GCE AS MARKING SCHEME

SUMMER 2025

AS
MATHEMATICS
UNIT 2 APPLIED MATHEMATICS A
2300U20-1

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

WJEC GCE AS MATHEMATICS

UNIT 2 APPLIED MATHEMATICS A

SUMMER 2025 MARK SCHEME

SECTION A – Statistics

Q1	Solution	Mark	Notes
(a)	Let the random variable X be the number of transactions in a one-hour period.		
	$X \sim \text{Po}(6)$	B1	
	$\text{P}(X = 5) = \frac{6^5 \times \text{e}^{-6}}{5!}$	M1	si Accept use of statistical function on calculator. If calculator used, 'PD' and $X = 5$ implied. Award for $\text{P}(X \leq 5) - \text{P}(X \leq 4)$ with at least one correct value shown. $\text{P}(X = 5) = \frac{\lambda^5 \times \text{e}^{-\lambda}}{5!}$ FT their λ for M1.
	$\text{P}(X = 5) = 0.1606$	A1 **[3]**	cao 3sf
(b)	Let the random variable Y be the number of transactions in a one-hour period.		
	$Y \sim \text{Po}(10)$ and $Y = 12$ identified.	B1	
	$\text{P}(Y \geq 12) = 1 - \text{P}(Y \leq 11)$	M1	Written or used. M0 for 360 or 300. $\text{P}(X = 12)$ scores M0.
	$\text{P}(Y \geq 12) = 1 - 0.6968$		
	$\text{P}(Y \geq 12) = 0.3032$	A1 **[3]**	cao 3sf
	Total for Question 1	**6**	

Q2	Solution	Mark	Notes
	Recognising options for $X_1 + X_2 = 6$. i.e. 2,4 3,3 4,2	B1	si, at least 2 pairs correct. Implied by the correct working. e.g. $0.1 \times 0.3 + 0.4 \times 0.4$ No more than one incorrect pair.
	$\text{P}(X_1 + X_2 = 6) = 0.1 \times 0.3 + 0.4 \times 0.4 + 0.3 \times 0.1$	M1	M1 for one correct product.
	$= 0.22$ or $\frac{11}{50}$	A1 A1 **[4]**	Fully correct method. cao
	Total for Question 2	**4**	

Q3	Solution	Mark	Notes
(a)	(Let p be the probabiltiy of a correct answer.) $H_0: p = \frac{1}{3}$ $\quad$ $H_1: p < \frac{1}{3}$	B1 **[1]**	
(b) (i)	(Let the random variable X represent the number of people who answer the new question correctly.) Under H_0, $X \sim \mathrm{B}\left(63, \frac{1}{3}\right)$ $p - \text{value} = \mathrm{P}(X \leq 15) = 0.0679$	B1 M1A1	si FT their (a) if stated. M1 for $\mathrm{P}(X \leq 15)$ written or used.
(ii)	Since $0.0679 > 0.05$ There is insufficient evidence to reject H_0. There is insufficient evidence at the 5% level to suggest that people do worse by trying to work out the correct answer rather than selecting the answer at random. e.g. Insufficient evidence to support Martin's claim.	M1 A1 **[5]**	 cso (all previous marks in (b) awarded)
(c)	If $X \sim \mathrm{B}\left(63, \frac{1}{3}\right)$ Critical region $\mathrm{P}(X \leq 14) = 0.0379$ Therefore CR is $X \leq 14$ Prob (Type II error) = $\mathrm{P}(X \geq 15 \mid X \sim \mathrm{B}(63, 0.2))$ $= 1 - 0.7318$ $= 0.2682$ Valid interpretation. e.g. People are worse at answering the new question correctly than if they had selected the answer randomly, but Martin fails to conclude that is the case. e.g. There is about a 27% chance that Martin will make the incorrect conclusion if $p = 0.2$. e.g. The probability of failing to reject the hypothesis that the probability of people answering the new question correctly is worse than average when, in fact, it should have been rejected is about 27%. e.g. If $p = 0.2$, Martin should reject H_0. He should conclude that people would indeed have been better off selecting their answer at random. There's about a 25% chance that he doesn't conclude that.	M1 A1 M1 A1 E1 **[5]**	M0 for $\mathrm{P}(X = x)$ cao 3sf or better FT their Type II error
	Total for Question 3	**11**	

Q4	Solution	Mark	Notes
(a) (i) (ii)	$\mathrm{P}(A) = 0.3$ $\mathrm{P}(A \cap B) = 0.13$	 B1 B1 **[2]**	
(b)	$\mathrm{P}(C) = 0.4$ $p + 0.08 = 0.4$ $p = 0.32$ ALTERNATIVE FOR p $1 - 0.3 - 0.08 = p + q + r$ $0.62 = p + 0.3$ $p = 0.32$ $\mathrm{P}(C) \times \mathrm{P}(D) = 0.08$ $0.4(0.08 + q) = 0.08$ $0.032 + 0.4q = 0.08$ $q = 0.12$ $0.13 + 0.17 + 0.08 + '0.32' + '0.12' + r = 1$ $0.3 + 0.4 + '0.12' + r = 1$ $r = 0.18$	 M1 A1 (M1) (A1) M1 A1 M1 A1 **[6]**	 or $0.4 - 0.08$ cao used correctly e.g. $0.4 \times \mathrm{P}(D) = 0.08$. cao FT their q and p for M1 provided valid probabilities. FT for A1 provided r is a valid probability. NOTE: Do not award marks for correct answers from incorrect working.
	Total for Question 4	**8**	

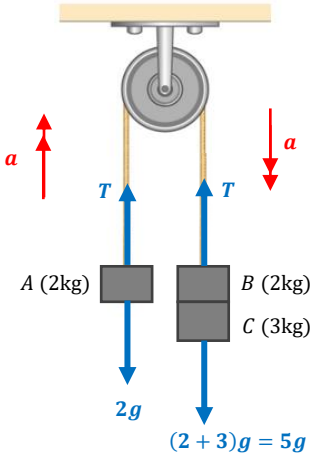
Q5	Solution	Mark	Notes
(a)	Valid way to clean data. e.g. Population figure for Saudi Arabia could be found. e.g. Add the population figure for Saudi Arabia. e.g. AB in the Adult Mortality column for Costa Rica is clearly incorrect. This could be found out or the data could be ignored, depending on the context. e.g. Remove duplicate columns. e.g. Check the accuracy of the 60 figure for Benin. e.g. Check the Polio figure for Benin. e.g. Investigate to see if polio in Benin is an outlier.	E2 **[2]**	E1 each correct one. Do not allow 'Don't use Saudi Arabia' or 'Don't use Costa Rica' unless justified e.g. 'Finding the Adult mortality for Costa Rica might be difficult.' E0 for 'should use percentages'. E0 for 'round to X significant figures'. E0 for 'don't use decimals.' E0 for 'group diseases together'. E0 for 'polio in Benin is an outlier therefore ignore it'. E0 for 'Use same number of significant figures for all data'. E0 for referencing lack of units.
(b)	For each **additional year of schooling**, the **life expectancy** goes up **2.95 (or 3)** years **on average**.	E1 **[1]**	
(c)	Valid comment. e.g. It could be causal. More education is likely to lead to better life choices and thus increases life expectancy. e.g. There may be a third factor like wealthy countries are likely to have more education and also better access to health care.	E1 **[1]**	E0 for 'life expectancy and schooling don't correlate'.
(d) (i)	$y = 2.9527 \times 14.6 + 31.873 = 74.98\ (or\ 75)$	B1	B1 for 74.98. B1 for 75 with correct calculation. B0 for 75 with no calculation.
(ii)	Valid comment E.g. Likely to be reasonably reliable because 14.6 is within the range of the data and the pattern of the data seems to be roughly linear. e.g. Reliable because we're interpolating.	E1 **[2]**	Condone without 'roughly linear'. E0 for unreliable. E0 for '75 is within the range of the data.' E0 sample is too small.
(e)	Valid comment. Eg. There seems to be lots of countries with 0 years of schooling. This is unlikely to be accurate. One could either ignore the data in any analysis or further research could be carried out to find the number of years of schooling for the countries with the missing data.	E1 **[1]**	
(f) (i)	$\bar{y} = \frac{13105.9}{183} (= 71.6)$ ag $\sigma = \sqrt{\frac{950615.47}{183} - \left(\frac{13105.9}{183}\right)^2}$ $\sigma = 8.101$	B1 M1 A1 **[3]**	Convincing M1A1 for use of calculator Accept answers rounding to 8.1, 8.2, 8.3, **8.25** Accept calculation of $s = \sqrt{\frac{1}{182}\left(950615.47 - \frac{13105.9^2}{183}\right)} = 8.1237\ldots$ M1A1
(ii)	Valid comment Eg. The mean should be weighted by country population size.	E1 **[1]**	E0 'May not include all countries of the world.' E0 Only a small number/handful of countries. E0 I support this claim. E0 Shows life expectancy of people who didn't go to school. E0 for implying we need to take into account the whole population. E0 for should use median or mode.
	Total for Question 5	**11**	

SECTION B – Mechanics

Q6	Solution	Mark	Notes
(a)	$3\mathbf{G} + 2\mathbf{H} = 3(-4\mathbf{i} + 6\mathbf{j}) + 2(k\mathbf{i} - 9\mathbf{j})$ $(= 0)$		
	$= -12\mathbf{i} + 18\mathbf{j} + 2k\mathbf{i} - 18\mathbf{j}$ $(= 0)$	M1	Attempt to expand both brackets and attempt to add
	$= (2k - 12)\mathbf{i}$ $= 0$	m1	Their $3\mathbf{G} + 2\mathbf{H} = 0$, oe
	$2k - 12 = 0$		
	$k = 6$	A1	Convincing, $\mathbf{j}$ coefficient $= 0$
	Note Award SC2 if $k = 6$ is assumed and equilibrium is shown	**[3]**	
(b)	$\mathbf{G} + \mathbf{H} = (-4\mathbf{i} + 6\mathbf{j}) + (6\mathbf{i} - 9\mathbf{j})$		
	$= 2\mathbf{i} - 3\mathbf{j}$	B1	cao, si
	Using N2L, $\mathbf{G} + \mathbf{H} = m\mathbf{a}$	M1	Vector form used
	$2\mathbf{i} - 3\mathbf{j} = 0 \cdot 5\mathbf{a}$		
	$\mathbf{a} = 4\mathbf{i} - 6\mathbf{j}$ (ms^{-2})	A1	FT their $\mathbf{G} + \mathbf{H}$
		[3]	isw, even in the case where magnitude is also given
	Total for Question 6	**6**	

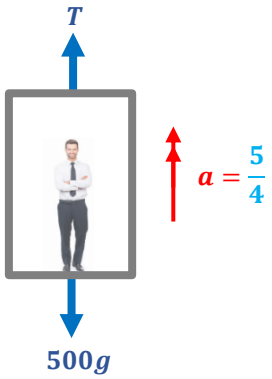
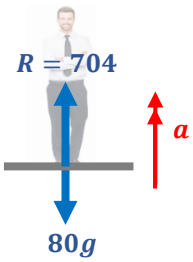
Q7	Solution	Mark	Notes
(a)	Substitution of $v = u + at$ into $s = \frac{1}{2}(u + v)t$ $s = \frac{1}{2}(u + \boldsymbol{u + at})t$	B1	Substitution
	$s = \begin{cases} \frac{1}{2}(2u + at)t \\ \frac{1}{2}(2ut + at^2) \\ \frac{1}{2}(ut + ut + at^2) \\ \frac{1}{2}ut + \frac{1}{2}ut + \frac{1}{2}at^2 \end{cases}$		
	$s = ut + \frac{1}{2}at^2$	B1 **[2]**	Convincing, intermediate line required
(b)	(i) Using $s = ut + \frac{1}{2}at^2$, with $s = 0, u = \pm 29 \cdot 4, a = \pm g$	M1	Used
	$0 = (\pm 29 \cdot 4)t + \frac{1}{2}(\mp 9 \cdot 8)t^2$	A1	g **opposing** u
	$4 \cdot 9t(t - 6) = 0$ $t = 0, 6$		No workings required
	$t = 6$ (s)	A1 **[3]**	cao, $t = 0$ must be clearly discarded
	(ii) Examples • Calculations are independent of the mass/weight of the object • Object modelled as a particle • Air resistance/external forces (apart from gravity) are all ignored • Acceleration remains constant (at $g = 9 \cdot 8$)	B1 **[1]**	
	Total for Question 7	**6**	

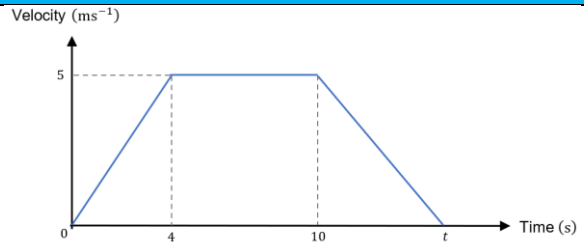
Further Notes			
	Alternative Solution for (b) (i): $v = u + at$ $u = \pm 29 \cdot 4, v = \pm 29 \cdot 4, a = \pm g$	M1	Using symmetry Used
	$\pm 29 \cdot 4 = \mp 29 \cdot 4 + (\pm 9 \cdot 8)t$	A1	g & v **opposing** u
	$t = 6$	A1	cao
(b)	Alternative Solution for (b) (i): Upwards: $v = u + at$, $u = \pm 29 \cdot 4, v = 0, a = \pm g$ Downwards: $v = u + at$, $u = 0, v = 29 \cdot 4, a = g$		Maximum height/symmetry
	$0 = \mp 29 \cdot 4 + (\pm 9 \cdot 8)t$ $29 \cdot 4 = 0 + (9 \cdot 8)t$	M1 A1	Used Only award if value of t is multiplied by 2 g **opposing** u for upwards only
	$t = 3$ Required time $= 3 \times 2 = 6$	A1	cao

Q8	Solution	Mark	Notes
(a)			
	(i) N2L applied to **both** A and $B\&C$	M1	Dimensionally correct eqn. for at least 1 direction T and $2g/(2+3)g$ opposing
	$T - 2g = 2a$ $\quad (T - 19 \cdot 6 = 2a)$	B1	1st correct equation
	$5g - T = 5a$ $\quad (49 - T = 5a)$	A1	2nd correct equation
	Eliminating one variable: Eliminating T	m1	Eliminating a
	$3g = 7a$ $\quad (29 \cdot 4 = 7a)$		$7T - 20g = 0$ $\quad (7T - 196 = 0)$
	$a = \frac{3}{7}g = 4 \cdot 2 \ \ (\text{ms}^{-2})$	A1	cao, any form
	$T = \frac{20}{7}g = 28 \ \ (\text{N})$	A1	cao, any form
	(ii) Force exerted on pulley $= 2T$		
	$T = 2 \times \frac{20}{7}g = \frac{40}{7}g = 56 \ \ (\text{N})$	B1	FT T, any form
		[7]	
(b)	Acceleration of $A = 0 \ \ (\text{ms}^{-2})$	B1	
		[1]	
	Total for Question 8	**8**	

Q9	Solution	Mark	Notes
(a)	Displacement, $x = \int (50t - 2t^3)\,\mathrm{d}t$ $x = \frac{50}{2}t^2 - \frac{2}{4}t^4 \ (+C)$ Working relative to the point A, when $t = 1, x = 0 \ \ \therefore \ \ C = -\frac{49}{2} = -24 \cdot 5$ $x = 25t^2 - \frac{1}{2}t^4 - \frac{49}{2}$	M1 A1 A1 **[3]**	Attempt to integrate, at least one correct term Allow any notation $s, r =$ oe, $x = 25t^2 - \frac{1}{2}t^4 \ (+C)$ Equivalently using limits of 1 and t cao, any form $x = \frac{1}{2}(50t^2 - t^4 - 49)$
(b)	When $t = 4$, $x = 25(4)^2 - \frac{1}{2}(4)^4 - \frac{49}{2}$ $AB = 247 \cdot 5$ or $\frac{495}{2}$ (cm)	 B1 **[1]**	OR $\int_1^4 (50t - 2t^3)\mathrm{d}t = 247 \cdot 5$ Manually or straight from calculator cao, any form
	Total for Question 9	**4**	

Further Notes			
(a)	<u>Alternative solution for (a) & (b):</u> Working relative to its starting position Displacement, $x = \int (50t - 2t^3)\,\mathrm{d}t$ $x = \frac{50}{2}t^2 - \frac{2}{4}t^4 \ (+C)$ When $t = 0, x = 0 \ \ \therefore \ \ C = 0$ $x = 25t^2 - \frac{1}{2}t^4$	 M1 A1 A0	 Attempt to integrate, at least one correct term oe
(b)	Working relative to its starting position When $t = 1, x = 24 \cdot 5$ When $t = 4, x = 272$ $\therefore AB = 272 - 24 \cdot 5$ $AB = 247 \cdot 5$ or $\frac{495}{2}$ (cm)	 B1	 cao, any form

Q10	Solution	Mark	Notes
(a)	Accelerating from $t = 0$ to $t = 4$, acceleration = gradient $= \frac{5}{4}$ or $1 \cdot 25$ (ms^{-2})	B1	cao, any form
	 		$(420 + 80)g = 500g$ $= 4900$ No extra forces
	N2L applied to lift, upwards positive $T - 500g = 500a$ $(T - 4900 = 500a)$ $T - 500g = 500\left(\frac{5}{4}\right)$ $(T - 4900 = 625)$ $T = 5\,525$ (N)	M1 A1 A1 **[4]**	Dimensionally correct equation T and $500g$ opposing Correct equation cao
(b)	 N2L on person only $R - 80g = \pm 80a$ $(R - 784 = 80a)$ $704 - 80g = \pm 80a$ $(704 - 784 = 80a)$ $a = \mp 1$ (ms^{-2}) Deceleration $= 1$ (ms^{-2}) For $10 < \text{time} < t$, acceleration = gradient $= -1$ $(1 =)$ $\frac{5 - 0}{t - 10}$ $t = 15$ **Note** Award SC1 if $a = 1$ is derived from assuming that $t = 15$	 M1 A1 A1 M1 A1 **[5]**	$80g = 784$ No extra forces Dimensionally correct equation with R and $80g$ opposing cao oe, gradient calculation Convincing

Q10	Solution	Mark	Notes
(c)			
	Distance = area	M1	Attempt to find relevant area Trapezium OR Composite parts
	$= \begin{cases} \frac{1}{2}((10-4)+15)(5) \\ \frac{1}{2}(4)(5)+(10-4)(5)+\frac{1}{2}(15-10)(5) \end{cases}$		All 3 attempted $(= 10 + 30 + 12 \cdot 5)$
	$= \frac{105}{2}$ or $52 \cdot 5$ (m)	A1 **[2]**	cao, any form
	Total for Question 10	11	

Further Notes			
(a)	Alternative Solution for B1 $v = u + at,\ u = 0, v = 5, t = 4$ $5 = 0 + a(4)$ $a = \frac{5}{4}$ or $1 \cdot 25$ (ms^{-2})	B1 **[1]**	cao
(b)	Alternative Solution to show that $t = 15$ Starting from $t = 10$ $v = u + at,\ u = 5, v = 0, a = -1$ $0 = 5 + (-1)t$ $t = 5$ $T = 10 + 5 = 15$	M1 A1 **[2]**	Used Convincing