm{d}x} = ae^{ax}$
- $e^x = y \Leftrightarrow \ln y = x$

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Trigonometry

Pythagorean Formulas

- $\sin^2 A + \cos^2 A = 1$
- $\sec^2 A = 1 + \tan^2 A$
- $\operatorname{cosec}^2 A = 1 + \cot^2 A$

Addition and subtraction Formulas

- $\sin(A + B) \equiv \sin A \cos B + \cos A \sin B$
- $\sin(A - B) \equiv \sin A \cos B - \cos A \sin B$
- $\cos(A + B) \equiv \cos A \cos B - \sin A \sin B$
- $\cos(A - B) \equiv \cos A \cos B + \sin A \sin B$
- $\tan(A + B) \equiv \dfrac{\tan A + \tan B}{1 - \tan A \tan B}$
- $\tan(A - B) \equiv \dfrac{\tan A - \tan B}{1 + \tan A \tan B}$

Double Angle Formulas:

- $\sin 2A \equiv 2 \sin A \cos A$
- $\cos 2A \equiv \cos^2 A - \sin^2 A$
- $\cos 2A \equiv 2\cos^2 A - 1$
- $\cos 2A \equiv 1 - 2\sin^2 A$
- $\tan 2A \equiv \dfrac{2\tan A}{1 - \tan^2 A}$

The Reciprocal Functions:

- $\tan\theta = \dfrac{\sin\theta}{\cos\theta}$
- $\sec\theta = \dfrac{1}{\cos\theta}$
- $\operatorname{cosec}\theta = \dfrac{1}{\sin\theta}$
- $\cot\theta = \dfrac{1}{\tan\theta}$
- $\tan\theta = \cot(90^\circ - \theta)$
- $\cos\theta = \sin(90^\circ - \theta)$

- **The form** $a\cos\theta + b\sin\theta$ **can be expressed as** $r\sin(\theta \pm \alpha)$ **or** $r\cos(\theta \pm \alpha)$,

  where $r = \sqrt{a^2 + b^2}$

  and $\tan\alpha = \pm\dfrac{b}{a}$ or $\tan\alpha = \pm\dfrac{a}{b}$

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Differentiation

- $y = x^n \Rightarrow \frac{dy}{dx} = n\,x^{n-1}$
- $f(x) = e^x \Rightarrow f'(x) = e^x$
- $f(x) = e^{kx} \Rightarrow f'(x) = ke^{kx}$
- $f(x) = \ln x \Rightarrow f'(x) = \frac{1}{x}$
- $f(x) = \ln(g(x)) \Rightarrow f'(x) = \frac{1}{g(x)}g'(x)$
- $f(x) = u\,v \Rightarrow f'(x) = u\frac{dv}{dx} + v\frac{du}{dx}$
- $f(x) = \frac{u}{v} \Rightarrow f'(x) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$
- $f(x) = \sin x \Rightarrow f'(x) = \cos x$
- $f(x) = \cos x \Rightarrow f'(x) = -\sin x$
- $f(x) = \tan x \Rightarrow f'(x) = \sec^2 x$
- $f(x) = \tan^{-1} x \Rightarrow f'(x) = \frac{1}{1+x^2}$

Discrete random variable

- $P(x) = \frac{\text{Frequency}}{\text{Total Frequency}}$
- $E(X) = \sum xp$
- $E(Y^2) = \sum y^2 p$
- $\text{Var}(X) = E(X^2) - \big(E(X)\big)^2$ or $\text{Var}(X) = \sum x^2 p - \big(E(X)\big)^2$

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Answer scheme

Diploma, Bilingual Private Schools, Advanced Mathematics

First Semester-First Session
Academic Year: 2024/2025



Answer Scheme

Diploma, Bilingual Private, Advanced Mathematics | First Semester-First Session | Academic Year: 2024/2025

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
1	AO1/L	Log. & Exponential Functions	39	■ 2 ☐ 5 ☐ 10 ☐ 20		-

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [4]	More information
2	AO1/L	Log. & Exponential Functions	50	$\ln\left(\frac{a^4}{b}\right)$		-
				$= \ln a^4 - \ln b$	1	
				$= 4\ln a - \ln b$	1	
				$= 4 \times 3 - 2$	1	
				$= 10$	1	

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer – Alternative Answer	Marks [4]	More information
2	AO1/L	**Log. & Exponential Functions**	**50**	$\ln a = 3 \quad \rightarrow \quad a = e^3$	1	-
				$\ln b = 2 \quad \rightarrow \quad b = e^2$		
				$\therefore \ln\left(\frac{a^4}{b}\right)$		
				$= \ln\left(\frac{(e^3)^4}{e^2}\right)$	1	
				$= \ln\left(\frac{e^{12}}{e^2}\right)$		
				$= \ln e^{12} - \ln e^2$	1	
				$= 12 - 2$		
				$= 10$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
3	AO1 \ L	Trigonometry	70	☐ tan 15° ☐ tan 30° ☐ tan 45° ■ tan 60°		-

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
4	AO1 \ L	**Trigonometry**	**78**	$\sec\left(\frac{\pi}{4}\right)$		If the student writes only the final answer without any steps, then he\she will get **2 mark**.
				$=\frac{1}{\cos\left(\frac{\pi}{4}\right)}$	1	
				$=\frac{1}{\left(\frac{1}{\sqrt{2}}\right)}$	1	
				$=\sqrt{2}$	1	

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
5	AO1 / L	**Differentiation**	**92**	■ $8\cos(2x+1)$ ☐ $4\cos(2x+1)$ ☐ $-4\cos(2x+1)$ ☐ $-8\cos(2x+1)$		-

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
6	AO1 / L	**Differentiation**	**100**	$\frac{dy}{dx} = 5\sec^2(5x) - 21x^6$	1+1+1	**1 Mark** for 5 **1 Mark** for $\sec^2(5x)$ **1 Mark** for $-21x^6$

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
7	AO1/L	**Discrete Random Variables**	**84 + 85**	☐ x: 1, 2, 3 — $P(X=x)$: 0.6, 0.2, 0.3 ■ x: 1, 2, 3 — $P(X=x)$: 0.5, 0.2, 0.3 ☐ x: 1, 2, 3 — $P(X=x)$: 0.1, 0.3, 0.1 ☐ x: 1, 2, 3 — $P(X=x)$: 0.3, 0.4, 0.1		-

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
8	AO1/M	**Log. & Exponential Functions**	**47**	$y = e^{0.3x}$		
				The gradient $= 0.3\ e^{0.3x}$	1	
				at (0,1)		
				The gradient $= 0.3\ e^{0.3(0)}$	1	➢ If the student substitutes $x = 0$ in the equation of the curve (ie: $y = e^{0.3x}$), then he/she will lose **2marks**.
				$= 0.3$	1	

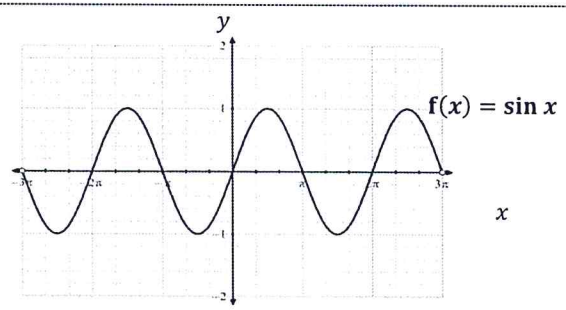
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Answer Scheme

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
9	AO1 / M	Trigonometry	68	☐ $\frac{1+\sqrt{3}}{2}$ ☐ $\frac{1+\sqrt{3}}{2\sqrt{2}}$ ■ $\frac{1-\sqrt{3}}{2\sqrt{2}}$ ☐ $\frac{1-\sqrt{3}}{2}$		-

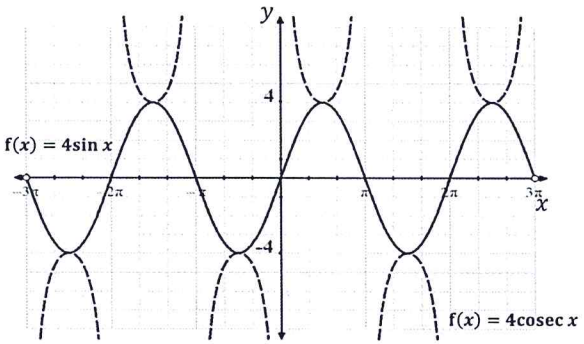
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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [4]	More information
10	AO1 / M	Trigonometry	77	**Range of $\sin x$ is**		
				$-1 \leq \sin x \leq 1$	1	
				$\operatorname{cosec} x = \dfrac{1}{\sin x}$		
				Range of $\operatorname{cosec} x$ is		
				$\operatorname{cosec} x \geq 1$ **and** $\operatorname{cosec} x \leq -1$	1	➢ If the student writes this step correctly without the step($-1 \leq \sin x \leq 1$), then he/she will get **2marks** implicitly. ➢ If the student writes anyone of the expressions wrong without the step ($-1 \leq \sin x \leq 1$), then he/she will lose **2marks.**
				∴Range of $4\operatorname{cosec} x$ is		
				$4\operatorname{cosec} x \geq 4$ **and** $4\operatorname{cosec} x \leq -4$ **Or** $f(x) \geq 4$ **and** $f(x) \leq -4$	1+1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer- Alternative solution	Marks [4]	More information
10	AO1 / M	**Trigonometry**	77	If the student solves the question by drawing **sin x**		-
					1	
				∴Range of cosec x is		
				$\text{cosec}\, x \geq 1$ and $\text{cosec}\, x \leq -1$	1	
				∴Range of 4cosec x is $4\,\text{cosec}\, x \geq 4$ and $4\,\text{cosec}\, x \leq -4$ **or** $f(x) \geq 4$ and $f(x) \leq -4$	1+1	

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer- Alternative solution	Marks [4]	More information
10	AO1 / M	**Trigonometry**	77	If the student solves the question by drawing **4sin x** and **4cosec x**		
					1+1	**1 Mark** for the correct sketch of 4 sin x **1 Mark** for the correct sketch of 4 cosec x
				∴Range of 4cosec x is		➢ If the student didn't write this step but he/she specify the sketch of **4cosec x** correctly in the graph, then he/she will get it implicitly.
				$4\text{cosec}\,x \geq 4$ and $4\,\text{cosec}\,x \leq -4$ **or** $f(x) \geq 4$ and $f(x) \leq -4$	1+1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
11	AO1 / M	**Differentiation**	**90**	☐ $\frac{1}{9}$ ☐ $\frac{1}{3}$ ☐ $\frac{4}{9}$ ■ $\frac{4}{3}$		-

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [5]	More information
12	AO1/M	**Discrete Random Variables**	**89**	$P(1 \leq X < 5)$		
				$= P(1) + P(2) + P(3) + P(4)$	1+1+1+1	**1 Mark** for each correct selection of the probabilities. ➢ If the student adds any extra values to this step, then he/she will <u>lose</u> **1mark** for each extra value.
				$= 0.1 + 0.3 + 0.2 + 0.1$		
				$= 0.7$	1	

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [5]	More information
12	AO1/M	**Discrete Random Variables**	**89**	$P(1 \leq X < 5)$		
				$= 1 - (P(5) + P(6))$	1+1+1	**1 Mark** for 1 **1 Mark** for the sign (-) **1 Mark** for $P(5) + P(6)$ ➢ If the student adds any extra values rather than $P(5) + P(6)$, then **1mark** will be deducted.
				$= 1 - 0.3$	1	
				$= 0.7$	1	

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
13	AO1 / H	Trigonometry	73 + 74	$r\cos\alpha = 1 \quad \text{and} \quad r\sin\alpha = \sqrt{3}$	1	
				Since $\sin\alpha > 0$ and $\cos\alpha > 0$, then $0° \leq \alpha \leq 90°$		
				$\therefore \tan\alpha = \dfrac{r\sin\alpha}{r\cos\alpha} = \dfrac{\sqrt{3}}{1}$	1	
				$\alpha = \tan^{-1}\sqrt{3}$		
				$\therefore \alpha = 60°$	1	➢ If the student finds the value of α in radians, then he/she will lose the mark of this step.



Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [4]	More information
14	AO1 / H	**Differentiation**	**86 + 100**	$u = e^{2x}$, $\frac{du}{dx} = 2e^{2x}$	1	**1 Mark** for $2e^{2x}$
				$v = x$, $\frac{dv}{dx} = 1$	1	**1 Mark** for 1
				$\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$		
				$\therefore \frac{dy}{dx} = \frac{2xe^{2x} - e^{2x}}{x^2}$	1+1	**1 Mark** for the correct numerator **1 Mark** for the correct denominator

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [4]	More information
14	AO1 / H	**Differentiation**	**86 + 100**	$u = e^{2x}$, $\frac{du}{dx} = 2e^{2x}$	1	**1 Mark** for $2e^{2x}$
				$v = x^{-1}$, $\frac{dv}{dx} = -x^{-2}$	1	**1 Mark** for $-x^{-2}$
				$\frac{dy}{dx} = u\frac{dv}{dx} + v\frac{du}{dx}$		
				$\therefore \frac{dy}{dx} = -x^{-2}e^{2x} + 2x^{-1}e^{2x}$	1+1	**1 Mark** for $-x^{-2}e^{2x}$ **1 Mark** for $2x^{-1}e^{2x}$

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [4]	More information
15	AO2/L	**Log. & Exponential Functions**	**50**	$e^{3x} = 7$	1	
				$\ln e^{3x} = \ln 7$	1	
				$3x \ln e = \ln 7$		
				$3x = \ln 7$	1	
				$\therefore x = \frac{\ln 7}{3}$ $\therefore x \approx 0.649$	1	If the student uses the calculator to find the result, then he/she will get **1mark**.

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [4]	More information
15	AO2/L	**Log. & Exponential Functions**	**50**	$e^{3x} = 7$	1	
				$\log e^{3x} = \log 7$	1	➢ It is accepted that the student apply log with any base to both side of the first step
				$3x \log e = \log 7$		
				$3x = \dfrac{\log 7}{\log e}$	1	
				$\therefore x = \dfrac{1}{3} \times \dfrac{\log 7}{\log e}$ $\therefore x \approx 0.649$	1	➢ If the student uses the calculator to find the result, then he/she will get **1mark**.

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
16	AO2 / L	**Trigonometry**	**70**	☐ $\frac{12}{25}$ ☐ $\frac{16}{25}$ ☐ $\frac{18}{25}$ ■ $\frac{24}{25}$		-

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [5]	More information
17	AO2 / L	**Differentiation**	**113**	$2x + \frac{dy}{dx} = 8$	1	
				$\frac{dy}{dx} = 8 - 2x$		
				$\frac{dy}{dx} = 0 \quad \rightarrow \quad 8 - 2x = 0$	1	➢ If the student equates the equation of the curve by 0 and completes the solution, then he/she will lose all the marks from this step and below.
				$x = 4$	1	
				$4^2 + y = 8 \times 4$	1	➢ If the student substitutes the value of x on $(8 - 2x)$ to get the value of y , then he/she will lose this mark.
				$y = 16$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
18	AO2/L	**Discrete Random Variables**	**92**	$\mathrm{E}(X^2) = 0^2 \times 0.1 + 1^2 \times 0.6 + 2^2 \times 0.3$	1	
				$= 0 + 0.6 + 1.2$	1	**1Mark:** correct multiplication results ➢ If the student didn't write this step, then he/she will get it implicitly.
				$= 1.8$	1	

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
19	AO2/L	**Discrete Random Variables**	**89**	■ $\frac{1}{8}$ ☐ $\frac{1}{7}$ ☐ 7 ☐ 8		-

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
20	AO2/M	**Log. & Exponential Functions**	**53**	$\ln 5^{x+2} < \ln 7$	1	➢ If the student solves the equation using log for any base with the correct steps, then he\she will get **3marks.**
				$(x+2)\ln 5 < \ln 7$	1	
				$x + 2 < \frac{\ln 7}{\ln 5}$		
				$x < -2 + \frac{\ln 7}{\ln 5}$	1	
				$x < -0.79$		

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
21	AO2/M	Log. & Exponential Functions	43	■ 1 ☐ 2 ☐ 3 ☐ 4		-



Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [6]	More information
22	AO2 / M	**Trigonometry**	**78 + 79**	$\cot(x - 50°) = \sqrt{3}$		
				$\tan(x - 50°) = \frac{1}{\sqrt{3}}$	1+1	**1mark** for $\tan(x - 50°)$ **1mark** for $\frac{1}{\sqrt{3}}$
				$x - 50° = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$	1	➢ If the student didn't write this step, then he/she will get **1mark** implicitly.
				$\therefore x - 50° = 30°$ **or** $x - 50° = 180° + 30°$	1+1	
				$\therefore x = 80°$ **or** $x = 260°$	1	

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
23	AO2 / M	Trigonometry	76	☐ $\sin x$ ■ $\cos x$ ☐ $\sin x \tan x$ ☐ $\cos x \cot x$		-



Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
24	AO2/M	**Differentiation**	**104**	☐ $y = 0$ ☐ $y = 2x - 5$ ■ $y = -5$ ☐ $y = 4x - 5$		-



Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [2]	More information
25	AO2/M	Discrete Random Variables	95	$0.55a + 0.35(6 - a) + 8 \times 0.1 = 3.3$	1	-
				$0.55a + 2.1 - 0.35a + 0.8 = 3.3$		
				$0.2a = 0.4$		
				$a = 2$	1	

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
26	AO2/H	Log. & Exponential Functions	39 + 40	■ $3x$ ☐ $30x$ ☐ 10^{3x} ☐ 10^{30x}		-



Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
27	AO2 / H	Trigonometry	79	LHS $= \sin x + \cot^2 x \sin x$		-
				$= \sin x\,(1 + \cot^2 x)$	1	
				$= \sin x \ \operatorname{cosec}^2 x$	1	
				$= \sin x \left(\frac{1}{\sin^2 x}\right)$		
				$= \frac{1}{\sin x}$	1	
				$= \operatorname{cosec} x$ $=$ RHS		

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer Alternative Answer	Marks [3]	More information
27	AO2 / H	Trigonometry	79	LHS $= \sin x + \cot^2 x \sin x$		-
				$= \sin x + \dfrac{\cos^2 x}{\sin^2 x} \sin x$	1	
				$= \sin x + \dfrac{\cos^2 x}{\sin x}$		
				$= \dfrac{\sin^2 x + \cos^2 x}{\sin x}$	1	
				$= \dfrac{1}{\sin x}$	1	
				$= \operatorname{cosec} x$ = RHS		

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer Alternative Answer	Marks [3]	More information
27	AO2 / H	Trigonometry	79	$\text{LHS} = \sin x + \cot^2 x \sin x$		-
				$= \sin x + (\text{cosec}^2 x - 1) \sin x$	1	
				$= \sin x + \left(\frac{1}{\sin^2 x} - 1\right) \sin x$		
				$= \sin x + \frac{1}{\sin x} - \sin x$	1	
				$= \frac{1}{\sin x}$	1	
				$= \text{cosec}\, x$ $= \text{RHS}$		

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer Alternative Answer	Marks [3]	More information
27	AO2 / H	Trigonometry	79	$\text{LHS} = \sin x + \cot^2 x \sin x$		-
				$= \sin x + \dfrac{\cos^2 x}{\sin^2 x} \sin x$	1	
				$= \sin x + \dfrac{(1 - \sin^2 x)}{\sin^2 x} \sin x$		
				$= \dfrac{\sin^3 x + \sin x - \sin^3 x}{\sin^2 x}$	1	
				$= \dfrac{\sin x}{\sin^2 x}$		
				$= \dfrac{1}{\sin x}$	1	
				$= \text{cosec}\, x$ $= \text{RHS}$		

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Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
28	AO2/H	**Differentiation**	**96**	$f'(x) = 2\ln(5x) + 2x\left(\frac{5}{5x}\right)$ **or** $f'(x) = 2\ln(5x) + 2$	1	-
				The gradient is 4 $\leftrightarrow f'(x) = 4$		
				$\therefore\ 2\ln(5x) + 2 = 4$	1	
				$\ln(5x) = 1$		
				$\therefore\ x = \frac{e}{5}$ **Or** $x \approx 0.544$	1	

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

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

الفصل الدراسي الأول - الدور الثاني

للعام الدراسي ١٤٤٧/١٤٤٦ هـ - ٢٠٢٥/٢٠٢٤ م

تنبيه:
- المادة: الرياضيات المتقدمة.
- الأسئلة في (١٤) 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

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Instructions:

1. List of formulae is given on 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) (Shade in the bubble ⬭ next to the value of $\log_2 8$)

⬭ 6 ⬭ 5

⬭ 3 ⬭ 2

[1]

2) Given $\log x = k$

Find the value of $\log\left(\frac{100}{x^3}\right)$ in term of k

[4]

Do not write in this space

3) Given $\cos\theta = \frac{4}{5}$

(Shade in the bubble ⬭ next to the exact value of $\cos 2\theta$)

⬭ $\frac{1}{5}$ ⬭ $\frac{7}{25}$

⬭ $\frac{9}{25}$ ⬭ $\frac{3}{5}$

[1]

4) Describe the range of $f(x) = \sec x$

[3]

5) $f(x) = 3\ln 5x$

(Shade in the bubble ⬭ next to $f'(x)$)

⬭ $\frac{3}{x}$ ⬭ $\frac{3}{5x}$

⬭ $\frac{1}{x}$ ⬭ $\frac{1}{5x}$

[1]

Do not write in this space

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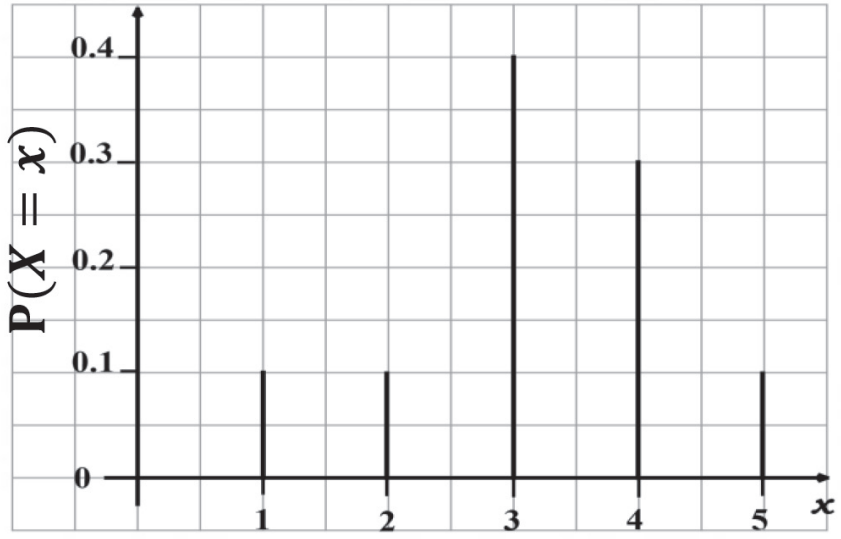
Do not write in this space

6) $y = (x-1)^4 + \sin(6x)$

Find $\frac{dy}{dx}$

[3]

7) The graph below shows the probability distribution of a discrete random variable X.



(Shade in the bubble ○ next to $P(X \geq 3)$)

○ 0.2 ○ 0.4

○ 0.6 ○ 0.8

[1]

Do not write in this space

8) Without using a calculator, find the value of $2\log_6 3 + \log_6 4$

[3]

9) (Shade in the bubble ⬭ next to the exact value of $\operatorname{cosec} 300^\circ$)

⬭ $-\frac{2}{\sqrt{3}}$ ⬭ $-\frac{\sqrt{3}}{2}$

⬭ $\frac{\sqrt{3}}{2}$ ⬭ $\frac{2}{\sqrt{3}}$

[1]

Do not write in this space

Do not write in this space

Do not write in this space

10) Simplify: $\cos\left(x - \frac{\pi}{6}\right) + \sin\left(x + \frac{\pi}{3}\right)$

[4]

11) $f(x) = 4e^{2x-2}$

(Shade in the bubble ⬭ next to the value of $f'(1)$)

⬭ 1 ⬭ 2

⬭ 4 ⬭ 8

[1]

Do not write in this space

12) The random variable X has the distribution shown below

x	–1	0	2
$\mathbf{P}(X = x)$	0.15	0.3	0.55

Find $\mathrm{E}(X)$.

[5]

13) Given that: $\sin 2A \cos A - \cos 2A \sin A = \frac{1}{2}$

Solve the equation for $0 < A < \frac{\pi}{2}$; A in radians.

[3]

Do not write in this space

Do not write in this space

Do not write in this space

14) Given $y = x^3 \tan(7x)$

Find $\frac{dy}{dx}$

[4]

15) By using logarithms, solve the equation $5^{2x-1} = 125$

[4]

Do not write in this space

16) Given $\sec(2x - 40^\circ) = 2$, where $0^\circ \leq x < 360^\circ$

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

⬭ $30^\circ, 330^\circ$ ⬭ $35^\circ, 185^\circ$

⬭ $50^\circ, 170^\circ$ ⬭ $60^\circ, 300^\circ$

[1]

17) The curve equation is $y = \frac{4x^2}{x+1}$, $x \neq -1$

Find the equation of the tangent to the curve at the point $(1, 2)$.

[5]

Do not write in this space

Do not write in this space

Do not write in this space

18) The random variable Y has the distribution shown below

y	0	2	3
$\mathbf{P}(Y = y)$	$\frac{2}{7}$	$\frac{1}{7}$	$\frac{4}{7}$

Given E(Y) = 2

Find Var(Y).

[3]

19) The discrete random variable X has the probability distribution given by:

$$\mathrm{P}(X = x) = \begin{cases} kx^2, & x = 1, 2, 3 \\ 0, & \text{otherwise} \end{cases}$$

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

⬭ $\frac{1}{14}$ ⬭ $\frac{1}{6}$

⬭ 6 ⬭ 14

[1]

Do not write in this space

20) Solve the equation $-2 + \ln(4x + 1) = 0$

(Give your answer to 3 decimal places).

[3]

21) Given the equation $e^{2x} - e^{x} - 12 = 0$

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

⬭ $\ln 3$ ⬭ $\ln 4$

⬭ 3 ⬭ 4

[1]

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22) Write $5\sin\theta + 5\cos\theta$ in the form $r\sin(\theta + \alpha)$, where α is in radians.

[6]

23) $k = \dfrac{1}{1 + \cot^2\theta} + \dfrac{2}{1 + \tan^2\theta} + \sin^2\theta$

(Shade in the bubble ○ next to the value of k)

○ 4 ○ 3

○ 2 ○ 1

[1]

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24) A curve has equation $bx^2 + 5y^2 = 23$, b is a constant and $\frac{dy}{dx} = -\frac{3}{10}$ at $(1, 2)$

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

⬭ -3

⬭ $-\frac{3}{4}$

⬭ $\frac{3}{4}$

⬭ 3

[1]

25) A random variable X, has the probability distribution shown in the table below

x	3	5
$\mathbf{P}(X = x)$	$1 - a$	a

Where $\mathrm{E}(X) = 3.8$

Find the value of a

[2]

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26) Given $\log_x 8x = 2$

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

⬭ 2 ⬭ 3

⬭ 4 ⬭ 8

[1]

27) Prove $\dfrac{\text{cosec}x - \sin x}{\cot x} \equiv \cos x$

[3]

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28) $f(x) = 3 + \tan^{-1}(x + 5)^2$

Find the x-coordinate of the point where the gradient is 0

[3]

[End of Examination]

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Formulae Sheet

Log. & Exponential Functions

- $\log xy = \log x + \log y$
- $\log \frac{x}{y} = \log x - \log y$
- $\log x^k = k \log x$
- $y = a^x \rightarrow \log_a y = x$
- $\log_a xy = \log_a x + \log_a y$
- $\log_a \frac{x}{y} = \log_a x - \log_a y$
- $\log_a x^k = k \log_a x$
- $\log_a a = 1 \quad , \quad \log_a 1 = 0$
- $y = e^x \Longrightarrow \frac{\mathrm{d}y}{\mathrm{d}x} = e^x = y$
- $y = e^{ax} \Longrightarrow \frac{\mathrm{d}y}{\mathrm{d}x} = ae^{ax}$
- $e^x = y \Leftrightarrow \ln y = x$

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Trigonometry

Pythagorean Formulas

- $\sin^2 A + \cos^2 A = 1$
- $\sec^2 A = 1 + \tan^2 A$
- $\operatorname{cosec}^2 A = 1 + \cot^2 A$

Addition and subtraction Formulas

- $\sin(A + B) \equiv \sin A \cos B + \cos A \sin B$
- $\sin(A - B) \equiv \sin A \cos B - \cos A \sin B$
- $\cos(A + B) \equiv \cos A \cos B - \sin A \sin B$
- $\cos(A - B) \equiv \cos A \cos B + \sin A \sin B$
- $\tan(A + B) \equiv \dfrac{\tan A + \tan B}{1 - \tan A \tan B}$
- $\tan(A - B) \equiv \dfrac{\tan A - \tan B}{1 + \tan A \tan B}$

Double Angle Formulas:

- $\sin 2A \equiv 2 \sin A \cos A$
- $\cos 2A \equiv \cos^2 A - \sin^2 A$
- $\cos 2A \equiv 2\cos^2 A - 1$
- $\cos 2A \equiv 1 - 2\sin^2 A$
- $\tan 2A \equiv \dfrac{2\tan A}{1 - \tan^2 A}$

The Reciprocal Functions:

- $\tan\theta = \dfrac{\sin\theta}{\cos\theta}$
- $\sec\theta = \dfrac{1}{\cos\theta}$
- $\operatorname{cosec}\theta = \dfrac{1}{\sin\theta}$
- $\cot\theta = \dfrac{1}{\tan\theta}$
- $\tan\theta = \cot(90^\circ - \theta)$
- $\cos\theta = \sin(90^\circ - \theta)$

- **The form** $a\cos\theta + b\sin\theta$ **can be expressed as** $r\sin(\theta \pm \alpha)$ **or** $r\cos(\theta \pm \alpha)$,

  where $r = \sqrt{a^2 + b^2}$

  and $\tan\alpha = \pm\dfrac{b}{a}$ or $\tan\alpha = \pm\dfrac{a}{b}$

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Differentiation

- $y = x^n \Rightarrow \frac{dy}{dx} = n\,x^{n-1}$
- $f(x) = e^x \Rightarrow f'(x) = e^x$
- $f(x) = e^{kx} \Rightarrow f'(x) = ke^{kx}$
- $f(x) = \ln x \Rightarrow f'(x) = \frac{1}{x}$
- $f(x) = \ln(g(x)) \Rightarrow f'(x) = \frac{1}{g(x)}g'(x)$
- $f(x) = u\,v \Rightarrow f'(x) = u\frac{dv}{dx} + v\frac{du}{dx}$
- $f(x) = \frac{u}{v} \Rightarrow f'(x) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$
- $f(x) = \sin x \Rightarrow f'(x) = \cos x$
- $f(x) = \cos x \Rightarrow f'(x) = -\sin x$
- $f(x) = \tan x \Rightarrow f'(x) = \sec^2 x$
- $f(x) = \tan^{-1} x \Rightarrow f'(x) = \frac{1}{1+x^2}$

Discrete random variable

- $P(x) = \frac{\text{Frequency}}{\text{Total Frequency}}$
- $E(X) = \sum xp$
- $E(Y^2) = \sum y^2 p$
- $\text{Var}(X) = E(X^2) - \big(E(X)\big)^2$ or $\text{Var}(X) = \sum x^2 p - \big(E(X)\big)^2$

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

سلطنة عُمان
وزارة التربية والتعليم

Answer scheme

Diploma, Bilingual Private Schools, Advanced Mathematics

First Semester-Second Session
Academic Year: 2024/2025

Answer Scheme

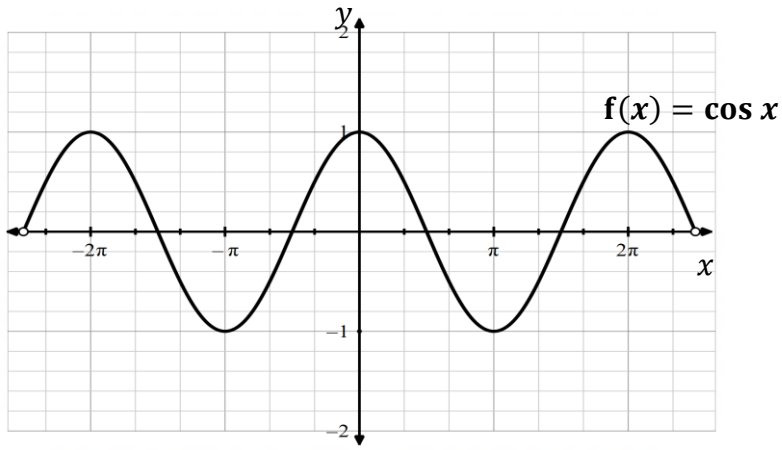
Diploma, Bilingual Private, Advanced Mathematics First Semester-Second Session Academic Year: 2024/2025

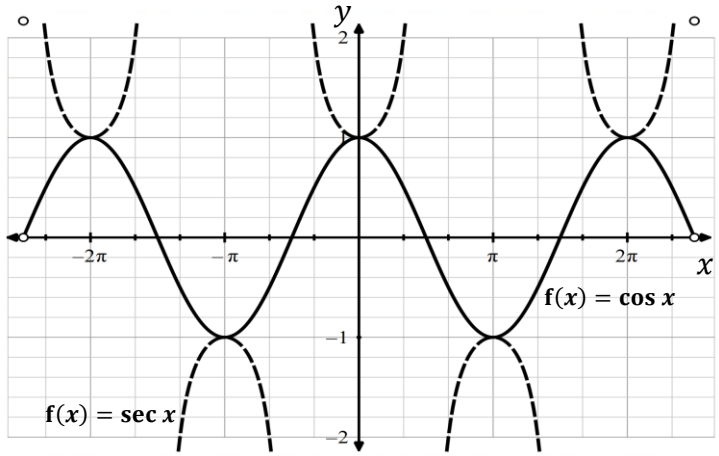
Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
1	AO1/L	Log. & Exponential Functions	42	☐ 6 ☐ 5 ■ 3 ☐ 2		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [4]	More information
2	AO1/L	**Log. & Exponential Functions**	**40**	$\log\left(\frac{100}{x^3}\right)$		
				$= \log 100 - \log x^3$	1	
				$= 2 - 3\log x$	1+1	**1 Mark** for 2 **1 Mark** for $3\log x$
				$= 2 - 3k$	1	**1 Mark** for the substitution of $\log x = k$ ➢ If the student writes the final result without any steps, then he/she will get **1mark** only.

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
3	AO1 / L	**Trigonometry**	**70**	☐ $\frac{1}{5}$ ■ $\frac{7}{25}$ ☐ $\frac{9}{25}$ ☐ $\frac{3}{5}$		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
4	AO1 / L	**Trigonometry**	**77**	Range of $\cos x$ is		
				$-1 \leq \cos x \leq 1$	1	
				$\sec x = \frac{1}{\cos x}$		
				∴Range of $\sec x$ is		
				Or $\sec x \geq 1$ **and** $\sec x \leq -1$ $f(x) \geq 1$ **and** $f(x) \leq -1$	1+1	**1 Mark** for $\sec x \geq 1$ or $f(x) \geq 1$ **1 Mark** for $\sec x \leq -1$ or $f(x) \leq -1$

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
4	AO1 / L	**Trigonometry**	**77**	If the student solves the question by drawing $\cos x$		
					1	**1 Mark** for the correct sketch of $\cos x$.
				∴Range of $\sec x$ is		
				Or $\sec x \geq 1$ **and** $\sec x \leq -1$ $f(x) \geq 1$ **and** $f(x) \leq -1$	1+1	**1 Mark** for $\sec x \geq 1$ or $f(x) \geq 1$ **1 Mark** for $\sec x \leq -1$ or $f(x) \leq -1$

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
4	AO1 / L	**Trigonometry**	**77**	If the student solves the question by drawing **$\cos x$** and **$\sec x$**		
					1+1	**1 Mark** for correct sketch of $\cos x$. **1 Mark** for correct sketch of $\sec x$.
				∴Range of $\sec x$ is		
				Or $\sec x \geq 1$ **and** $\sec x \leq -1$ $f(x) \geq 1$ **and** $f(x) \leq -1$	1	➢ If the student didn't write this step but he/she specify the sketch of **$\sec x$** correctly in the graph, then he/she will get **1mark** implicitly.

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
5	AO1 / L	**Differentiation**	**90**	■ $\frac{3}{x}$ ☐ $\frac{3}{5x}$ ☐ $\frac{1}{x}$ ☐ $\frac{1}{5x}$		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
6	AO1/L	**Differentiation**	**92 + 101**	$\frac{\mathrm{d}y}{\mathrm{d}x} = 4(x-1)^3 + 6\cos(6x)$	1+1+1	**1 Mark** for $4(x-1)^3$ **1 Mark** for 6 **1 Mark** for $\cos(6x)$

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
7	AO1/L	**Discrete Random Variables**	**88**	☐ 0.2 ☐ 0.4 ☐ 0.6 ■ 0.8		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
8	AO1/M	**Log. & Exponential Functions**	**41**	$2\log_6 3 + \log_6 4$		➢ If the student writes the final result without any steps, then he/she will get **1mark** only.
				$= \log_6 3^2 + \log_6 4$	1	
				$= \log_6(9 \times 4)$	1	
				$= \log_6 36$		
				$= \log_6 6^2$		
				$= 2\log_6 6$		
				$= 2$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
9	AO1 / M	**Trigonometry**	**78**	■ $-\frac{2}{\sqrt{3}}$ ☐ $-\frac{\sqrt{3}}{2}$ ☐ $\frac{\sqrt{3}}{2}$ ☐ $\frac{2}{\sqrt{3}}$		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [4]	More information
10	AO1 / M	**Trigonometry**	**68**	$\cos\left(x-\frac{\pi}{6}\right)+\sin\left(x+\frac{\pi}{3}\right)$		
				$=\left(\cos x\cos\frac{\pi}{6}+\sin x\ \sin\frac{\pi}{6}\right)$ $+\left(\sin x\cos\frac{\pi}{3}+\cos x\sin\frac{\pi}{3}\right)$	1 + 1	**1 Mark:** for expanding $\cos\left(x-\frac{\pi}{6}\right)$ correctly. **1 Mark:** for expanding $\sin\left(x+\frac{\pi}{3}\right)$ correctly.
				$=\frac{\sqrt{3}}{2}\cos x+\frac{1}{2}\sin x+\frac{1}{2}\sin x+\frac{\sqrt{3}}{2}\cos x$	1	
				$=\sqrt{3}\cos x+\sin x$	1	The final answer must be in the simplest form.

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
11	AO1/M	**Differentiation**	**86**	☐ 1 ☐ 2 ☐ 4 ■ 8		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [5]	More information
12	AO1/M	**Discrete Random Variables**	**91**	$\mathrm{E}(X) = -1 \times 0.15 + 0 \times 0.3 + 2 \times 0.55$	1+1+1	**1Mark:** for each correct multiplication term.
				$= -0.15 + 0 + 1.1$	1	**1Mark:** correct multiplication results If the student didn't write this step, then he/she will get it implicitly.
				$= 0.95$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
13	AO1/ H	**Trigonometry**	**68 + 71**	$\sin 2A \cos A - \cos 2A \sin A = \frac{1}{2}$		-
				$\sin(2A - A) = \frac{1}{2}$	1	
				$\sin A = \frac{1}{2}$	1	
				$\therefore A = \frac{\pi}{6}$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
13	AO1/ H	**Trigonometry**	**70 + 71**	$\sin 2A \cos A - \cos 2A \sin A = \frac{1}{2}$		➢ If the student uses the following formulae $\cos 2A = \cos^2 A - \sin^2 A$ $\sin 2A = 2 \sin A \cos A$ to solve the equation, then he/she will get **1mark** when the student reaches this step $(\cos^2 A + \sin^2 A) \sin A = \frac{1}{2}$
				$(2\sin A \cos A) \cos A - (2\cos^2 A - 1) \sin A = \frac{1}{2}$		
				$2 \sin A \cos^2 A - 2 \sin A \cos^2 A + \sin A = \frac{1}{2}$	1	
				$\sin A = \frac{1}{2}$	1	
				$\therefore A = \frac{\pi}{6}$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [4]	More information
14	AO1/H	**Differentiation**	**94 + 100**	$u = x^3 \rightarrow \frac{du}{dx} = 3x^2$	1	**1 Mark** for $3x^2$
				$v = \tan(7x) \rightarrow \frac{dv}{dx} = 7\sec^2(7x)$	1	**1 Mark** for $7\sec^2(7x)$
				$\frac{dy}{dx} = u\frac{dv}{dx} + v\frac{du}{dx}$		
				$\therefore \frac{dy}{dx} = 7x^3\sec^2(7x) + 3x^2\tan(7x)$	1 + 1	**1 Mark** for the correct term $7x^3\sec^2(7x)$ **1 Mark** for the correct term $3x^2\tan(7x)$

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [4]	More information
15	AO2/L	**Log. & Exponential Functions**	**53**	$\log 5^{2x-1} = \log 125$	1	➢ If the student solves the equation using ln or log for any base with the correct steps, then he\she will get **4marks.** ➢ If the student uses any correct methods other than logarithms, then he\she will get **2marks** only**.**
				$(2x-1)\log 5 = \log 125$	1	
				$2x-1 = \dfrac{\log 125}{\log 5}$	1	
				$2x-1 = 3$		
				$x = 2$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
16	AO2 / L	**Trigonometry**	**78**	☐ $30°, 330°$ ☐ $35°, 185°$ ■ $50°, 170°$ ☐ $60°, 300°$		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [5]	More information
17	AO2/L	**Differentiation**	**101**	$\frac{dy}{dx} = \frac{8x(x+1) - 4x^2}{(x+1)^2}$ **Or** $\frac{dy}{dx} = \frac{4x^2 + 8x}{(x+1)^2}$	1 + 1	**1 Mark** for the correct value of the numerator. **1 Mark** for the correct value of the denominator.
				At $(1,2) \rightarrow \quad \frac{dy}{dx} = \frac{4(1)^2+8(1)}{(1+1)^2}$	1	
				$\therefore \frac{dy}{dx} = 3$	1	
				The equation of the tangent is: $y - 2 = 3(x-1)$ **Or** $y = 3x - 1$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
18	AO2/L	**Discrete Random Variables**	**95**	$\mathrm{E}(Y^2) = 0^2 \times \frac{2}{7} + 2^2 \times \frac{1}{7} + 3^2 \times \frac{4}{7}$ $\therefore \mathrm{E}(Y^2) = \frac{40}{7}$	1	-
				$\mathrm{Var}(Y) = \frac{40}{7} - 2^2$	1	
				$\mathrm{Var}(Y) = \frac{12}{7}$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
19	AO2/L	**Discrete Random Variables**	**87 + 88**	■ $\frac{1}{14}$ ☐ $\frac{1}{6}$ ☐ 6 ☐ 14		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
20	AO2/M	**Log. & Exponential Functions**	**50**	$\ln(4x+1)=2$	1	-
				$4x+1=\mathrm{e}^2$	1	
				$4x=\mathrm{e}^2-1$		
				$x=\dfrac{\mathrm{e}^2-1}{4}$		
				$x\approx 1.597$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
21	AO2/M	**Log. & Exponential Functions**	**51**	☐ ln 3 ■ ln 4 ☐ 3 ☐ 4		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [6]	More information
22	AO2 / M	**Trigonometry**	**73 + 74**	$5\sin\theta + 5\cos\theta \equiv r\sin(\theta+\alpha)$		-
				$r = \sqrt{(5)^2 + (5)^2}$	1	
				$\therefore r = \sqrt{50} = 5\sqrt{2}$	1	
				$5\sin\theta + 5\cos\theta \equiv r\sin(\theta+\alpha)$ $5\sin\theta + 5\cos\theta \equiv r[\sin\theta\cos\alpha + \cos\theta\sin\alpha]$		
				By equating the coefficients $r\sin\alpha = 5$ **and** $r\cos\alpha = 5$	1	
				Since $\sin\alpha > 0$ and $\cos\alpha > 0$, then $0 \le \alpha \le \frac{\pi}{2}$		
				$\tan\alpha = \frac{r\sin\alpha}{r\cos\alpha} = \frac{5}{5} = 1$	1	
				$\therefore \alpha = \frac{\pi}{4}$	1	
				$5\cos\theta + 5\sin\theta \equiv 5\sqrt{2}\sin\left(\theta + \frac{\pi}{4}\right)$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
23	AO2/ M	**Trigonometry**	**76 + 79**	☐ 4 ☐ 3 ■ 2 ☐ 1		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
24	AO2/M	**Differentiation**	**115**	☐ -3 ☐ $-\frac{3}{4}$ ☐ $\frac{3}{4}$ ■ 3		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [2]	More information
25	AO2/M	**Discrete Random Variables**	95	$3(1-a)+5a=3.8$	1	-
				$2a=0.8$		
				$a=0.4$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
26	AO2/H	**Log. & Exponential Functions**	**43**	☐ 2 ☐ 3 ☐ 4 ■ 8		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
27	AO2 / H	**Trigonometry**	**76**	$\text{LHS} = \frac{\operatorname{cosec} x - \sin x}{\cot x}$		-
				$= \frac{\frac{1}{\sin x} - \sin x}{\frac{\cos x}{\sin x}}$	1	
				$= \frac{\frac{1 - \sin^2 x}{\sin x}}{\frac{\cos x}{\sin x}}$		
				$= \frac{1-\sin^2 x}{\cos x}$	1	
				$= \frac{\cos^2 x}{\cos x}$	1	
				$= \cos x = \text{RHS}$		

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
27	AO2 / H	**Trigonometry**	**76**	$\text{LHS} = \frac{\text{cosec}\, x - \sin x}{\cot x}$		-
				$= \tan x \left(\frac{1}{\sin x} - \sin x\right)$	1	
				$= \frac{\sin x}{\cos x}\left(\frac{1-\sin^2 x}{\sin x}\right)$		
				$= \frac{1-\sin^2 x}{\cos x}$	1	
				$= \frac{\cos^2 x}{\cos x}$	1	
				$= \cos x = \text{RHS}$		

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
28	AO2/H	**Differentiation**	**101 + 104**	$f'(x) = 0 + \frac{2(x+5)}{1+(x+5)^4}$ **or** $f'(x) = \frac{2(x+5)}{1+(x+5)^4}$	1	-
				gradient $= 0$ at $x \rightarrow f'(x) = 0$		
				$\therefore \frac{2(x+5)}{1+(x+5)^4} = 0$	1	
				$2(x+5) = 0$		
				$\therefore x = -5$	1	