Mark Scheme (Pre-standardisation)

Summer 2018

Pearson Edexcel GCE Mathematics
In Decision D1(8FM0/27)

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

EDEXCEL GCE MATHEMATICS

General Instructions for Marking

1. The total number of marks for the paper is 40.

2. The Edexcel Mathematics mark schemes use the following types of marks:

- **M** marks: method marks are awarded for 'knowing a method and attempting to apply it', unless otherwise indicated.
- **A** marks: Accuracy marks can only be awarded if the relevant method (M) marks have been earned.
- **B** marks are unconditional accuracy marks (independent of M marks)
- Marks should not be subdivided.

3. Abbreviations

These are some of the traditional marking abbreviations that will appear in the mark schemes.

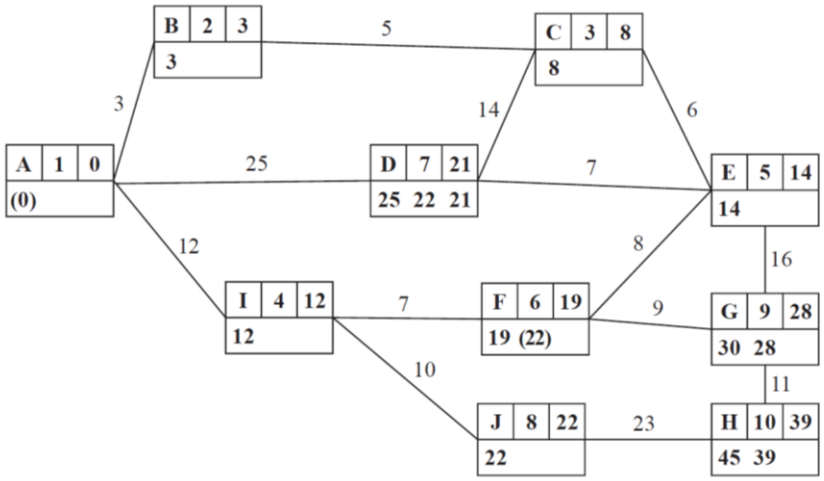
- bod – benefit of doubt
- ft – follow through
- the symbol $\surd$ will be used for correct ft
- cao – correct answer only
- cso - correct solution only. There must be no errors in this part of the question to obtain this mark
- isw – ignore subsequent working
- awrt – answers which round to
- SC: special case
- oe – or equivalent (and appropriate)
- dep – dependent
- indep – independent
- dp decimal places
- sf significant figures
- * The answer is printed on the paper
- ⌐ The second mark is dependent on gaining the first mark

4. All A marks are 'correct answer only' (cao.), unless shown, for example, as A1 ft to indicate that previous wrong working is to be followed through. After a misread however, the subsequent A marks affected are treated as A ft, but manifestly absurd answers should never be awarded A marks.

5. For misreading which does not alter the character of a question or materially simplify it, deduct two from any A or B marks gained, in that part of the question affected.

6. If a candidate makes more than one attempt at any question:
   - If all but one attempt is crossed out, mark the attempt which is NOT crossed out.
   - If either all attempts are crossed out or none are crossed out, mark all the attempts and score the highest single attempt.

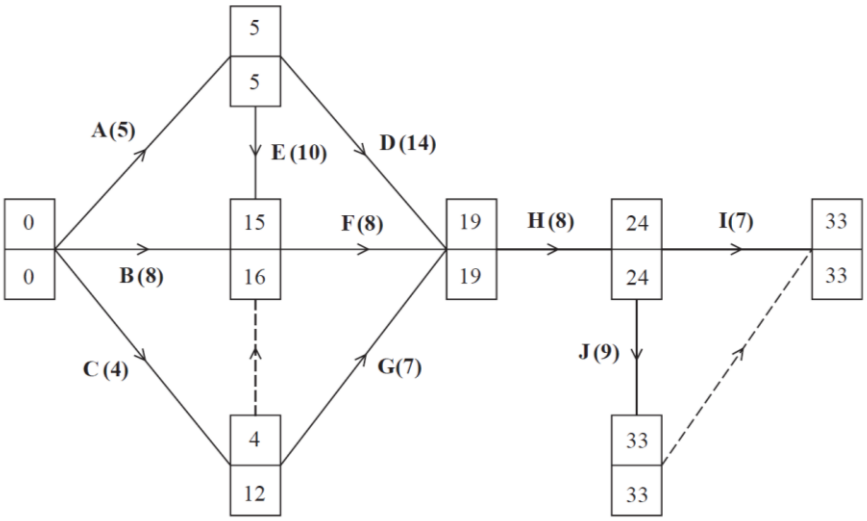
7. Ignore wrong working or incorrect statements following a correct answer.

Question	Scheme	Marks	AOs
1(a)	**(i)** 	M1 A1 A1 A1ft	1.1b 1.1b 1.1b 1.1b
	Shortest time to travel from A to H is 39 minutes	A1ft	1.1b
	(ii) Quickest route is AIFGH	A1	1.1b
		(6)	
(b)	$1.5\times\left(\frac{9500}{250}\right)^2$	M1	1.1a
	= 2166 seconds	A1	1.1b
		(2)	
(c)	order of n^2 does not mean that the order is proportional to n^2 (which is the assumption behind the answer in part (b)) but merely means that the dominant term is of order n^2	B1	3.2b
		(1)	
			(9 marks)

Notes for Question 1
(a)(i) **M1:** For a larger number replaced by a smaller one in the working values boxes at D, G or H **A1:** For all values correct (and in correct order) at A, B, C, I and E **A1:** For all values correct (and in correct order) at F and D **A1ft:** For all values correct (and in correct order) on the follow through at G and H **A1ft:** Follow through their final value at H **(ii) A1:** Cao **(b)** **M1** Complete method – allow 250/9500 (but must be squared) **A1:** Cao (accept 2170) **(c)** **B1:** Cao

Question	Scheme	Marks	AOs
2(a)	Minimum number of arcs is 3	B1	2.2a
	Maximum number of arcs is 6	B1	2.2a
		(2)	
(b)	(i) e.g. 	B1	1.1b
	(ii) The graph has exactly two odd nodes and so the graph is semi-Eulerian	B1 DB1	2.4 2.2a
		(3)	
(c)	The sum of the orders of the vertices = 2(number of arcs) = 10	B1	1.2
	One possibility is that the orders are 1, 3, 3 and 3	M1	2.1
	In a simply connected graph with four vertices each of the vertices of order 3 must connect to the three other vertices therefore it is not possible to have three vertices all with order 3	A1	2.4
	The second possibility is that the orders are 2, 2, 3 and 3	M1	2.1
	There is only one way to make a graph with vertices of orders 2, 2, 3 and 3 as the two vertices of order 2 cannot be connected to each other (note that as the graph is connected no node can have order 0). There are no other possible graphs as the maximum order of a node is 3 (due to the condition that the graph must be simple).	A1	2.2a
		(5)	
			(10 marks)

Notes for Question 2
(a) **B1:** Cao **B1:** Cao
(b)(i) **B1:** Cao **(b)(ii)** **B1:** Explanation considering that the graph consists of exactly two nodes **DB1:** Deduction that therefore it is semi-Eulerian
(c) **B1:** 10 seen (but not from incorrect working) **M1:** Considers the vertex orders being either 1, 3, 3, 3 or 2, 2, 3,3 **A1:** Convincing argument that 1, 3, 3, 3 is not possible **M1:** Considers the second possibility (or states that the only possibility is 2, 2, 3, 3) **A1:** Convincing argument that there is only one way of making 2, 2, 3, 3 and no other graphs

Question	Scheme	Marks	AOs
3(a) and (b)		M1 A1 A1 **(3)** M1 M1 A1 **(3)**	1.1b 1.1b 1.1b 1.1b 1.1b 1.1b
(c)	The critical activities are A, D, H and J	B1	1.1b
		(1)	
(d)(i)	No effect as G is not one of the critical activities	B1	2.4
(d)(ii)	Activity C is the only affected activity and it can now start 4 days later at time 12 (rather than at time 8) (or finish as late as time 16)	M1 A1	3.4 1.1b
		(3)	
			(10 marks)

Notes for Question 3
(a) **M1:** Two of activities D, E, G, J added together with at least one dummy **A1:** All four activities added correctly including arrows (with no additional activities) **A1:** Both dummies added correctly including arrows (with no additional activities)
(b) **M1:** All top boxes complete, numbers generally increasing in the direction of the arrows (dependent on M mark in (a)) **M1:** All bottom boxes complete, numbers generally decreasing in the opposite direction of the arrows (dependent on the M mark in (a)) **A1:** Cao
(c): Cao (A, D, H and J)
(d)(i) **B1:** Clear explanation that there is no effect on the completion time as G is not critical
(d)(ii)
M1: Use their model to deduce that C is the only activity that is affected **A1:** Correct answer that activity C can e.g. finish at time 16

Question	Scheme	Marks	AOs
4(a)	x is the number of cabinets produced in week 1, y is the number of cabinets produced in week 2 and z is the number of cabinets produced in week 3	B1	2.5
		(1)	
(b)	$x+y\leq z$ $z\leq 2y$ $y+z\leq 125$ $(x,y,z\geq 0)$	B1 B1	3.3 3.3
		(2)	
(c)(i)	Objective is $P=250x+275y+200(150-x-y)$	M1	3.1a
	$P = 50x + 75y$ (+ 30000)	A1	1.1b
	Objective line drawn or at least two vertices tested	M1	3.1a
	Optimal point $\left(25,\frac{125}{3}\right)$	A1	1.1b
	Point testing around optimal point	M1	1.1b
	Correct integer coordinate (25, 42)	A1	1.1b
	The production schedule is 25 cabinets in week 1, 42 cabinets in week 2 and 83 cabinets in week 3	B1	3.2a
	(ii) Total cost of production is £34 400	B1	1.1b
		(8)	
			(11 marks)

Notes for Question 4
(a) **B1:** Cao - must contain ‘number of…’
(b) **B1:** Any two correct **B1:** All three correct
(c)(i) **M1:** Attempt to derive new objective function in terms of x and y only **A1:** Cao for objective in terms of x and y only **M1:** Correct objective line drawn or correctly testing two of their vertices in $k(2x+3y)$ **A1:** Correct optimal point $\left(25, \frac{125}{3}\right)$ **M1:** Testing integer coordinates in the correct pair of inequalities **A1:** Correct integer coordinate (25, 42) stated <u>and</u> either clear rejection of (26, 41) (by checking in correct pair if inequalities) <u>or</u> testing of (27, 41) in a correct objective function **B1:** Cao (in context – so not in terms of x, y and z) **(ii)** **B1:** Cao

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