AQA

Level 3 Certificate
MATHEMATICAL STUDIES
1350/2B

Paper 2B Critical Path and Risk Analysis

Mark scheme

June 2022

Version: 1.1 Final Mark Scheme

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Q	Answer	Mark	Comments
1 (a)	11 : 5	B1	

Q	Answer	Mark	Comments
1 (b)	**Alternative method 1**		
	10 × 1 and 15 × 2 and 25 × 2 and 20 × 3 and 5 × 3 and 5 × 4 or 10 × 1 and 40 × 2 and 20 × 3 and 5 × 3 and 5 × 4 or 10 and 30 and 50 and 60 and 15 and 20 or 10 and 80 and 60 and 15 and 20	M1	allow one error or omission may be seen beside table
	185 with correct method	A1	may be implied by 185 + their assumed visitor spaces
	185 and no	E1ft	ft their 185 with yes if their total < 185 or no if their total > 185

Q	Answer	Mark	Comments
1 (b) cont	**Alternative method 2 (interprets as a total of 3 and 4 spaces for all 4-bed and 5-bed properties)**		
	10 × 1 and 15 × 2 and 25 × 2 and 20 × 3 and 3 and 4 or 10 × 1 and 40 × 2 and 20 × 3 and 3 and 4 or 10 and 30 and 50 and 60 and 3 and 4 or 10 and 80 and 60 and 3 and 4	M1	allow one error or omission may be seen beside table
	157 with correct method	A1	
	157 and yes	E1ft	ft their 157 with yes if their total < 157 or no if their total > 157
	Additional Guidance		
	10 + 15 + 25 + 20 + 15 + 20 and 105 and yes		M0 A0 E1ft
	185 may be implied, eg 10 + 80 + 60 + 15 + 20 + 40 = 225 (where 40 spaces assumed for visitor parking) and no		M1 A1 E1
	185 and no with no method seen		M0 A0 E0

Q	Answer	Mark	Comments
1 (c)	**Alternative method 1**		
	80 × 23 ÷ 100 or 18(.4) or 19	M1	implied by 9 or 8 for 2-bedroom flat in table with no incorrect working
	9	A1	no incorrect working number of 2-bedroom flats
	31	B1ft	number of 2-bedroom houses ft 40 – their 9 accept decimals
	Alternative method 2		
	80 × ((23 ÷ 100) − (10 ÷ 80)) or 80 × (0.23 − 0.125) or 8.4	M1	implied by 9 or 8 for 2-bedroom flat in table with no incorrect working
	9	A1	no incorrect working number of 2-bedroom flats
	31	B1ft	number of 2-bedroom houses ft 40 – their 9 accept decimals

Additional Guidance	
Award M1 for correct percentage calculation, even if 2-bedroom flat value is greater than 9	
correct values from incorrect method score M0 A0 but can gain B1ft, eg 40 × 23 ÷ 100 or 9.2 and 9 and 31	M0 A0 B1ft
80 × 23 ÷ 100 or 18.4 and 8 and 32	M1 A0 B1ft

Q	Answer	Mark	Comments
2 (a)	Any two valid improvements eg Spell out Northern Ireland Include 'other fuels'/the missing category in the key Break down renewables/fossil fuels into different types Add a title to the chart Show the amount of electricity generated in GWh, not the percentage Use pattern to better distinguish the fuel types or label the bars with the fuel type or reorder the bars (so that similar shades are not next to each other) Include grid lines Include more increments on the vertical axis Label the axes Make the gaps equal Include values Add another bar for the whole UK/the UK average	E2	E1 for one valid improvement ignore any additional but non-contradictory suggestions SC1 two or more errors identified instead of improvement

Additional Guidance	
One correct error and one improvement	E1 only
Make the y-axis bigger	E0
Make the y-axis more accurate	E0
Larger scale	E0
Use a separate bar chart for each country	E0
Use a different type of chart	E0
Use colour	E0

Q	Answer	Mark	Comments
2 (b)	**Morning Record**		
	Alternative method 1		
	110 221 × 70 ÷ 100 or 77 154.(7) or 77 155	M1	oe
	77 154.(7) or 77 155 and True	A1	
	Alternative method 2		
	78 105 ÷ 70 × 100 or 111 578.(57…) or 111 579	M1	oe
	111 578.(57…) or 111 579 and True	A1	
	Alternative method 3		
	78 105 ÷ 110 221 (× 100) or 70.8(6…) or 70.9 or 0.708(6…) or 0.709	M1	oe accept 71 or 0.71
	70.8(6…) or 70.9 or 0.708(6…) or 0.709 and True	A1	accept 71 or 0.71

Q	Answer	Mark	Comments
2 (b) cont	**Alternative method 4**		
	$(110\,221 - 78\,105) \div$ $110\,221\ (\times 100)$ or $32\,116 \div 110\,221\ (\times 100)$ or $0.29(1\ldots)$ or $29(.1\ldots)$	M1	oe
	$0.29(1\ldots)$ or $29(.1\ldots)$ and True	A1	

Q	Answer	Mark	Comments
	Daily Bulletin Review		
	Alternative method 1 (comparing proportions of wind to other renewables)		
	$78\,105 - 33\,791$ or $129 + 11\,228 + 32\,957$ or $44\,314$	M1	
	$33\,791 \div$ their $44\,314$ or $0.76(\ldots)$ and $13 \div 17$ or $0.76(\ldots)$	M1	
	$0.76(\ldots)$ with full method seen and True	A1	oe percentage
2 (b) cont	**Alternative method 2 (comparing multiplier from wind to other renewables)**		
	$78\,105 - 33\,791$ or $129 + 11\,228 + 32\,957$ or $44\,314$	M1	
	their $44\,314 \div 33\,791 = 1.3(1\ldots)$ and $17 \div 13 = 1.3(07\ldots)$ or $17 \div 13 = 1.31$	M1	correct for their $44\,314$
	$1.3(\ldots)$ with full method seen and True	A1	oe percentage

Q	Answer	Mark	Comments
	Alternative method 3 (what other renewables should be in 13 : 17)		
	78 105 − 33 791 or 129 + 11 228 + 32 957 or 44 314	M1	
	33 791 ÷ 13 × 17 or 44 188.(…)	M1	
	44 188.(…) and 44 314 and True	A1	
2 (b) cont	**Alternative method 4 (comparing one part of wind with one part of other renewables)**		
	78 105 − 33 791 or 129 + 11 228 + 32 957 or 44 314	M1	
	33 791 ÷ 13 and their 44 314 ÷ 17	M1	oe eg 33 791 ÷ 13 or 2599 and 44 314 ÷ 2599 or 17.05
	2599.(3…) and 2606.(7…) or 2607 and True	A1	allow 2600

Q	Answer	Mark	Comments
2 (b) cont	**Alternative method 5 (finding an approximately equivalent ratio)**		
	78 105 − 33 791 or 129 + 11 228 + 32 957 or 44 314	M1	
	33 791 ÷ [2533, 2685] and 44 314 ÷ [2533, 2685]	M1	both divisiors must be the same
	33 791 ÷ [2533, 2685] and 44 314 ÷ [2533, 2685] and correct results for their divisor and True	A1	results may be rounded to 13 and 17 with divisor shown
	Alternative method 6 (working out other renewables as 17 parts of total)		
	78 105 − 33 791 or 129 + 11 228 + 32 957 or 44 314	M1	
	78 105 ÷ 30 × 17 or 44 259(.5) or 44 260	M1	
	44 259(.5) or 44 260 and 44 314 and True	A1	

Q	Answer	Mark	Comments
2 (b) cont	**Alternative method 7 (working out wind as 13 parts of total)**		
	78 105 ÷ 30 or 2603.5 or 2604	M1	
	their 2603.5 × 13 or 33 845(.5) or 33 846	M1	
	33 845(.5) or 33 846 and True	A1	
	Alternative method 8 (comparing wind as a proportion of total renewables)		
	13 ÷ 30 or 0.43(3…)	M1	
	33 791 ÷ 78 105 or 0.43(2…)	M1	
	0.43 with full method seen and True	A1	oe percentage
	Additional Guidance		
	Variations which mix alternative methods are acceptable. Choose the scheme that favours the student.		
	Accept Yes for True		
	33 791 : 44 314 and 13 : 17.04(8…) and True		M1 M1 A1
	33 791 : 44 314 and 13 : 17.05 and True		M1 M1 A1
	33 791 : 44 314 and 12.96(3…) : 17 and True		M1 M1 A1
	33 791 : 44 314 and 13 : 17 and True with no divisor shown		M1 M0 A0

Q	Answer	Mark	Comments
2 (c)	**Alternative method 1 (first finding GWh used)**		
	4189 × 1 000 000 or 4 189 000 000	M1	oe
	their 4 189 000 000 × 14.4 ÷ 100 or 603 216 000	M1	oe
	603 216 000 or 603 000 000 and Yes	A1	oe
	Alternative method 2 (first finding price per GWh)		
	14.4 × 1 000 000 or 14 400 000	M1	oe
	their 14 400 000 × 4189 ÷ 100 or 603 216 000	M1	oe
	603 216 000 or 603 000 000 and Yes	A1	oe
	Additional Guidance		
	Accept all values in standard form		
	Accept comparison in pence with 60 000 000 000 seen		
	Condone recovery to pounds after working in pence with division by 100 not seen		

Q	Answer	Mark	Comments
2 (d)	**Alternative method 1**		
	7700 ÷ 26.9 or 286.2(4…) or 286.25 or 7700 ÷ 0.269	M1	oe
	[28 490, 28 644]	A1	
	Alternative method 2		
	7700 × 73.1 ÷ 26.9 or 20 924.(5…) or 20 925	M1	oe
	[28 490, 28 644]	A1	
	Additional Guidance		
	Ignore further rounding after answer in interval seen		

Q	Answer	Mark	Comments
2 (e)	Any valid reason eg The amount of electricity produced by each nation is not the same England produces more electricity than Scotland He should have worked out a weighted mean He should have worked out the total energy generated by renewables as a percentage of the overall total He should have used actual values (rather than percentages) You can't always just average percentages Each percentage is the percentage of its own country, not the UK as a whole He has calculated the mean percentage based on each country's total, not the UK as a whole	E1	oe condone the sizes of the nations are not the same

Q	Answer	Mark	Comments
3 (a)	0.1	B1	oe fraction, decimal or percentage

Q	Answer	Mark	Comments
3 (b)	50 × 0.15 or 7.5(0) or 20 × 0.55 or 11 or 10 × 0.2 or 2	M1	oe
	50 × 0.15 + 20 × 0.55 + 10 × 0.2 or their 7.5 + their 11 + their 2 or 20.5	M1dep	
	20.50	A1	

Q	Answer	Mark	Comments
4 (a)	**Alternative method 1**		
	1 − 0.95 or 0.05	M1	oe
	their 0.05 × 1300	M1dep	
	(£)65	A1	
	Does not recommend insurance (as expected value is less than £70)	E1ft	ft their expected value ie recommends insurance if their expected value > £70
	Alternative method 2		
	1 − 0.95 or 0.05	M1	oe
	0.95 × 70 − 0.05 × (1300 − 70) or 0.95 × 70 and 0.05 × (1300 − 70)	M1dep	
	(£) 5 or (£) 66.5(0) and 61.5(0)	A1	
	Does not recommend insurance (as it is expected to cost £5 more if she buys the policy)	E1ft	ft their expected value ie recommends insurance if their expected value > £70

Q	Answer	Mark	Comments
4 (b)	Any valid reason eg if **not** recommended in **4(a)** She cannot afford to pay for medical costs if she has an accident She thinks the medical costs will be higher than estimated She wants peace of mind The statistics could under-estimate how many people would claim eg if recommended in **4(a)** She cannot afford the additional cost She thinks the medical costs will be lower than estimated The statistics could over-estimate how many people would claim She may be covered elsewhere	E1ft	ft from their recommendation in **4(a)** if no recommendation in **4(a)** then mark as if **not** recommended

Q	Answer	Mark	Comments
	Durations fully correct	B1	accept in either column
	Immediate predecessors all correct in correct column	B2	B1 for 11 or more correct in either column accept blanks or similar for A and B predecessors can be in any order

Additional guidance

Task	Activity	Immediate predecessor(s)	Duration (hours)
A	Remove furniture	-	2
B	Remove blinds	-	1.5
C	Remove carpet tiles	A	1
D	Prepare ceiling	B, C	1
E	Prepare walls	B, C	2
F	Paint ceiling	D	2
G	Paint walls	E	4
H	Allow paint to dry	F, G	6
I	Prepare floor	H	1
J	Install carpet tiles	I	2
K	Install blinds	H	2.5
L	Replace furniture	J	2
M	Check redecoration and clean	K, L	1

5 (a)

Q	Answer	Mark	Comments
5 (b)	Forward pass fully correct	B2	B1 one error
	Backward pass fully correct	B2ft	B1 one error ft their forward pass
	Additional guidance		
	A cumulative error counts as one error Incorrect but identical earliest start times of D and E, or K and I count as one error Incorrect but identical latest finish times for K and L, or F and G, or B and C count as one error		

Q	Answer	Mark	Comments
5 (c)	ACEGHIJLM	B1ft	ft or correct ft their critical path which must start at A or B and must finish at M

Q	Answer	Mark	Comments
	At least four tasks plotted correctly	M1	ignore floats
	Critical tasks plotted accurately	M1	must not have floats A, C, E, G, H, I, J, L, M
	At least two floats of correct duration plotted	M1	
	All correct including timescale evenly spaced and horizontal axis labelled with hours	A1ft	ft their activity network
	Additional guidance		
	ft their activity network throughout		
	Accept tasks drawn elsewhere on the diagram if labelled unambigously		
5 (d)			

Q	Answer	Mark	Comments
5 (e) (i)	8 am or 08:00	B1ft	oe
			ft or correct
			ft their earliest start time for activity H
			ie 5 pm – their earliest start time for activity H
	Additional Guidance		
	ft Gantt chart or network diagram		
	Time must be between 7 am and 5 pm		

Q	Answer	Mark	Comments
5 (e) (ii)	1 pm or 13:00	B1ft	oe
			ft or correct
			ft the difference between
			the latest finish time of activity M
			and
			the earlier of the start times of activities I and K
			or
			the latest finish time of activity H
			ie 7 am + their difference
	Additional Guidance		
	ft Gantt chart or network diagram		
	Time must be between 7 am and 5 pm		

Q	Answer	Mark	Comments
6 (a)	**Alternative method 1**		
	1 − 0.974 or 0.026	M1	oe decimal, fraction or percentage
	their 0.026 × 0.02 or 0.00052	M1dep	oe decimal, fraction or percentage
	0.052	A1	
	Alternative method 2 (assumes number of trains, eg 1000)		
	1000 − (0.974 × 1000) or (1 − 0.974) × 1000 or 26	M1	oe decimal, fraction or percentage
	their 26 × 0.02 or 0.52	M1dep	oe decimal, fraction or percentage
	0.052	A1	

Q	Answer	Mark	Comments
6 (b)	3370 ÷ 57.6 (× 40.4) or 58.5(…) (× 40.4) or 3370 ÷ 0.576 (× 0.404) or 5850.(…) (× 0.404) or 2363.6… or 2363.7	M1	
	2363 or 2364	A1	accept 2360

Q	Answer	Mark	Comments
6 (c)	Valid comment eg the statistics are representative of Scotland as well as the UK	E1	

	Additional guidance	
	The percentages haven't changed	E1
	The percentages are the same as in the table	E1
	That you can't have a fraction of a train	E0
	There were exactly 3370 trains late due to rail infrastructure	E0
	1% of the trains late is 59	E0

Q	Answer	Mark	Comments
7 (a)	0.4 for No and 0.6 for Yes	B1	oe fraction, decimal or percentage
	0.7 for Fewer than six and 0.3 for At least six	B1	oe fraction, decimal or percentage

	Additional guidance	
	Percentages without % signs, eg 40	B0 B0

Q	Answer	Mark	Comments
7 (b)	**Alternative method 1**		
	their 0.6 × their 0.7 or 0.42	M1	oe fraction, decimal or percentage
	their 0.6 × their 0.3 or 0.18	M1	oe fraction, decimal or percentage
	their 0.42 × 3 × 200 or 252 or their 0.18 × 12 × 200 or 432	M1	
	their 252 + their 432	M1	
	684	A1ft	ft their diagram from **7(a)**
	Alternative method 2		
	their 0.6 × their 0.7 or 0.42	M1	oe fraction, decimal or percentage
	their 0.6 × their 0.3 or 0.18	M1	oe fraction, decimal or percentage
	their 0.42 × 3 + 0.18 × 12 or 3.42	M1	
	their 3.42 × 200	M1	
	684	A1ft	ft their diagram in **7(a)**

Q	Answer	Mark	Comments
7 (c)	**Alternative method 1**		
	their 0.42 × 3 × (200 − 150) or 63 or their 0.18 × 12 × (200 − 150) or 108	M1	ft their probabilities from **7(a)** or **7(b)**
	600 + their 63 + their 108	M1	
	(£)771	A1ft	
	Do not recommend as the insurance is more than the expected costs or Do not recommend as the expected costs are only 684 or Do not recommend as the insurance is £87 more than the expected costs.	E1ft	ft their £684 from **7(b)** must be consistent with their expected cost found using probabilities and their expected cost from **7(b)**
	Alternative method 2		
	their 0.42 × 3 × 150 or 189 or their 0.18 × 12 × 150 or 324	M1	ft their probabilities from **7(a)** or **7(b)**
	their 189 + their 324	M1	
	(£) 513 or (£) 87	A1ft	
	Do not recommend as the expected income from the insurance is (£87) less than the cost of the policy	E1ft	must be consistent with their expected value found using probabilities