



امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

الفصل الدراسي الثاني - الدور الأول

للعام الدراسي ١٤٤٧/١٤٤٦ هـ - ٢٠٢٤ / ٢٠٢٥ م

تنبيه:
- المادة: الرياضيات المتقدمة.
- الأسئلة في (١٦) 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. The 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 table below gives some values of the function $f(x)$

x	1	2	3	4
$f(x)$	3	1.5	1	0.75

By using the trapezium rule, estimate $\int_1^4 f(x)\,dx$

[5]

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2) (Shade in the bubble ⬭ next to the vector given by $2\begin{pmatrix} 2 \\ -4 \end{pmatrix}$)

⬭ $\begin{pmatrix} 4 \\ -8 \end{pmatrix}$ ⬭ $\begin{pmatrix} 4 \\ -2 \end{pmatrix}$

⬭ $\begin{pmatrix} 0 \\ -6 \end{pmatrix}$ ⬭ $\begin{pmatrix} 1 \\ -2 \end{pmatrix}$

[1]

3) Given the complex number $z = 1 - 6\mathrm{i}$

Let z^* be the conjugate of z

Find $3z^*$ in the form $x + \mathrm{i}y$

[3]

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4) The standardised normal random variable $Z \sim \mathrm{N}(0, 1)$

(Shade in the bubble ⬭ next to the value of $\mathrm{P}(Z < 0.6)$)

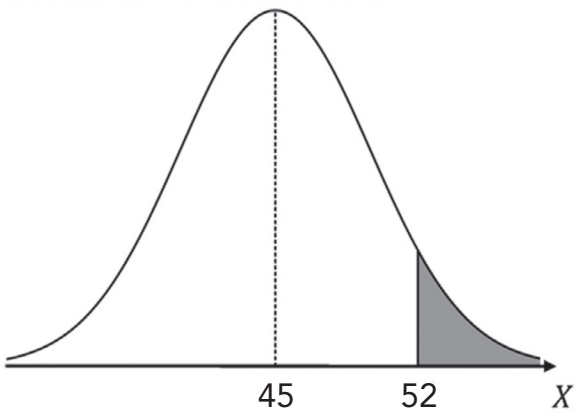
⬭ 0.2743 ⬭ 0.4761

⬭ 0.5239 ⬭ 0.7257

[1]

5) The random variable $X \sim \mathrm{N}(45, 5^2)$

Find $\mathrm{P}(X > 52)$



[4]

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6) (Shade in the bubble ⬭ next to $\int 10\sec^2(5x)\,\mathrm{d}x$)

⬭ $\frac{1}{5}\tan(5x)+c$

⬭ $\frac{1}{3}\tan(5x)+c$

⬭ $2\tan(5x)+c$

⬭ $10\tan(5x)+c$

[1]

7) Find $\int_0^3 6e^{(2x-1)}\,\mathrm{d}x$

[4]

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8) For the points A, B with position vectors $\mathbf{a} = \begin{pmatrix} 4 \\ 2 \\ 1 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 7 \\ 2 \\ 5 \end{pmatrix}$

Find the magnitude of $\overrightarrow{AB}$

[3]

9) The complex number $z = 3 - 3\,\mathrm{i}$

Write z in the form $r(\cos\theta + \mathrm{i}\sin\theta)$, $-\pi < \theta \leq \pi$

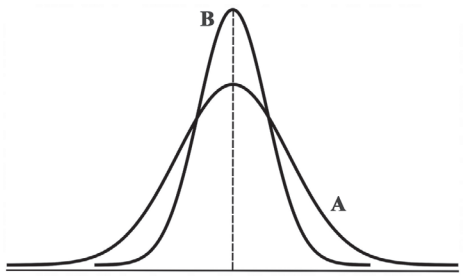
[5]

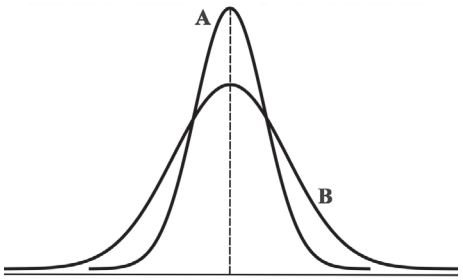
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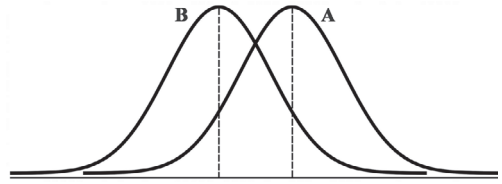
10) **A** and **B** are two normal distribution curves.

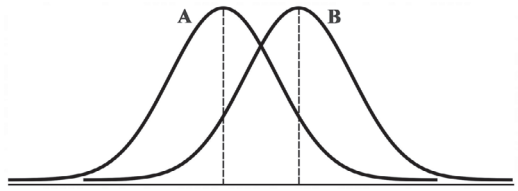
The standard deviation of curve **A** is greater than the standard deviation of curve **B**.

(Shade in the bubble ⬭ next to the correct diagram of **A** and **B** curves)

⬭ 

⬭ 

⬭ 

⬭ 

[1]

11) Given that $\int \frac{1}{8x^2 + 2} \, dx = \frac{1}{4} \tan^{-1}(bx) + c$

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

⬭ 4

⬭ 2

⬭ $\frac{1}{2}$

⬭ $\frac{1}{4}$

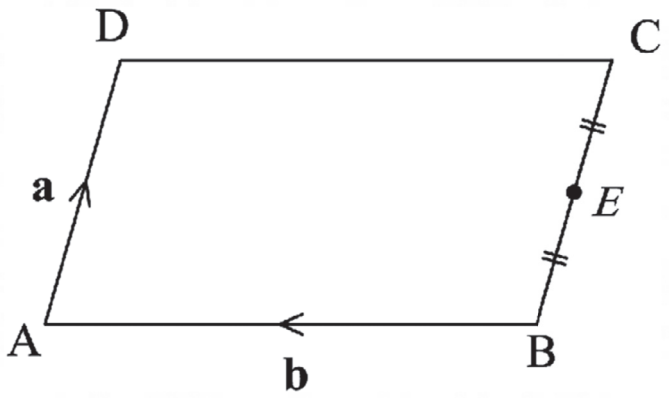
[1]

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12) The figure below shows a parallelogram $ADCB$



Given $\overrightarrow{AD} = \mathbf{a}$ and $\overrightarrow{BA} = \mathbf{b}$

E is the mid-point of BC

Find $\overrightarrow{AE}$ in terms of $\mathbf{a}$ and $\mathbf{b}$

[2]

13) Given that $4(1 - 2\mathrm{i}^3) = 4 + (a + 5)\mathrm{i}$

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

⬭ -5 ⬭ -1

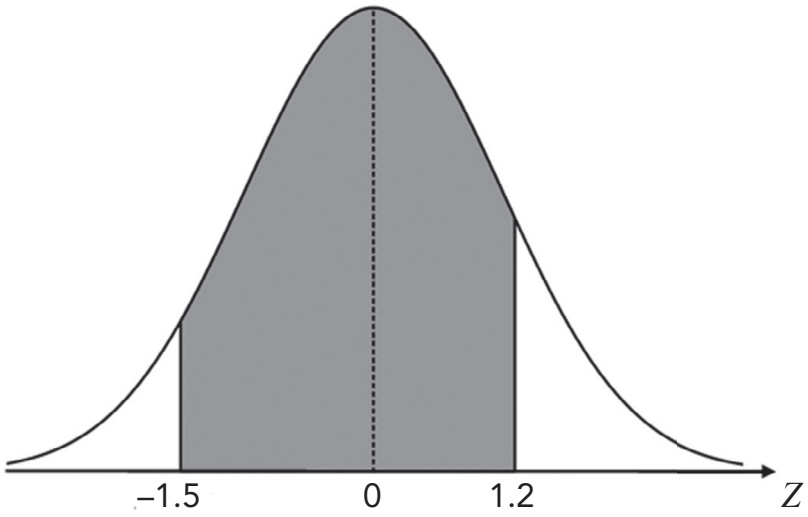
⬭ 3 ⬭ 8

[1]

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14) The standardized normal random variable $Z \sim \mathrm{N}(0, 1)$

The diagram below shows the standard normal curve



Find the area of the indicated region under the curve.

[3]

15) (Shade in the bubble ⬭ next to the integration with respect to x of $\cot(7x)$)

⬭ $\ln|\sin 7x| + c$

⬭ $-\ln|\cos 7x| + c$

⬭ $\frac{1}{7}\ln|\sin 7x| + c$

⬭ $-\frac{1}{7}\ln|\cos 7x| + c$

[1]

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16) By using partial fractions, find $\int \frac{x-1}{(x+2)(x+3)}\,\mathrm{d}x$

[4]

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17) The vector $\mathbf{B} = -\mathbf{i} + \sqrt{3}\,\mathbf{j}$ makes an angle with the positive $\mathbf{i}$ axis.

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

⬭ 150° ⬭ 120°

⬭ 60° ⬭ 30°

[1]

18) Two vectors $\mathbf{a}$ and $\mathbf{b}$ given by $\mathbf{a} = n\mathbf{i} + \mathbf{j}$ and $\mathbf{b} = \mathbf{i} + 2\mathbf{j}$

Given that $3\mathbf{a} - \mathbf{b} = 5\mathbf{i} + \mathbf{j}$

Find the value of n

[2]

19) Given that the complex numbers are $z_1 = 4 + 2\mathrm{i}$ and $5z_2 = 15 - 5\mathrm{i}$

Find $z_1 z_2$ in the form $a + b\mathrm{i}$

[4]

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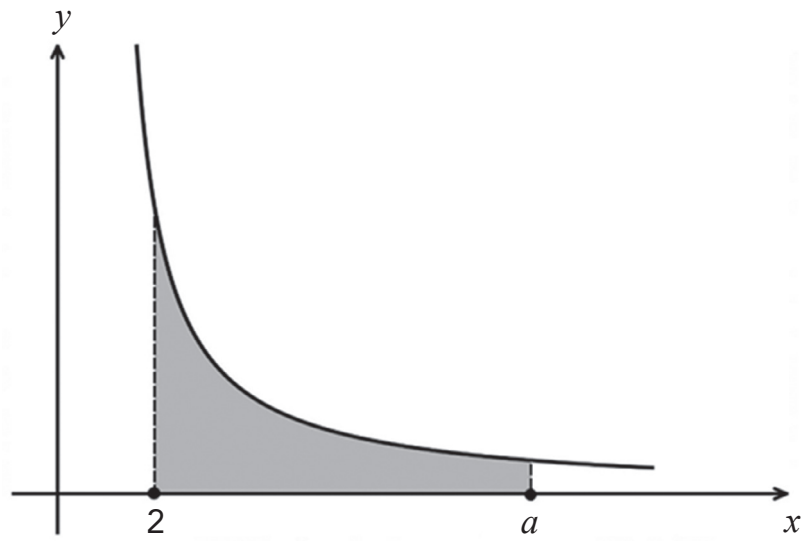
20) The random variable $X \sim \mathrm{N}(\mu, 36)$

$\mathrm{P}(X < 30) = \mathrm{P}(Z < 0.5)$

Find the mean μ

[2]

21) The graph of $y = \dfrac{7}{x - 1}$ is shown below



The shaded region has an area of 21

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

⬭ 3 ⬭ 4

⬭ e^3 ⬭ $1 + e^3$

[1]

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22) Find $\int 3x \ln x \ \mathrm{d}x$

[3]

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23) Given the vector $\mathbf{q} = 6\mathbf{i} - 8\mathbf{j} - 24\mathbf{k}$

Find the unit vector in the direction of $\mathbf{q}$

[3]

24) The equation $z^2 - 4z + 5 = 0$

(Shade in the bubble ⬭ next to the complex roots of the equation)

⬭ $2 \pm i$ ⬭ $1 \pm i$

⬭ $2 \pm 3i$ ⬭ $1 \pm 2i$

[1]

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25) Two complex numbers $z_1 = 3\left(\cos\frac{\pi}{3} + \mathrm{i}\sin\frac{\pi}{3}\right)$ and $z_2 = \frac{1}{2}e^{\mathrm{i}\pi}$

(Shade in the bubble ⬭ next to $\frac{z_1}{z_2}$)

⬭ $6\left(\cos\frac{2\pi}{3} + \mathrm{i}\sin\frac{2\pi}{3}\right)$

⬭ $6\left(\cos\frac{2\pi}{3} - \mathrm{i}\sin\frac{2\pi}{3}\right)$

⬭ $\frac{3}{2}\left(\cos\frac{4\pi}{3} + \mathrm{i}\sin\frac{4\pi}{3}\right)$

⬭ $\frac{3}{2}\left(\cos\frac{4\pi}{3} - \mathrm{i}\sin\frac{4\pi}{3}\right)$

[1]

26) Given $Z \sim \mathrm{N}(0\,,\,1)$ where $\mathrm{P}(-a < Z < 0) = 0.091$

Find the value of a

[5]

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27) Find $\int 5x^4 \sin^2(x^5)\, dx$

[3]

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28) The complex number $z = 24e^{i\theta}$, where $0 \leq \theta < \frac{\pi}{2}$

Given that $\mathrm{Im}(z) = 12$

Find the value of θ

[3]

29) Students' marks in a school follow a normal distribution

with a mean of 75 and a standard deviation of 5

(Shade in the bubble ⬭ next to the percentage of students who obtained marks less than 71)

⬭ 78.81%

⬭ 56.36%

⬭ 43.64%

⬭ 21.19%

[1]

[End of Examination]

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Formulae Sheet

Integration

- **The trapezium rule:**

$$\int_a^b \mathrm{f}(x)\,\mathrm{d}x \approx \frac{1}{2}\,h\,\{y_0 + 2\,(y_1 + y_2 + \cdots + y_{n-1}) + y_n\}$$

, where $h = \frac{b-a}{n}$ and n is the number of intervals.

- **Rules of integration:**

- $\int x^n\,\mathrm{d}x = \frac{x^{n+1}}{n+1} + c\ ,\ n \neq -1$
- $\int \mathrm{f}(x) \pm \mathrm{g}(x)\,\mathrm{d}x = \int \mathrm{f}(x)\mathrm{d}x \pm \int \mathrm{g}(x)\mathrm{d}x$
- $\int e^x\,\mathrm{d}x = e^x + c$
- $\int \frac{1}{x}\,\mathrm{d}x = \ln|x| + c$, where $x \neq 0$
- $\int \sin x\,\mathrm{d}x = -\cos x + c$
- $\int \cos x\,\mathrm{d}x = \sin x + c$
- $\int \sec^2 x\,\mathrm{d}x = \tan x + c$
- **Integration by substitution:**

$$\int \mathrm{f}(x)\,\mathrm{d}x = \int \mathrm{f}(x)\,\frac{\mathrm{d}x}{\mathrm{d}u}\,\mathrm{d}u$$

- $\int k\,\mathrm{f}(x)\mathrm{d}x = k\int \mathrm{f}(x)\mathrm{d}x$
- $\int k(ax+b)^n\,\mathrm{d}x = \frac{k}{a(n+1)}\,(ax+b)^{n+1} + c$, $n \neq -1$
- $\int e^{ax}\,\mathrm{d}x = \frac{1}{a}\,e^{ax} + c$
- $\int \frac{\mathrm{f}'(x)}{\mathrm{f}(x)}\,\mathrm{d}x = \ln|\mathrm{f}(x)| + c$
- $\int \sin(ax)\,\mathrm{d}x = \frac{-1}{a}\cos(ax) + c$
- $\int \cos(ax)\,\mathrm{d}x = \frac{1}{a}\sin(ax) + c$
- $\int \frac{1}{x^2+a^2}\,\mathrm{d}x = \frac{1}{a}\tan^{-1}\left(\frac{x}{a}\right) + c$
- **Integration by parts:**

$$\int \mathrm{u}\,\frac{dv}{dx}\,\mathrm{d}x = uv - \int \mathrm{v}\,\frac{\mathrm{d}u}{\mathrm{d}x}\,\mathrm{d}x$$

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Vectors

- If a and b are the position vectors of the points A and B, then the mid-point of AB is given by $\frac{1}{2}(a+b)$.
- The magnitude (or length) of vector $\overrightarrow{AB} = \binom{a}{b}$ is $\left|\overrightarrow{AB}\right| = \sqrt{a^2+b^2}$
- The distance d between $A(x_1, y_1)$ and $B(x_2, y_2)$ is $d = \sqrt{(x_1-x_2)^2+(y_1-y_2)^2}$
- The direction of the vector $A = x\mathbf{i} + y\mathbf{j}$ is measure from the positive **i** vector by $\theta = \tan^{-1}\left(\frac{y}{x}\right)$
- If the position vector of A is $\boldsymbol{a}$ and the postion vector of B is $\boldsymbol{b}$, then the relative displacement of B from A is $\overrightarrow{AB} = \boldsymbol{b} - \boldsymbol{a}$

Complex Numbers

If $z = x + \mathrm{i}y$ is a complex number, then:

1) The modulus of $z = |z| = \sqrt{x^2 + y^2}$
2) The argument of $z = \arg(z) = \tan^{-1}\left(\frac{y}{x}\right)$
3) Polar form of $z = r(\cos\theta + \mathrm{i}\sin\theta) = re^{\mathrm{i}\theta}$, where $r = |z|, \theta = \arg(z)$.
4) $|z_1 z_2| = |z_1||z_2|$
5) $\arg(z_1 z_2) = \arg z_1 + \arg z_2$
6) $\left|\frac{z_1}{z_2}\right| = \frac{|z_1|}{|z_2|}$
7) $\arg\left(\frac{z_1}{z_2}\right) = \arg z_1 - \arg z_2$

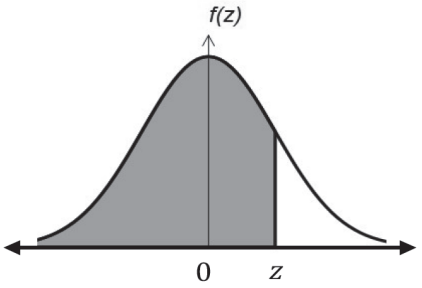
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Normal Distribution

- $z = \frac{x-\mu}{\sigma}$
- If Z has a normal distribution with mean 0 and variance 1, then for each value of z, the table gives the value of $\Phi(z)$, where

$$\boldsymbol{\Phi(z) = P(Z \leq z)}$$



- If $\boldsymbol{z > 0}$, then $\boldsymbol{\Phi(-z) = 1 - \Phi(z)}$

z	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
											ADD								
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359	4	8	12	16	20	24	28	32	36
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753	4	8	12	16	20	24	28	32	36
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141	4	8	12	15	19	23	27	31	35
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517	4	7	11	15	19	22	26	30	34
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879	4	7	11	14	18	22	25	29	32
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224	3	7	10	14	17	20	24	27	31
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549	3	7	10	13	16	19	23	26	29
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852	9	3	6	12	15	18	21	24	27
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133	8	3	5	11	14	16	19	22	25
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389	8	3	5	10	13	15	18	20	23
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621	7	2	5	9	12	14	16	19	21
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830	6	2	4	8	10	12	14	16	18
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015	6	2	4	7	9	11	13	15	17
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177	5	2	3	6	8	10	11	13	14
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319	4	1	3	6	7	8	10	11	13
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441	4	1	2	5	6	7	8	10	11
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545	3	1	2	4	5	6	7	8	9
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633	3	1	2	4	4	5	6	7	8
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706	2	1	1	3	4	4	5	6	6
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767	2	1	1	2	3	4	4	5	5
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817	1	0	1	2	2	3	3	4	4
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857	1	0	1	2	2	2	3	3	4
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890	1	0	1	1	2	2	2	3	3
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916	1	0	1	1	1	2	2	2	2
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936	1	0	0	1	1	1	1	2	2
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952	0	0	0	1	1	1	1	1	1
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964	0	0	0	0	1	1	1	1	1
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974	0	0	0	0	0	1	1	1	1
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981	0	0	0	0	0	0	0	1	1
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986	0	0	0	0	0	0	0	0	0

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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

Second Semester-First Session
Academic Year: 2024/2025

Answer Scheme

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

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [5]	More information
1	AO1 \ L	**Integration**	**125**	$n = 3$	1	
				$h = \frac{4-1}{3}$	1	
				$\therefore h = 1$	1	
				$\therefore \int_1^4 \mathrm{f}(x)\ \mathrm{d}x$		
				$\approx \frac{1}{2} \times 1\ \{3 + 2(1.5 + 1) + 0.75\}$	1	**1Mark:** for applying the trapezium rule with the correct position of the brackets. If the student starts the answer from this step with the correct substitution of h, then the student will get the previous **3Marks** implicitly.
				$= \ 4.375$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
2	AO1/L	**Vectors**	**179**	■ $\begin{pmatrix}4\\-8\end{pmatrix}$ ☐ $\begin{pmatrix}4\\-2\end{pmatrix}$ ☐ $\begin{pmatrix}0\\-6\end{pmatrix}$ ☐ $\begin{pmatrix}1\\-2\end{pmatrix}$		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
3	AO1/L	**Complex numbers**	**250**	$z^* = 1 + 6\text{i}$	1+1	**1 Mark** for $\text{Re}(z^*)$ **1 Mark** for $\text{Im}(z^*)$
				$3z^* = 3(1 + 6\text{i})$		
				$= 3 + 18\text{i}$	1	**1 Mark** for correct values of $\text{Re}(3z^*)$ and $\text{Im}(3z^*)$

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
4	AO1/L	**Normal Distribution**	**128**	☐ 0.2743 ☐ 0.4761 ☐ 0.5239 ■ 0.7257		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [4]	More information
5	AO1/L	**Normal Distribution**	**134**	$z = \frac{52 - 45}{5}$		
				$\therefore z = 1.4$	1	**1 Mark** for value of z
				$\mathrm{P}(X > 52) = \mathrm{P}(Z > 1.4)$		
				$\mathrm{P}(Z > 1.4) = 1 - \mathrm{P}(Z < 1.4)$	1	**1 Mark** for finding $\mathrm{P}(Z > 1.4)$ using $\mathrm{P}(Z < 1.4)$ or $\Phi(1.4)$ If the student didn't write these steps and the following step is correct $(1 - 0.9192)$, then the student will get this mark implicitly.
				$= 1 - \Phi(1.4)$		
				$= 1 - 0.9192$	1	**1 Mark** for the value of $\Phi(1.4)$=0.9192
				$= 0.0808$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
6	AO1/M	**Integration**	**132**	☐ $\frac{1}{5}\tan(5x)+c$ ☐ $\frac{1}{3}\tan(5x)+c$ ■ $2\tan(5x)+c$ ☐ $10\ \tan(5x)+c$		-

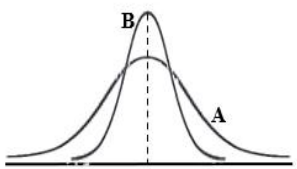
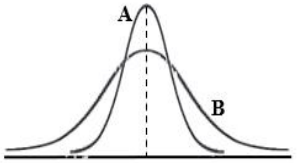
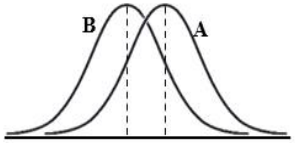
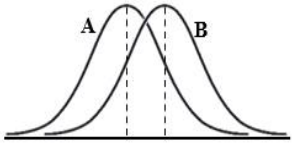
Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [4]	More information
7	AO1 / M	**Integration**	**130**	$\int_0^3 6e^{(2x-1)}\ \mathrm{d}x = 3\int_0^3 2e^{(2x-1)}\ \mathrm{d}x$	1	**1 Mark** for $\int_0^3 2e^{(2x-1)}\mathrm{d}x$
				$= \left[\, 3e^{(2x-1)} \,\right]_0^3$	1	**1 Mark** for $3e^{(2x-1)}$
				$= 3\, e^{(2\times 3-1)} - 3e^{(2\times 0-1)}$	1	
				$= 3\, e^5 - 3e^{-1}$	1	**1 Mark** for any correct form.
				$= 3\, e^5 - \frac{3}{e}$ or $3(e^5 - e^{-1})$		

Item #	Assessment Object / Level of Demand	Unit	Page	Answer - Alternative answer	Marks [4]	More information
7	AO1 / M	**Integration**	**130**	Let $u = 2x - 1$ **then** $\mathrm{d}u = 2\,\mathrm{d}x \rightarrow \mathrm{d}x = \frac{\mathrm{d}u}{2}$ When $x = 0 \rightarrow u = -1$ $x = 3 \rightarrow u = 5$	1	
				$\int_0^3 6e^{(2x-1)}\,\mathrm{d}x$		
				$= \int_{-1}^{5} 3e^{u}\,\mathrm{d}u$	1	**1 Mark** for changing the integral limits $\int_0^3 \rightarrow \int_{-1}^{5}$ ⬚ and correct simplification after applying the substitution (ie. $3e^{u}\,\mathrm{d}u$)
				$= [\,3e^{u}\,]_{-1}^{5}$	1	
				$= 3\,e^{5} - 3e^{-1}$	1	**1 Mark** for any correct form.
				$= 3\,e^{5} - \frac{3}{e}$ or $3(e^{5} - e^{-1})$		

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
8	AO1/M	**Vectors**	**197**	$\overrightarrow{AB} = \begin{pmatrix}7\\2\\5\end{pmatrix} - \begin{pmatrix}4\\2\\1\end{pmatrix} = \begin{pmatrix}7-4\\2-2\\5-1\end{pmatrix}$		
				$= \begin{pmatrix}3\\0\\4\end{pmatrix}$	1	**1 Mark** for the vector $\overrightarrow{AB}$
				Magnitude $= \sqrt{(3)^2 + (0)^2 + (4)^2}$	1	
				$= 5$	1	If the student finds the magnitude $= \pm 5$, then the student will lose this mark.

Item #	Assessment Object / Level of Demand	Unit	Page	Answer - Alternative answer	Marks [3]	More information
8	AO1/M	**Vectors**	**197**	Magnitude of $\overrightarrow{AB}$ = Distance between position vectors a and b Distance $= \sqrt{(7-4)^2 + (2-2)^2 + (5-1)^2}$	1	
				$= \sqrt{3^2 + (0)^2 + (4)^2}$	1	
				$= \sqrt{25}$		
				$= 5$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [5]	More information
9	AO1/M	**Complex Numbers**	**260**	$r = \sqrt{(3)^2 + (-3)^2}$	1	
				$\therefore\ r = 3\sqrt{2}$	1	
				$\arg(z) = -\tan^{-1}(1)$	1	If the student finds $\arg(z) = -\frac{\pi}{4}$ by any correct method, then the student will get **2Marks.**
				$\therefore \arg(z) = -\frac{\pi}{4}$	1	
				$\therefore z = 3\sqrt{2}\left(\cos\left(\frac{-\pi}{4}\right) + \mathrm{i}\sin\left(\frac{-\pi}{4}\right)\right)$ **Or** $z = 3\sqrt{2}\left(\cos\frac{\pi}{4} - \mathrm{i}\sin\frac{\pi}{4}\right)$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
10	AO1/M	**Normal Distribution**	**120 + 121**	■  ☐  ☐  ☐ 		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
11	AO1/H	**Integration**	**135**	☐ 4 ■ 2 ☐ $\frac{1}{2}$ ☐ $\frac{1}{4}$		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [2]	More information
12	AO1/H	**Vectors**	**187**	$\overrightarrow{AE} = \overrightarrow{AB} + \overrightarrow{BE}$	1	-
				$= -\mathbf{b} + \frac{1}{2}\mathbf{a}$	1	
				$= \frac{1}{2}\mathbf{a} - \mathbf{b}$		

Item #	Assessment Object / Level of Demand	Unit	Page	Answer - Alternative solution	Marks [2]	More information
12	AO1/H	**Vectors**	**187**	$\overrightarrow{AE} = \overrightarrow{AD} + \overrightarrow{DC} + \overrightarrow{CE}$	1	-
				$= \mathbf{a} + (-\mathbf{b}) + (-\frac{1}{2}\mathbf{a})$	1	
				$= \frac{1}{2}\mathbf{a} - \mathbf{b}$		

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
13	AO1/H	**Complex Numbers**	**251**	☐ -5 ☐ -1 ■ 3 ☐ 8		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
14	AO1/H	**Normal Distribution**	**133**	$\text{Area} = \Phi(1.2) - (1 - \Phi(1.5))$	1	**1Mark** for the fully correct expression of the area.
				$= 0.8849 - (1 - 0.9332)$	1	**1Mark** for the substitution of $\Phi(1.5) = 0.9332$ and $\Phi(1.2) = 0.8849$
				$= 0.8181$	1	**1Mark** for the correct value of the area.

Item #	Assessment Object / Level of Demand	Unit	Page	Answer - Alternative solution	Marks [3]	More information
14	AO1/H	**Normal Distribution**	**133**	$\mathrm{P}(Z < 1.2) = \Phi(1.2) = 0.8849$	1	**1Mark** for the correct value of $\Phi(1.2)$
				$\mathrm{P}(Z < -1.5) = 1 - \Phi(1.5)$		
				$= 1 - 0.9332$	1	**1Mark** for both correct steps to find the value of $\mathrm{P}(Z < -1.5)$
				$= 0.0668$		
				Area $= 0.8849 - 0.0668$		
				$= 0.8181$	1	**1Mark** for the correct value of the area.

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
15	AO2/L	**Integration**	**138**	☐ $\ln\|\sin 7x\| + c$ ☐ $-\ln\|\cos 7x\| + c$ ■ $\frac{1}{7}\ln\|\sin 7x\| + c$ ☐ $-\frac{1}{7}\ln\|\cos 7x\| + c$		-

Item #	Assessment Object Level of Demand	Unit	Page	Answer	Marks [4]	More information
16	AO2/L	**Integration**	**141**	$\frac{x-1}{(x+2)(x+3)} \equiv \frac{A(x+3)+B\,(x+2)}{(x+2)(x+3)}$	1	-
				$\therefore x-1 \equiv A(x+3)+B\,(x+2)$	1	
				When $x=-2 \longrightarrow -2-1=A(-2+3)$ When $x=-3 \longrightarrow -3-1=B(-3+2)$		
				$\therefore A=-3 \quad \text{and} \quad B=4$	1	
				$\therefore \int \frac{x-1}{(x+2)(x+3)}\,dx = \int \frac{-3}{(x+2)}dx + \int \frac{4}{(x+3)}dx$		
				$= -3\ln\lvert x+2\rvert + 4\ln\lvert x+3\rvert + c$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
17	AO2/L	**Vectors**	**190 + 192**	☐ 150° ■ 120° ☐ 60° ☐ 30°		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [2]	More information
18	AO2/L	**Vectors**	**180**	$3\boldsymbol{a} - \boldsymbol{b} = 5\mathbf{i} + \mathbf{j}$		-
				$(3n\mathbf{i} + 3\mathbf{j}) - (\mathbf{i} + 2\mathbf{j}) = 5\mathbf{i} + \mathbf{j}$		
				$3n - 1 = 5$	1	
				$3n = 6$		
				$\therefore n = 2$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [4]	More information
19	AO2/L	**Complex Numbers**	**250**	$z_2 = 3 - \mathrm{i}$	1	-
				$z_1 z_2 = (4 + 2\mathrm{i})(3 - \mathrm{i})$		
				$= 12 - 4\mathrm{i} + 6\mathrm{i} - 2\mathrm{i}^2$	1	
				$= (12 + 2) + (6 - 4)\mathrm{i}$	1	
				$= 14 + 2\mathrm{i}$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [2]	More information
20	AO2/L	**Normal Distribution**	**139 + 147**	$\frac{30-\mu}{6}=0.5$	1	**1 Mark** for transforming the value of $x=30$ to a standardised value.
				$30-\mu=3$		
				$\mu=27$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
21	AO2/M	**Integration**	**130**	☐ 3 ☐ 4 ☐ e^3 ■ $1+e^3$		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
22	AO2 / M	**Integration**	**147**	Integrate $\int 3x \ln x \, dx$ by parts		-
				$u = \ln x \rightarrow \therefore \frac{du}{dx} = \frac{1}{x}$ **and** $\frac{dv}{dx} = 3x \rightarrow \therefore v = \frac{3}{2}x^2$	1	
				$\therefore \int 3x \ln x \, dx = \frac{3}{2}x^2 \ln x - \int \frac{3}{2} x^2 \left(\frac{1}{x}\right) dx$	1	
				$= \frac{3}{2}x^2 \ln x - \frac{3}{2}\int x \, dx$		
				$= \frac{3}{2}x^2 \ln x - \frac{3}{4} x^2 + c$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
23	AO2/M	**Vectors**	**193**	Magnitude $= \sqrt{6^2 + (-8)^2 + (-24)^2}$		**1 Mark** for finding magnitude of $\mathbf{q} = 26$
				$= 26$	1	
				Hence the unit vector of $\mathbf{q} = \frac{1}{26}(6\mathbf{i} - 8\mathbf{j} - 24\mathbf{k})$	1	**1 Mark** for multiplying the vector $\mathbf{q}$ by $\frac{1}{26}$
				$= \frac{3}{13}\mathbf{i} - \frac{4}{13}\mathbf{j} - \frac{12}{13}\mathbf{k}$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
24	AO2/M	Complex Numbers	257 + 259	■ $2 \pm i$ □ $1 \pm i$ □ $2 \pm 3i$ □ $1 \pm 2i$		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
25	AO2/M	**Complex numbers**	**260**	☐ $6(\cos\frac{2\pi}{3}+\mathrm{i}\sin\frac{2\pi}{3})$ ■ $6(\cos\frac{2\pi}{3}-\mathrm{i}\sin\frac{2\pi}{3})$ ☐ $\frac{3}{2}(\cos\frac{4\pi}{3}+\mathrm{i}\sin\frac{4\pi}{3})$ ☐ $\frac{3}{2}(\cos\frac{4\pi}{3}-\mathrm{i}\sin\frac{4\pi}{3})$		-

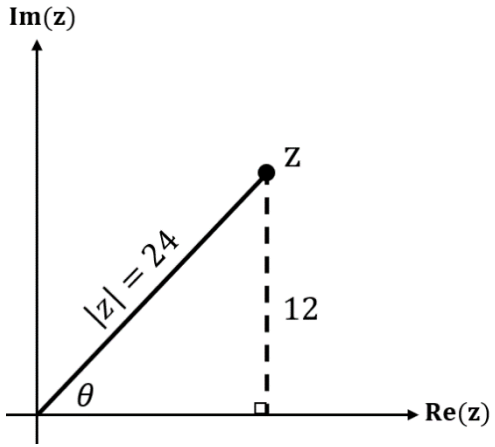
Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [5]	More information
26	AO2/M	**Normal Distribution**	**137 + 138**	$\mathrm{P}(-a < Z < 0) = 0.091$		
				$\mathrm{P}(Z < 0) - \mathrm{P}(Z < -a) = 0.091$	1+1	**1 Mark** for $\mathrm{P}(Z < 0)$ **1 Mark** for $-\mathrm{P}(Z < -a)$
				$0.5 - \mathrm{P}(Z < -a) = 0.091$	1	**1 Mark** for the substitution of $\mathrm{P}(Z < 0) = 0.5$
				$\mathrm{P}(Z < -a) = 0.5 - 0.091$		
				$1 - \Phi(a) = 0.409$		
				$\Phi(a) = 0.591$	1	
				$a = \Phi^{-1}(0.591)$		
				$a = 0.23$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
27	AO2 / H	**Integration**	**133 + 134**	$\int 5x^4 \sin^2(x^5)\,dx$		
				$= \int \frac{5}{2}x^4 \ (1-\cos 2(x^5))\,dx$	1	**1Mark** for substitution of $\sin^2(x^5) = \frac{1}{2}(1-\cos 2(x^5))$
				$= \frac{5}{2}\int x^4\,dx - \frac{5}{2}\int x^4\cos(2x^5)\,dx$		
				$= \frac{5}{2}\int x^4\,dx - \frac{1}{4}\int 10\,x^4\cos(2x^5)\,dx$	1	
				$= \frac{5}{2}\left(\frac{x^5}{5}\right) - \frac{1}{4}\sin(2x^5) + c$		
				$= \frac{1}{2}x^5 - \frac{1}{4}\sin(2x^5) + c$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer- Alternative Answer	Marks [3]	More information
27	AO2 / H	**Integration**	**133 + 134 + 142**	$u = x^5 \rightarrow \therefore \mathrm{d}u = 5x^4\,\mathrm{d}x \quad \rightarrow \quad \therefore \mathrm{d}x = \dfrac{\mathrm{d}u}{5x^4}$	1	**1Mark** for make the substitution $u = x^5$ and finding $\mathrm{d}u$ and $\mathrm{d}x$
				$\therefore \int 5x^4 \sin^2(x^5)\,\mathrm{d}x = \int 5x^4 \sin^2(u) \dfrac{\mathrm{d}u}{5x^4}$		
				$= \int \sin^2(u)\,\mathrm{d}u$		
				$= \int \frac{1}{2}(1 - \cos 2(u))\,\mathrm{d}u$	1	**1Mark** for substitution of $\sin^2(u) = \frac{1}{2}(1 - \cos 2(u))$
				$= \frac{1}{2}\left(u - \frac{1}{2}\sin(2u)\right) + c$		
				$= \frac{1}{2}x^5 - \frac{1}{4}\sin(2x^5) + c$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
28	AO2/H	**Complex Numbers**	**254 + 264**	$z = 24e^{i\theta}$		
				$z = 24(\cos\theta + i\sin\theta)$	1	**1Mark** for rewrite z in the polar form
				$\therefore \text{Im}(z) = 24\sin\theta$		
				$24\sin\theta = 12$	1	**1Mark** for substitution of $\text{Im}(z) = 12$
				$\sin\theta = \frac{1}{2}$		
				$\theta = \sin^{-1}\left(\frac{1}{2}\right)$		
				$\therefore \theta = \frac{\pi}{6}$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer- Alternative Answer	Marks [3]	More information
28	AO2/H	**Complex Numbers**	**254 + 264**	Let $z = x + iy \rightarrow \lvert z\rvert = \sqrt{x^2 + y^2}$		
				$\therefore 24 = \sqrt{x^2 + (12)^2}$	1	**1Mark** for substitution of values in $\lvert z\rvert$ equation
				$(24)^2 = x^2 + (12)^2$		
				$x^2 = 432 \rightarrow x = \pm 12\sqrt{3}$		
				Since $0 \leq \theta < \frac{\pi}{2}$		
				$\therefore x = 12\sqrt{3}$	1	**1Mark** for correct value of x
				$\theta = \tan^{-1}\left(\frac{12}{12\sqrt{3}}\right)$		
				$\therefore \theta = \frac{\pi}{6}$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer- Alternative Answer	Marks [3]	More information
28	AO2/H	**Complex Numbers**	**254 + 264**		1	**1Mark** for correct sketch of z with correct representation of the right tringle sides' length
				$\sin\theta = \frac{12}{24}$	1	**1Mark** for correct value of $\sin\theta$ using the sketch
				$\theta = \sin^{-1}\left(\frac{1}{2}\right)$		
				$\therefore \theta = \frac{\pi}{6}$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
29	AO2/H	**Normal Distribution**	**142**	☐ 78.81% ☐ 56.36% ☐ 43.64% ■ 21.19%		-



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 الثاني- الدور الثاني

للعام الدراسي ١٤٤٧/١٤٤٦ هـ - ٢٠٢٥/٢٠٢٤ م

تنبيه:
- المادة: الرياضيات المتقدمة.
- الأسئلة في (١٥) 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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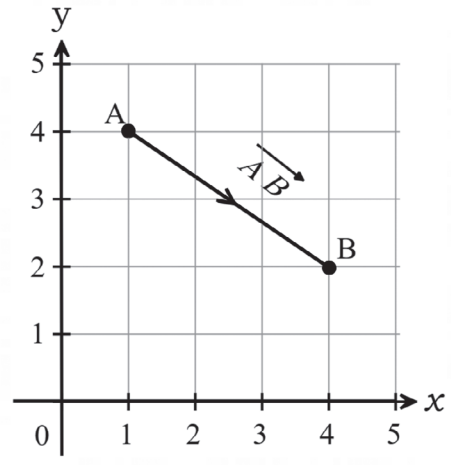
Instructions

1. The 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) Find $\int \left(\cos(3x) + \frac{2}{x} + \sec^2(x) \right) dx$

[5]

2) The diagram below shows the vector $\overrightarrow{AB}$ where $A(1, 4)$ and $B(4, 2)$



(Shade in the bubble ⬭ next to the column vector that represents $\overrightarrow{AB}$)

⬭ $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$ ⬭ $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$

⬭ $\begin{pmatrix} 3 \\ 2 \end{pmatrix}$ ⬭ $\begin{pmatrix} -3 \\ -2 \end{pmatrix}$

[1]

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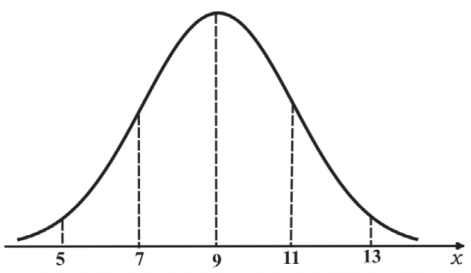
3) Given the complex numbers $z_1 = 3 + \mathrm{i}$ and $z_2 = 5 + 4\mathrm{i}$

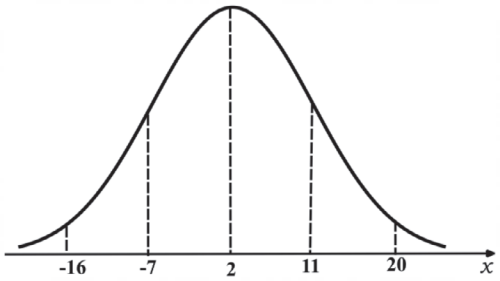
Find the simplified expression of $2z_1 + z_2$

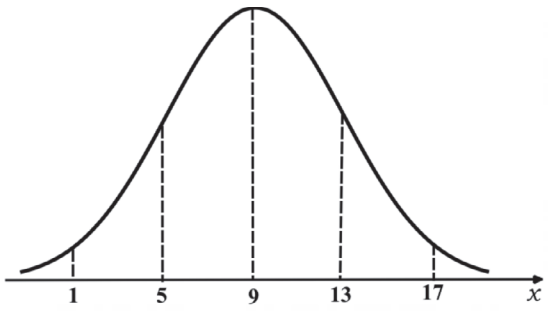
[3]

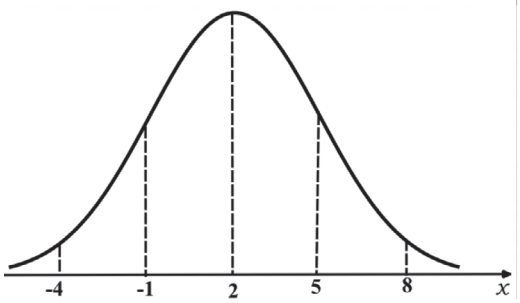
4) The random variable $X \sim \mathrm{N}(9, 2^2)$

(Shade in the bubble ⬭ next to the normal distribution curve of X)

⬭ 

⬭ 

⬭ 

⬭ 

[1]

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5) The standardised normal random variable $Z \sim \mathrm{N}(0, 1)$

Find $\mathrm{P}(Z > 0.13)$

[4]

6) (Shade in the bubble ⬭ next to $\int \tan(4x)\ \mathrm{d}x$)

⬭ $-\ln|\cos(4x)| + c$

⬭ $\ln|\sin(4x)| + c$

⬭ $-\frac{1}{4}\ln|\cos(4x)| + c$

⬭ $\frac{1}{4}\ln|\sin(4x)| + c$

[1]

7) The table below gives some values of the function $\mathrm{f}(x) = \frac{3x}{x+1}$, $x \neq -1$

x	0	2	4
$\mathbf{f}(x)$	0	2	2.4

Using the trapezium rule, estimate $\int_0^4 \mathrm{f}(x)\ \mathrm{d}x$

[4]

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8) For the points A, B with position vectors $\mathbf{a} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 9 \\ 8 \end{pmatrix}$

Find the distance between A and B

[3]

9) The complex number $z = \sqrt{3} - \mathrm{i}$

Write z in the form $re^{\mathrm{i}\theta}$

[5]

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10) The height of students is normally distributed.

(Shade in the bubble ⬭ next to the percentage of the students' heights between -2.1 standard deviations and the mean)

⬭ 98.21%

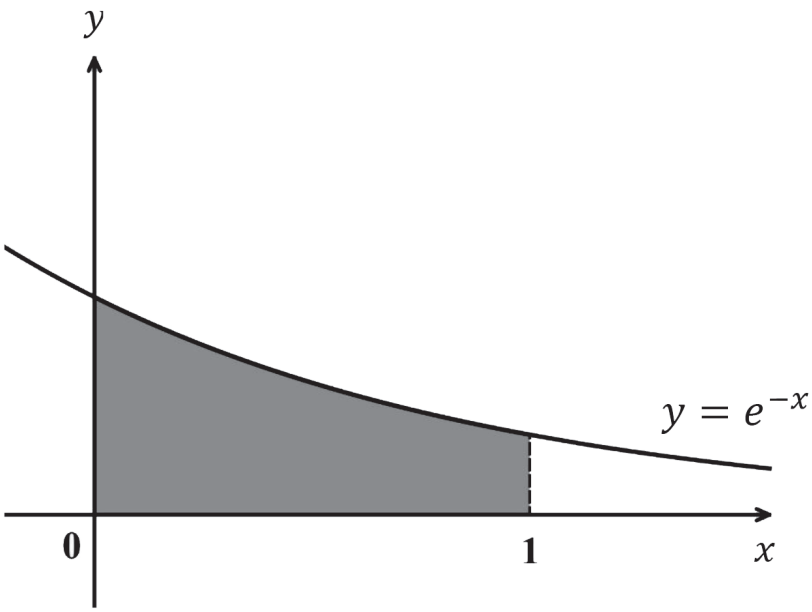
⬭ 88.49%

⬭ 48.21%

⬭ 38.49%

[1]

11) The graph of $y = e^{-x}$ is shown below



(Shade in the bubble ⬭ next to the area of the shaded region)

⬭ e

⬭ $e-1$

⬭ $\frac{1}{e}$

⬭ $1-\frac{1}{e}$

[1]

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12) The vectors $\mathbf{a}$ and $\mathbf{b}$ are given by $\mathbf{a} = \begin{pmatrix} 2 \\ n \\ 5 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -4 \\ 1 \\ 7 \end{pmatrix}$

Given that $\mathbf{a} - 2\mathbf{b} = 10\mathbf{i} + 5\mathbf{j} - 9\mathbf{k}$

Find the value of n

[2]

13) The complex number $z = \frac{1}{\mathrm{i}^5}$

(Shade in the bubble ○ next to the simplest form of z)

○ -1 ○ $-\mathrm{i}$

○ 1 ○ i

[1]

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14) The diagram below shows the standard normal curve



Find the total area of the shaded region under the curve.

[3]

15) (Shade in the bubble ⬭ next to $\int \frac{1}{2x^2 + 18}\, dx$)

⬭ $4x \ln|2x^2 + 18| + c$

⬭ $\frac{1}{2}\tan^{-1}\left(\frac{x}{3}\right) + c$

⬭ $2x \ln|2x^2 + 18| + c$

⬭ $\frac{1}{6}\tan^{-1}\left(\frac{x}{3}\right) + c$

[1]

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16) By using partial fractions, find $\int \frac{4}{(x-1)(x+3)}\,\mathrm{d}x$

[4]

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17) The vector $(-7\mathbf{i} - 7\mathbf{j})$ makes an angle θ with the positive $\mathbf{i}$ axis.

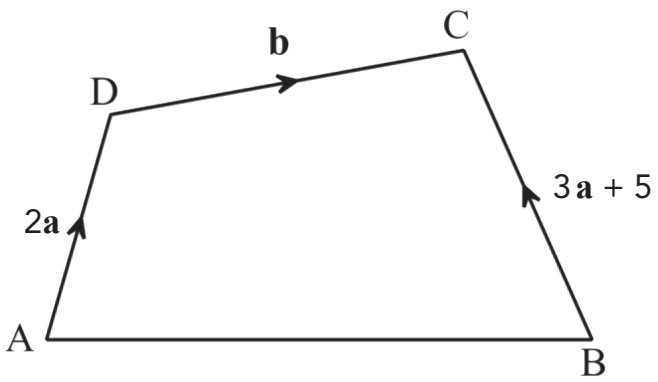
(Shade in the bubble ⬭ next to the value of θ)

⬭ $-135°$ ⬭ $-45°$

⬭ $45°$ ⬭ $135°$

[1]

18) The figure below shows a quadrilateral



Given that $\overrightarrow{AD} = 2\mathbf{a}$, $\overrightarrow{DC} = \mathbf{b}$, $\overrightarrow{BC} = 3\mathbf{a} + 5$

Find $\overrightarrow{AB}$ in terms of $\mathbf{a}$ and $\mathbf{b}$

[2]

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19) The complex numbers are $z_1 = 3 + 4\mathrm{i}$ and $z_2 = 2 + \mathrm{i}$

Find $\frac{z_1}{z_2}$ in the form $a + b\mathrm{i}$

[4]

20) $Z \sim \mathrm{N}(0, 1)$

$\mathrm{P}(Z \geq a) = 0.4801$

Find the value of a

[2]

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21) $\mathrm{f}(x) = \left(1 + \frac{1}{x^2}\right) e^{\left(x - \frac{1}{x}\right)}$

(Shade in the bubble ⬭ next to the expression of $\int_1^2 \mathrm{f}(x)\,\mathrm{d}x$)

⬭ $\frac{5}{4}e^{\frac{3}{2}} - 2$

⬭ $e^{\frac{3}{2}} - 1$

⬭ $1 - e^{\frac{3}{2}}$

⬭ $2 - \frac{5}{4}e^{\frac{3}{2}}$

[1]

22) Find $\int \frac{x}{\sqrt{1 + 5x^2}}\,\mathrm{d}x$

[3]

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23) The vector $\mathbf{a} = \begin{pmatrix} 5u \\ 0 \\ -12u \end{pmatrix}$ where the magnitude is 39

Find the values of u

[3]

24) Two complex numbers $z_1 = 2\left(\cos\frac{\pi}{12} - i\sin\frac{\pi}{12}\right)$ and $z_2 = \sqrt{2}e^{i\frac{\pi}{3}}$

(Shade in the bubble ○ next to $z_1 z_2$)

○ $2 - 2i$ ○ $-2 - 2i$

○ $-2 + 2i$ ○ $2 + 2i$

[1]

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25) The complex number $z = -\mathrm{i}$ is a root of the equation $z^3 - z^2 + z + 7 + q = 0$

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

○ -8 ○ -7

○ -6 ○ -1

[1]

26) The random variable $X \sim \mathrm{N}(16, 5^2)$

$\mathrm{P}(8 < X < a) = 0.7333$

Find the value of a

[5]

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27) $\int_{0.5}^{b} \ln(2x)\,\mathrm{d}x = \frac{1}{2}$

Find the value of b

[3]

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28) Two complex numbers $z_1 = 1 - \mathrm{i}$ and $z_2 = a + 3\mathrm{i}$

Given that $\arg(z_1 + z_2) = \frac{\pi}{4}$

Find the value of a

[3]

29) Students' marks in a school follow a normal distribution with a mean of (70) and a standard deviation (σ).

The percentage of students who obtained marks higher than 80 was 5.48%

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

⬭ 18.25 ⬭ 10.58

⬭ 6.25 ⬭ 1.82

[1]

[End of Examination]

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Formulae Sheet

Integration

- **The trapezium rule:**

$$\int_a^b \mathrm{f}(x)\,\mathrm{d}x \approx \frac{1}{2}\,h\,\{y_0 + 2\,(y_1 + y_2 + \cdots + y_{n-1}) + y_n\}$$

, where $h = \frac{b-a}{n}$ and n is the number of intervals.

- **Rules of integration:**

- $\int x^n\,\mathrm{d}x = \frac{x^{n+1}}{n+1} + c\ ,\ n \neq -1$
- $\int \mathrm{f}(x) \pm \mathrm{g}(x)\,\mathrm{d}x = \int \mathrm{f}(x)\mathrm{d}x \pm \int \mathrm{g}(x)\mathrm{d}x$
- $\int e^x\,\mathrm{d}x = e^x + c$
- $\int \frac{1}{x}\,\mathrm{d}x = \ln|x| + c$, where $x \neq 0$
- $\int \sin x\,\mathrm{d}x = -\cos x + c$
- $\int \cos x\,\mathrm{d}x = \sin x + c$
- $\int \sec^2 x\,\mathrm{d}x = \tan x + c$
- **Integration by substitution:**

$$\int \mathrm{f}(x)\,\mathrm{d}x = \int \mathrm{f}(x)\,\frac{\mathrm{d}x}{\mathrm{d}u}\,\mathrm{d}u$$

- $\int k\,\mathrm{f}(x)\mathrm{d}x = k\int \mathrm{f}(x)\mathrm{d}x$
- $\int k(ax+b)^n\,\mathrm{d}x = \frac{k}{a(n+1)}\,(ax+b)^{n+1} + c$, $n \neq -1$
- $\int e^{ax}\,\mathrm{d}x = \frac{1}{a}\,e^{ax} + c$
- $\int \frac{\mathrm{f}'(x)}{\mathrm{f}(x)}\,\mathrm{d}x = \ln|\mathrm{f}(x)| + c$
- $\int \sin(ax)\,\mathrm{d}x = \frac{-1}{a}\cos(ax) + c$
- $\int \cos(ax)\,\mathrm{d}x = \frac{1}{a}\sin(ax) + c$
- $\int \frac{1}{x^2+a^2}\,\mathrm{d}x = \frac{1}{a}\tan^{-1}\left(\frac{x}{a}\right) + c$
- **Integration by parts:**

$$\int \mathrm{u}\,\frac{dv}{dx}\,\mathrm{d}x = uv - \int \mathrm{v}\,\frac{\mathrm{d}u}{\mathrm{d}x}\,\mathrm{d}x$$

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Vectors

- If a and b are the position vectors of the points A and B, then the mid-point of AB is given by $\frac{1}{2}(a+b)$.
- The magnitude (or length) of vector $\overrightarrow{AB} = \binom{a}{b}$ is $\left|\overrightarrow{AB}\right| = \sqrt{a^2+b^2}$
- The distance d between $A(x_1, y_1)$ and $B(x_2, y_2)$ is $d = \sqrt{(x_1-x_2)^2+(y_1-y_2)^2}$
- The direction of the vector $A = x\mathbf{i} + y\mathbf{j}$ is measure from the positive **i** vector by $\theta = \tan^{-1}\left(\frac{y}{x}\right)$
- If the position vector of A is $\boldsymbol{a}$ and the postion vector of B is $\boldsymbol{b}$, then the relative displacement of B from A is $\overrightarrow{AB} = \boldsymbol{b} - \boldsymbol{a}$

Complex Numbers

If $z = x + \mathbf{i}y$ is a complex number, then:

1) The modulus of $z = |z| = \sqrt{x^2 + y^2}$
2) The argument of $z = \arg(z) = \tan^{-1}\left(\frac{y}{x}\right)$
3) Polar form of $z = r(\cos\theta + \mathrm{i}\sin\theta) = re^{\mathrm{i}\theta}$, where $r = |z|, \theta = \arg(z)$.
4) $|z_1 z_2| = |z_1||z_2|$
5) $\arg(z_1 z_2) = \arg z_1 + \arg z_2$
6) $\left|\frac{z_1}{z_2}\right| = \frac{|z_1|}{|z_2|}$
7) $\arg\left(\frac{z_1}{z_2}\right) = \arg z_1 - \arg z_2$

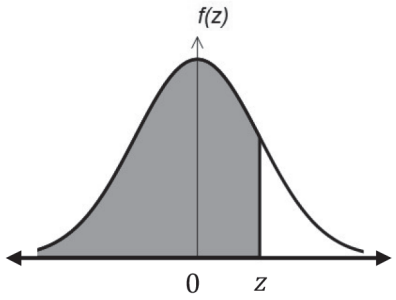
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Normal Distribution

- $Z = \frac{x-\mu}{\sigma}$
- If Z has a normal distribution with mean 0 and variance 1, then for each value of z, the table gives the value of $\Phi(z)$, where

$$\boldsymbol{\Phi(z) = P(Z \leq z)}$$



- If $\boldsymbol{z > 0}$, then $\boldsymbol{\Phi(-z) = 1 - \Phi(z)}$

z	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
											ADD								
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359	4	8	12	16	20	24	28	32	36
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753	4	8	12	16	20	24	28	32	36
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141	4	8	12	15	19	23	27	31	35
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517	4	7	11	15	19	22	26	30	34
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879	4	7	11	14	18	22	25	29	32
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224	3	7	10	14	17	20	24	27	31
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549	3	7	10	13	16	19	23	26	29
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852	9	3	6	12	15	18	21	24	27
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133	8	3	5	11	14	16	19	22	25
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389	8	3	5	10	13	15	18	20	23
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621	7	2	5	9	12	14	16	19	21
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830	6	2	4	8	10	12	14	16	18
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015	6	2	4	7	9	11	13	15	17
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177	5	2	3	6	8	10	11	13	14
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319	4	1	3	6	7	8	10	11	13
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441	4	1	2	5	6	7	8	10	11
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545	3	1	2	4	5	6	7	8	9
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633	3	1	2	4	4	5	6	7	8
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706	2	1	1	3	4	4	5	6	6
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767	2	1	1	2	3	4	4	5	5
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817	1	0	1	2	2	3	3	4	4
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857	1	0	1	2	2	2	3	3	4
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890	1	0	1	1	2	2	2	3	3
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916	1	0	1	1	1	2	2	2	2
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936	1	0	0	1	1	1	1	2	2
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952	0	0	0	1	1	1	1	1	1
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964	0	0	0	0	1	1	1	1	1
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974	0	0	0	0	0	1	1	1	1
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981	0	0	0	0	0	0	0	1	1
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986	0	0	0	0	0	0	0	0	0

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مُسَوَّدَة

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

سلطنة عُمان
وزارة التربية والتعليم



Answer scheme

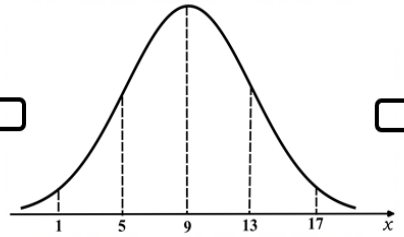
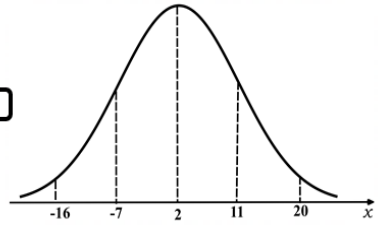
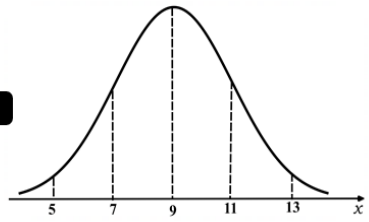
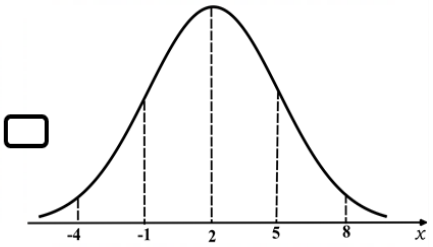
Diploma, Bilingual Private Schools, Advanced Mathematics

Second Semester-Second Session
Academic Year: 2024/2025

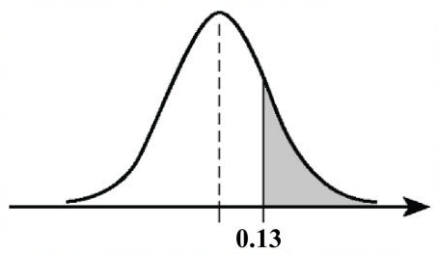
Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [5]	More information
1	AO1/L	**Integration**	**127 + 129 + 132**	$\int \cos(3x) + \frac{2}{x} + \sec^2(x)\ \ \mathrm{d}x$		**1 Mark** for $\frac{1}{3}$ **1 Mark** for $\sin(3x)$ **1 Mark** for $2\ln\lvert x\rvert$ **1 Mark** for $\tan x$ **1 Mark** for c
				$= \frac{1}{3}\sin(3x) + 2\ln\lvert x\rvert + \tan(x) + c$	1+1 + 1+1+1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
2	AO1/L	**Vectors**	**177 + 178**	☐ $\begin{pmatrix}-3\\2\end{pmatrix}$ ■ $\begin{pmatrix}3\\-2\end{pmatrix}$ ☐ $\begin{pmatrix}3\\2\end{pmatrix}$ ☐ $\begin{pmatrix}-3\\-2\end{pmatrix}$		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
3	AO1/L	**Complex Numbers**	**251**	$2z_1 + z_2 = 2(3 + \mathrm{i}) + 5 + 4\mathrm{i}$		
				$= 6 + 2\mathrm{i} + 5 + 4\mathrm{i}$	1	**1 Mark** for the correct expression of $2(3 + \mathrm{i})$
				$= (6 + 5) + (2 + 4)\mathrm{i}$		
				$= 11 + 6\mathrm{i}$	1+1	**1 Mark** for the correct value of the real part. **1 Mark** for the correct value of the imaginary part.

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
4	AO1/L	**Normal Distribution**	**122**	☐  ☐  ■  ☐ 		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [4]	More information
5	AO1/L	**Normal Distribution**	**129**	$\mathrm{P}(Z > 0.13) = 1 - \mathrm{P}(Z < 0.13)$		
				$= 1 - \Phi(0.13)$	1+1	**1 Mark** for the area under the curve $= 1$ **1 Mark** for $-\Phi(0.13)$
				$= 1 - 0.5517$	1	**1 Mark** for the substitution the value of $\Phi(0.13)$
				$= 0.4483$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer-Alternative Answer	Marks [4]	More information
5	AO1/L	**Normal Distribution**	**129**			
				$\text{Area} = 1 - \Phi(0.13)$	1+1	**1 Mark** for the area under the curve $= 1$ **1 Mark** for $-\Phi(0.13)$
				$\text{Area} = 1 - 0.5517$	1	**1 Mark** for the substitution the value of $\Phi(0.13)$
				$= 0.4483$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
6	AO1/M	**Integration**	**138**	☐ $-\ln\lvert\cos 4x\rvert + c$ ☐ $\ln\lvert\sin 4x\rvert + c$ ■ $-\frac{1}{4}\ln\lvert\cos 4x\rvert + c$ ☐ $\frac{1}{4}\ln\lvert\sin 4x\rvert + c$		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [4]	More information
7	AO1 / M	**Integration**	**125**	$n = 2$	1	
				$\therefore h = \frac{4-0}{2} = 2$	1	
				$\int_0^4 \mathrm{f}(x)\ \mathrm{d}x$		
				$\approx \frac{1}{2} \times 2\{0 + 2(2) + 2.4\}$	1	**1Mark:** for applying the trapezium rule with the correct position of the brackets. ➢ If the student starts the answer from this step with correct substitution of h, then the student will get **3Marks** implicitly.
				$= 6.4$ **or** $6\frac{2}{5}$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
8	AO1 \ M	**Vectors**	**189 + 194**	$\overrightarrow{AB} = \begin{pmatrix}9\\8\end{pmatrix} - \begin{pmatrix}1\\2\end{pmatrix}$		➢ If the student solves the question by finding the vector $\overrightarrow{BA}$ and the distance between B, A, then the student will get **3Marks**.
				$= \begin{pmatrix}8\\6\end{pmatrix}$	1	
				Distance between A and B $= \sqrt{8^2 + 6^2}$	1	
				$= 10$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer-Alternative Answer	Marks [3]	More information
8	AO1 \ M	**Vectors**	**189**	$d = \sqrt{(9-1)^2 + (8-2)^2}$	1	➢ If the student finds the distance between B and A, then the student will get this mark.
				$= \sqrt{8^2 + 6^2}$	1	➢ If the student did not write this step, then the student will get this mark **implicitly**.
				$= 10$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [5]	More information
9	AO1/M	**Complex numbers**	**260 + 246**	$r = \sqrt{\left(\sqrt{3}\right)^2 + (-1)^2}$	1	
				$\therefore r = 2$	1	
				$\arg(z) = -\tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$	1	➢ If the student found $\arg(z) = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right) = \frac{\pi}{6}$, then the student will lose **2marks**.
				$\therefore \arg(z) = -\frac{\pi}{6}$	1	
				$\therefore\ z = 2e^{-\frac{\pi}{6}\mathrm{i}}$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
10	AO1/M	**Normal Distribution**	**120**	☐ 38.49% ■ 48.21% ☐ 88.49% ☐ 98.21%		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
11	AO1/H	**Integration**	**130**	☐ $e-1$ ■ $1-\frac{1}{e}$ ☐ $\frac{1}{e}-1$ ☐ $1-e$		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [2]	More information
12	AO1 \ H	**Vectors**	**180**	$\boldsymbol{a} - 2\boldsymbol{b} = 10\mathbf{i} + 5\mathbf{j} - 9\mathbf{k}$		-
				$\begin{pmatrix} 2 \\ n \\ 5 \end{pmatrix} - 2\begin{pmatrix} -4 \\ 1 \\ 7 \end{pmatrix} = \begin{pmatrix} 10 \\ 5 \\ -9 \end{pmatrix}$		
				$\therefore\ n - 2 = 5$	1	
				$\therefore n = 7$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
13	AO1/H	**Complex Numbers**	**252**	☐ 1 ☐ i ☐ -1 ■ $-i$		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
14	AO1/H	**Normal Distribution**	**133**	Total area = $\mathrm{P}(Z < 0) + \mathrm{P}(Z > 2.25)$	1	➢ If the student starts the answer from 3rd step with correct values and operations $(+, -)$, then the student will get the first mark **implicitly**.
				$= \Phi(0) + (1 - \Phi(2.25))$		
				$= 0.5 + (1 - 0.9878)$	1	
				$= 0.5122$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
15	AO2/L	**Integration**	**135**	☐ $4x\ln\|2x^2+18\|+c$ ☐ $\frac{1}{2}\tan^{-1}\left(\frac{x}{3}\right)+c$ ☐ $2x\ln\|2x^2+18\|+c$ ■ $\frac{1}{6}\tan^{-1}\left(\frac{x}{3}\right)+c$		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [4]	More information
16	AO2 \ L	**Integration**	**141**	$\frac{4}{(x-1)(x+3)} \equiv \frac{A}{(x-1)} + \frac{B}{(x+3)}$	1	
				$\frac{4}{(x-1)(x+3)} \equiv \frac{A(x+3)+B(x-1)}{(x-1)(x+3)}$		
				$\therefore 4 \equiv A(x+3)+B(x-1)$	1	
				When $x=-3 \longrightarrow -4B=4$,When $x=1 \longrightarrow 4A=4$		
				$\therefore A=1$ and $B=-1$	1	
				$\therefore \int \frac{4}{(x-1)(x+3)}\,dx = \int \frac{1}{(x-1)}dx - \int \frac{1}{(x+3)}dx$		
				$= \ln\lvert x-1\rvert - \ln\lvert x+3\rvert + c$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
17	AO2/L	**Vectors**	**192**	■ $-135°$ ☐ $-45°$ ☐ $45°$ ☐ $135°$		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [2]	More information
18	AO2 \ L	**Vectors**	**186**	$\overrightarrow{AB} = \overrightarrow{AD} + \overrightarrow{DC} + \overrightarrow{CB}$	1	-
				$= 2\,\mathbf{a} + \mathbf{b} - (\mathbf{3a} + 5)$		
				$= -\mathbf{a} + \mathbf{b} - \mathbf{5}$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [4]	More information
19	AO2/L	**Complex numbers**	**252**	$\frac{3+4\mathrm{i}}{2+\mathrm{i}} = \frac{3+4\mathrm{i}}{2+\mathrm{i}} \times \frac{2-\mathrm{i}}{2-\mathrm{i}}$	1	**1 Mark** for multiplying by the conjugate z_2^* and dividing by z_2^*
				$= \frac{(6+4)+(8-3)\mathrm{i}}{4+1}$	1+1	**1 Mark** for the numerator **1 Mark** for the denominator
				$= \frac{10+5\mathrm{i}}{5}$		
				$= 2+\mathrm{i}$	1	➢ If one of the parts (either real or the imaginary) is not correct, then the student will lose **1mark**.

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [2]	More information
20	AO2/L	**Normal Distribution**	**136**	$\mathrm{P}(Z \geq a) = 0.4801$		
				$\mathrm{P}(Z < a) = 1 - 0.4801$		
				$\Phi(a) = 0.5199$	1	**1 Mark** for the correct value 0.5199
				$a = \Phi^{-1}(0.5199)$		
				$\therefore a = 0.05$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
21	AO2/M	**Integration**	**130**	☐ $\frac{5}{4}e^{\frac{3}{2}} - 2$ ■ $e^{\frac{3}{2}} - 1$ ☐ $1 - e^{\frac{3}{2}}$ ☐ $2 - \frac{5}{4}e^{\frac{3}{2}}$		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
22	AO2 /M	**Integration**	**141**	Let $u = 1 + 5x^2 \quad \rightarrow \quad \mathrm{d}u = 10x\,\mathrm{d}x$	1	**1 Mark** for u and $\mathrm{d}u$
				$\int \frac{x}{\sqrt{1+5x^2}}\,\mathrm{d}x$		
				$= \frac{1}{10} \int u^{-\frac{1}{2}}\,\mathrm{d}u$	1	**1 Mark** for applying the substitution.
				$= \frac{1}{10} \times 2\, u^{\frac{1}{2}} + c$		
				$= \frac{1}{5} \left(1+5x^2\right)^{\frac{1}{2}} + c$	1	**1 Mark** for any correct step.
				$= \frac{1}{5} \sqrt{1+5x^2} + c$		

Item #	Assessment Object / Level of Demand	Unit	Page	Answer – Alternative Answer	Marks [3]	More information
22	AO2 / M	**Integration**	**141**	$\int \frac{x}{\sqrt{1+5x^2}}\ \mathrm{d}x$		
				$= \frac{1}{10}\int \frac{10x}{\sqrt{1+5x^2}}\ \mathrm{d}x$	1	
				$= \frac{1}{10}\int 10x\,(1+5x^2)^{-\frac{1}{2}}\ \mathrm{d}x$	1	
				$= \frac{1}{10} \times 2\ \left(1+5x^2\right)^{\frac{1}{2}} + c$		
				$= \frac{1}{5}\ \left(1+5x^2\right)^{\frac{1}{2}} + c$	1	**1 Mark** for any correct step.
				$= \frac{1}{5}\ \sqrt{1+5x^2} + c$		

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
23	AO2 / M	**Vectors**	**194**	$\sqrt{(5u)^2 + (0)^2 + (-12u)^2} = 39$		
				$25\,u^2 + 144\,u^2 = 39^2$	1	**1 Mark** for taking the squares of both sides.
				$169\,u^2 = 1521$		
				$u^2 = 9$	1	
				$u = \pm 3$	1	**1 Mark** for both values ± 3

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
24	AO2/M	**Complex Numbers**	**263**	☐ $2-2i$ ☐ $-2-2i$ ☐ $-2+2i$ ■ $2+2i$		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
25	AO2/M	**Complex Numbers**	**259**	■ -8 ☐ -7 ☐ -6 ☐ -1		-

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [5]	More information
26	AO2/M	**Normal Distribution**	**136**	$\mathrm{P}\left(\frac{8-16}{5} < Z < \frac{a-16}{5}\right) = 0.7333$		
				$\mathrm{P}(-1.6 < Z < z) = 0.7333$ where $z = \frac{a-16}{5}$	1	
				$\Phi(z) - \left(1 - \Phi(-1.6)\right) = 0.7333$		
				$\Phi(z) - (1 - 0.9452) = 0.7333$		
				$\therefore \Phi(z) = 0.7881$	1	
				$\therefore z = 0.8$	1	
				$\frac{a-16}{5} = 0.8$	1	**1 Mark** for substitution $z = \frac{a-16}{5}$
				$\therefore a = 20$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
27	AO2 / H	**Integration**	**148**	$u = \ln 2x \rightarrow \therefore \frac{\mathrm{d}u}{\mathrm{d}x} = \frac{1}{x}$ and $\frac{\mathrm{d}v}{\mathrm{d}x} = 1 \rightarrow \therefore v = x$		-
				$\therefore \int_{0.5}^{b} \ln 2x \ \mathrm{d}x = x \ln 2x]_{0.5}^{b} - \int_{0.5}^{b} dx$		
				$= x \ln 2x - x]_{0.5}^{b}$	1	
				$\therefore \frac{1}{2} = b \ln 2b - b - (0.5 \ln 1 - 0.5)$		
				$b \ln 2b = b$	1	
				$2b = e$		
				$\therefore b = \frac{e}{2}$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [3]	More information
28	AO2/H	**Complex Numbers**	**249**	$z + w = (1 + a) + 2\mathrm{i}$		-
				Since $\arg(z + w) = \frac{\pi}{4}$		
				$\arg(z + w) = \tan^{-1}(\frac{2}{a+1})$		
				$\tan^{-1}\left(\frac{2}{a+1}\right) = \frac{\pi}{4}$	1	
				$\frac{2}{a+1} = \tan\left(\frac{\pi}{4}\right)$	1	
				$\frac{2}{a+1} = 1$		
				$a + 1 = 2$		
				$a = 1$	1	

Item #	Assessment Object / Level of Demand	Unit	Page	Answer	Marks [1]	More information
29	AO2/H	**Normal Distribution**	**135**	☐ 18.25 ☐ 10.58 ■ 6.25 ☐ 1.82		-