Level 3 Certificate
Mathematical Studies

1350/2B – Paper 2B – Critical path and risk analysis

Mark scheme

1350

June 2018

Version/Stage: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

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Q	Answer	Mark	Comments
1a	71.5	B1	
	Additional Guidance		

Q	Answer	Mark	Comments
1b	**Graph 1**: EU immigration in the UK	E4	E1 for each valid improvement with a maximum of E2 for each graph
	Identify 'm' as millions or state what 'm' means		Ignore any additional but incorrect suggestions
	Reposition 'm'		
	Use grid/graph paper to enable more accurate readings		Not label the axes
	Extend the all curves to 2045/ same point		Not make lines distinct from each other
	Add a broken axis		Not define 'high' or 'low'
	Add a line for high net migration		Not make a bar chart
	The starting point for each line should be the same		
			SC1 (two errors identified but no suggestions for improvement)
	Graph 2: Brexit's impact on the pound		SC2 (three errors identified but no suggestions for improvement)
	Use a key		
	Indicate what 'NIESR' or 'OECD' stands for		eg. Don't know what 'm' stands for, line not extended to 2045 etc
	Use lines/points rather than bars		
	Switch or remove the higher and lower labels		
	Add more organisations		
	Add space between each column		
	Add (horizontal) grid lines		
	Make it clear which currency they are comparing with		
	Additional Guidance		

Q	Answer	Mark	Comments
1c	**Alternative method 1**		
	14 600 000 000 ÷ 52 or $1.46 \times 10^{10} \div 52$ or 14.6 ÷ 52 or [280 000 000, 281 000 000]	M1	oe
	[280 000 000, 281 000 000] **and** No	A1	oe SC1 14 600 000 000 ÷ 48 = 304million **and** No
	Alternative method 2		
	350 000 000 × 52 or $3.5 \times 10^{8} \times 52$ or [18 000 000 000, 18 300 000 000]	M1	oe
	[18 000 000 000, 18 300 000 000] **and** No	A1	oe SC1 350 000 000 × 48 = 16.8billion **and** No
	Alternative method 3		
	14.6billion ÷ 350million	M1	
	41.7 **weeks and** No or 41.7 **and** 52 **and** No	A1	
	Additional Guidance		
	For use of [48, 52) use SC1 rule		
	Use of 365 ÷ 7 or 365.25 ÷ 7 in place of 52 is correct		
	Allow use of words such as million/billion or standard form rather than full ordinary figures		
	'Exaggeration' implies No		
	For final answer, allow self-correction		

Q	Answer	Mark	Comments
1d	**Tim** **Alternative method 1**		
	(46 500 001 – 33 577 342) ÷ 46 500 001 or 12 922 659 ÷ 46 500 001 or 0.278 or 33 577 342 ÷ 46 500 001 or 0.72	M1	oe Condone interchange of 33 577 342 with 33 551 983 accept [0.26, 0.285] or [27, 28]% accept [0.715, 0.74] or [71.5, 74]%
	0.278 or 27.8(%) **and** No or 72 **and** 80 **and** No	A1	accept [0.27, 0.28] or [27, 28]% accept [71.5, 74]%
	Tim **Alternative method 2**		
	0.2 ✖ 46 500 001 or 9 300 000 **and** 46 500 001 – 33 577 342	M1	accept [9 200 000, 9 400 000] accept [46 000 000, 13 000 000] Condone interchange of 33 577 342 with 33 551 983
	9 300 000 **and** 12 922 659 **and** No	A1	
	Kelly **Alternative method 1**		
	16 141 241 ÷ 12 or 1 345 103 **and** 17 410 742 ÷ 1 345 103 or 12.9(…)	M1	allow reverse order
	12.9(...) **and** Yes or 12.0(…) **and** Yes	A1	
	Kelly **Alternative method 2**		
	16 141 241 ÷ 17 410 742 or [0.925,0.928] or 12 ÷ 13 or 0.923	M1	allow reverse order
	[0.925,0.928] **and** 0.923 **and** Yes	A1	

Kelly **Alternative method 3**			
33 551 983 ÷ 25 ×12 or 16 104 951.(84) or 33 551 983 ÷ 25 ×13 or 17 447 031.(16)		M1	Condone interchange of 33 577 342 with 33 551 983
16 104 951 **and** 17 447 031 **and** Yes		A1	
Kelly **Alternative method 4**			
12 ÷ 25 or 0.48 or 13 ÷ 25 or 0.52		M1	oe
0.48 **and** 0.52 **and** Yes		A1	oe
Kelly **Alternative method 5**			
16 141 241 ÷ 12 or 1 345 103 and 17 410 742 ÷ 13 or 1 339 288		M1	
1 345 103 **and** 1 339 288 **and** Yes		A1	
Larissa			
2 000 000 + 16 141 241 or 18 141 241 or 2 000 000 + 33 577 342 or 35 577 342 or 2 000 000 + 33 551 983 or 35 551 983		M1	Condone interchange of 33 577 342 with 33 551 983
18 141 241 ÷ 35 577 342 (×100)	18 141 241 ÷ 35 551 983 (×100)	M1	oe Condone interchange of 33 577 342 with 33 551 983
0.509(…) or 0.51 **and** No (from using 35 577 342)	0.5102(…) or 0.5103 **and** Yes (from using 35 551 983)	A1	oe A1 for the correct answer **and** statement SC1 for 54.(...)%
Additional Guidance			
Be careful not all possible alternatives are shown for this question.			
Any fully correct method gains full marks.			
Condone interchange of 33 577 342 with 33 551 983			

Q	Answer	Mark	Comments
2	**Alternative method 1 – Euros**		
	1.08 ÷ 0.9 or 1.2	M1	
	17 000 × their 1.2 or 20 400	M1	Allow 1.08 or 1.188 or 1.19 in place of 1.2 to obtain 18 360 or 20 196 or 20 230
	253 000 × 1.125 or 284 625	M1	oe
	their 284 625 × 1.08 or 307 395	M1	oe
	their 20 400 + 307 395 or 20 400 + their 307 395 or 327 795	M1	
	327 795 **and** Yes	A1	SC4 for 325 755 or 327 591or 327 625
	Alternative method 2– Pounds		
	1.08 ÷ 0.9 or 1.2	M1	
	17 000 × their 1.2 or 20 400	M1	Allow 1.08 or 1.188 or 1.19 in place of 1.2 to obtain 18 360 or 20 196 or 20 230
	253 000 × 1.125 or 284 625	M1	oe
	their 20 400 ÷ 1.08 or 18 888.(89) or 327 500 ÷ 1.08 or 303 240.(74)	M1	oe
	their 18 888.(89) + 284 625 or 18 888.(89) + their 284 625 or 303 513.(89)	M1	
	303 513.(89) and 303 240.(74) **and** Yes	A1	SC4 for 301 625 or 303 325 or 303 356.(4815)
	Additional Guidance		
	Alternative 2: Method of 17 000 ÷ 0.9 (=18 888.89) scores the 1st M1, 2nd M1 and 4th M1		

Q	Answer	Mark	Comments
3(a)	91 or 179 seen	M1	oe
	91/179	A1	or 0.51 or 0.508

Q	Answer	Mark	Comments
3(b)	Office B	B1	
	A higher proportion of people walk or a lower proportion of people go by car or More people walk **and** fewer go by car	E1	Or other sensible reason "More people walk and cycle" is not sufficient.

Q	Answer	Mark	Comments
4(a)	$P(D\|S) = P(D) \quad (= \frac{3}{4})$ or The probabilities on the second branches are the same: having a smart TV has not changed the probability of having a dishwasher or $P(D \cap S) = \frac{3}{10}$ and $P(D) \times P(S) = \frac{3}{10}$	E1	

Q	Answer	Mark	Comments
4(b)(i)	$\frac{3}{5} \times \frac{1}{4} \times 1220$	M1	oe
	183	A1	Accept 180 with working

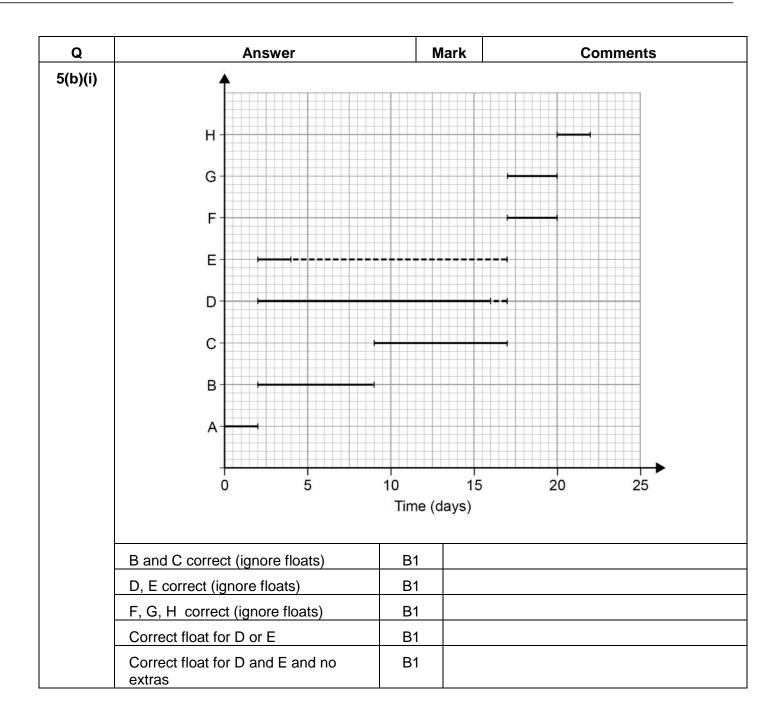| Q	Answer	Mark	Comments
4(b)(ii)	Assumption that the students in Hugo's survey are representative of the students in the school as a whole	E1	Or other reasonable answer

Q	Answer	Mark	Comments
5(a)(i)			

All letters correct		B1	
All durations correct		B1	
Forward pass correct		B1	
Backward pass correct		B1	

Q	Answer	Mark	Comments
5(a)(ii)	ADFH	B1	

Q	Answer	Mark	Comments
5(a)(iii)	17 days		

Q	Answer	Mark	Comments
5(a)(iv)	2 + 7 + 8 + 3 + 3 + 2 or 1 extra day	M1	
	25 (days)	A1	

Q	Answer	Mark	Comments
5(b)(i)			
	B and C correct (ignore floats)	B1	
	D, E correct (ignore floats)	B1	
	F, G, H correct (ignore floats)	B1	
	Correct float for D or E	B1	
	Correct float for D and E and no extras	B1	

Q	Answer	Mark	Comments
5(b)(ii)	13 days	B1ft	Follow through a non-zero float from (b)(i)

Q	Answer	Mark	Comments
6(a)	0.68×0.80 or 0.544	M1	
	0.32×0.49 or 0.1568	M1	
	0.7008 or 0.701	A1	Accept 0.7(0) with working
Guidance			
Candidates may use a tree diagram			

Q	Answer	Mark	Comments
6(b)	3500 or 3504 or 3505	B1ft	Ft their answer to 6(a)

Q	Answer	Mark	Comments
6(c)	0.66×0.75 or 0.495 or $(1 - 0.66)x$	M1	
	$(1 - 0.66)x + 0.495$ (=0.69)	M1	
	their $0.34x = 0.195$ or $x = 0.5735 \ldots$ or $x = 0.574$	M1	
	$(x =)0.57$	A1	Must be to 2 sig. fig.

Q	Answer	Mark	Comments
7 (a)	2 × 3000 or 6000 or 12 × 3000 or 36 000	B1	For working out cost of option C, either for 12 weeks or final two weeks
	0.4 × 0.9 or 0.36	B1	For working out the probability of a one week delay
	0.4 × 0.1 or (0.4 – 0.36) or 0.04	B1	For working out the probability of a two week delay
	0.36 × 9000 or 0.04 × 18000 or 0.40 × 9000 or 0.36 × 39000 or 0.04 × 48000 or 0.04 × 42000 or 0.4 × 39000 or 0.04 × 9000	M1	For working out the (extra) cost of 11 weeks or 12 weeks
	0.36 × 9000 + 0.04 × 18000 or 0.4 × 9000 + 0.04 × 9000 or 3960 or 10 × 3000 + 0.36 × 9000 + 0.04 × 18000 or 10 × 3000 + 0.4 × 9000 + 0.04 × 9000 or 0.6 × 30000 + 0.36 × 39000 + 0.04 × 48000 or 0.6 × 30000 + 0.4 × 39000 + 0.04 × 9000 or 33960	M1	For valid method to work out the expected cost of option A, either for 12 weeks or final two weeks
	3000 + 0.04 × 9000 or 3 360 or 33000 + 0.04 × 9000 or 0.6 × 33000 + 0.36 × 33000 + 0.04 × 42000 or 33 360	M1	For valid method to work out the expected cost of option B, either for 12 weeks or final two weeks

	(Option A) £33 960 or £3960 and (Option B) £33 360 or £3360 and (Option C) £36 000 or £6000	A1	
	Recommends Option B after using probabilities to find expected values	E1	Follow through Option A or Option C if consistent with their expected values

Q	Answer	Mark	Comments
7 (b)	(£640 × 5 =) £3200	B1	Cost of additional worker for five weeks
	Comparison of £3200 with their £3360 or £33 200 with their £33 360 **and** Yes, they should employ the extra worker.	E1 ft	Follow through correct conclusion based on their comparison