Pearson Edexcel

Mark Scheme (Results)

Summer 2025

Pearson Edexcel GCE
In AS Further Mathematics (8FM0)
Paper 27 Decision Mathematics 1

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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.

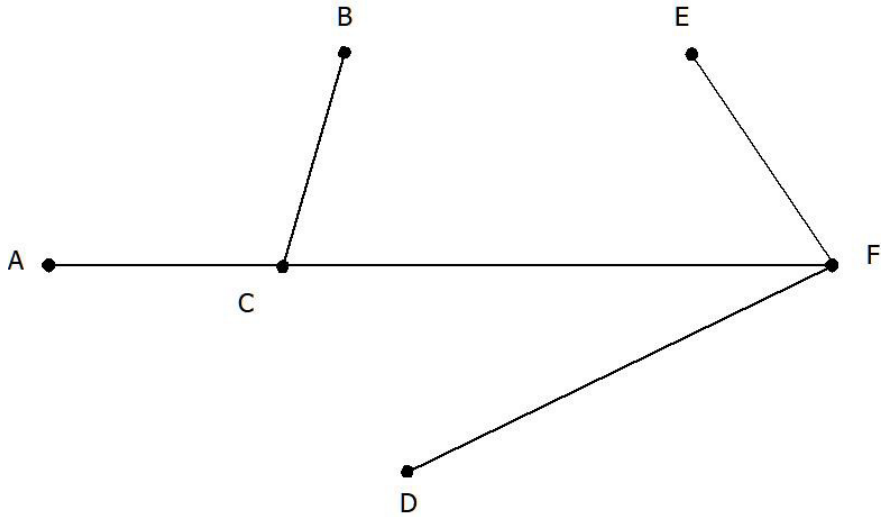
- bod – benefit of doubt
- ft – follow through
- the symbol $\surd$ will be used for correct ft
- cao – correct answer only
- cso - correct solution only. There must be no errors in this part of the question to obtain this mark
- isw – ignore subsequent working
- awrt – answers which round to
- SC: special 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. 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.

5. Where a candidate has made multiple responses and indicates which response they wish to submit, examiners should mark this response.
   If there are several attempts at a question which have not been crossed out, examiners should mark the final answer which is the answer that is the most complete.

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

7. Mark schemes will firstly show the solution judged to be the most common response expected from candidates. Where appropriate, alternatives answers are provided in the notes. If examiners are not sure if an answer is acceptable, they will check the mark scheme to see if an alternative answer is given for the method used.

Question	Scheme	Marks	AOs
1(a)	16 10 25 30 13 12 28 22 23 20 10 16 25 13 12 28 22 23 20 **30** 10 16 13 12 25 22 23 20 **28** **30** 10 13 12 16 22 23 20 **25** **28** **30** 10 12 13 16 22 20 **23** **25** **28** **30** 10 12 13 16 20 **22** **23** **25** **28** **30** 10 12 13 16 20 22 23 25 28 30 (sort complete)	**M1** **A1** **A1CSO**	1.1b 1.1b 1.1b
		(3)	
(b)	AC (10), BC (12), CF (20), EF (16), DF (25)	**M1** **A1**	1.1b 1.1b
		(2)	
(c)(i)		**B1**	2.2a
(ii)	83	**B1**	2.2a
		(2)	
			(7 marks)

Notes	
a1M1	Bubble sort using all 10 numbers (condone one error or omission). Consistent direction, end number (30) in place and list beginning with correct three numbers (10, 16, 25). Quick sort scores **M0**.
a1A1	First, second and third passes correct – so end three numbers (25, 28, 30) in place.
a2A1	CSO (previous two marks must have been awarded in this part). Must state **either** 'sort/algorithm complete' **or** show 6th pass showing no swaps/changes.
SC	Bubble sort from right hand end of list:

16	10	25	30	13	12	28	22	23	20
10	16	12	25	30	13	20	28	22	23
10	**12**	16	13	25	30	20	22	28	23
10	**12**	**13**	16	20	25	30	22	23	28
10	**12**	**13**	**16**	**20**	22	25	30	23	28
10	**12**	**13**	**16**	**20**	**22**	**23**	25	30	28
10	**12**	**13**	**16**	**20**	**22**	**23**	**25**	**28**	30
10	12	13	16	20	22	23	25	28	30

M1 Consistent direction, end number (10) in place and list ending with correct three numbers (28,22,23).

A1 First, second and third passes correct – so first three numbers (10,12,13) in place.

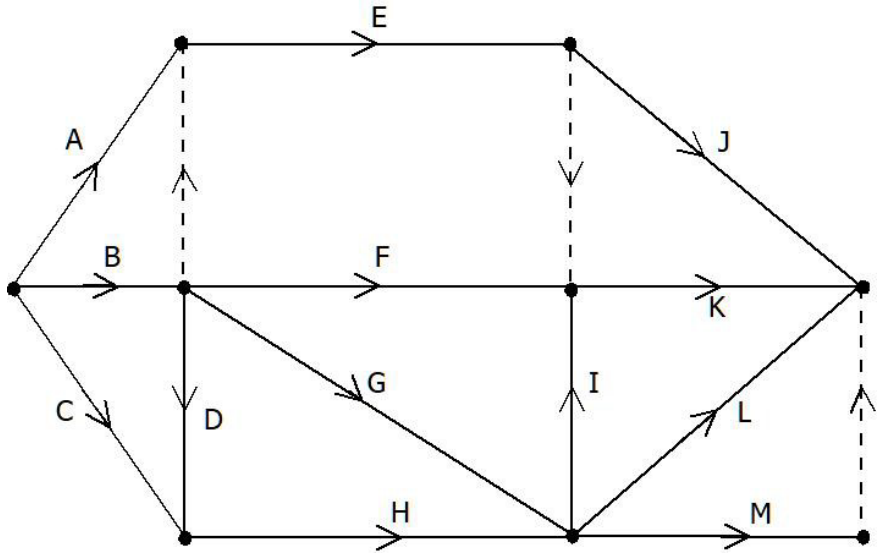
A1 CSO (previous two marks must have been awarded in this part). Must state **either** 'sort complete' **or** show 7th pass showing no swaps/changes.

SC **If the candidate sorts into descending order from left hand side they can score M1 only for a fully correct sort (even if reversed). (see below)**

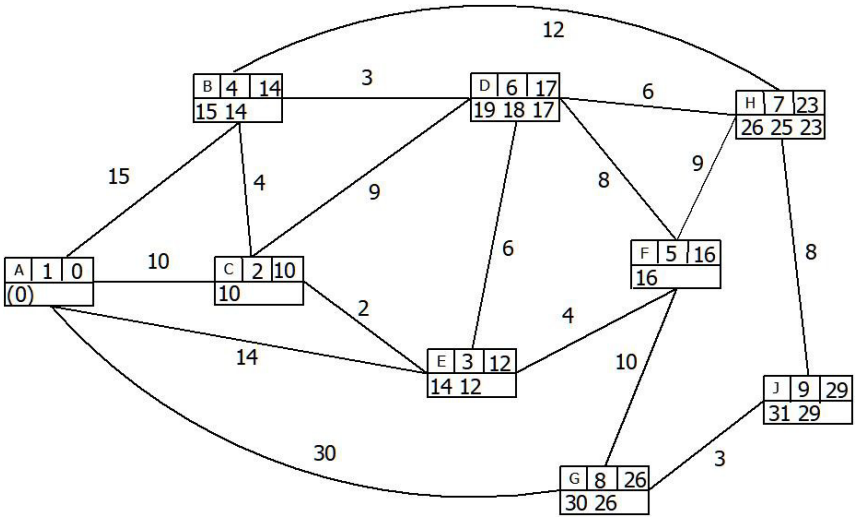
b1M1	First three arcs correctly chosen in order. Any rejection seen implies M0.
b1A1	All 5 arcs correctly chosen in order.
SC	All 6 nodes written in the correct order ACBFED scores M1A0
c(i) 1B1	Correct tree drawn.
c(ii) 1B1	CAO

Descending from left-hand side (maximum M1A0A0)

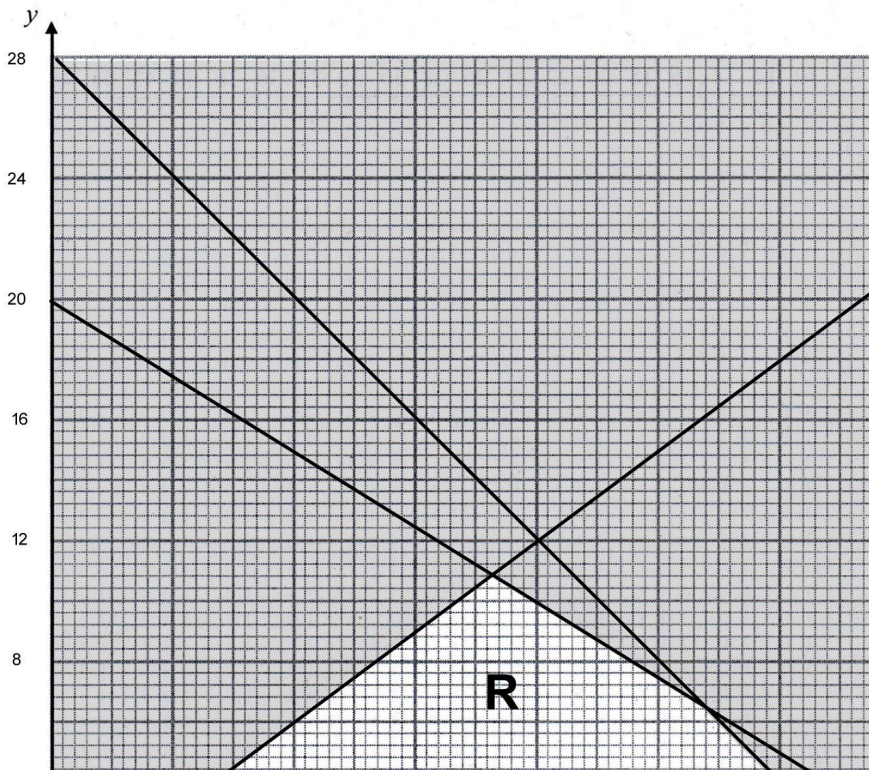
16	10	25	30	13	12	28	22	23	20
16	25	30	13	12	28	22	23	20	**10**
25	30	16	13	28	22	23	20	**12**	**10**
30	25	16	28	22	23	20	**13**	**12**	**10**
30	25	28	22	23	20	**16**	**13**	**12**	**10**
30	28	25	23	**22**	**20**	**16**	**13**	**12**	**10**
30	**28**	**25**	**23**	**22**	**20**	**16**	**13**	**12**	**10**

Question	Scheme	Marks	AOs
2(a)	e.g. Activity D (or F or G) is preceded by activity B only, but activity E is preceded by both activity A and activity B.	**B1**	2.4
		(1)	
(b)		**M1** **A1** (ABCDE) **A1** (FGHJ) **A1** (IKLM) **A1**	1.1b 1.1b 1.1b 1.1b 1.1b
		(5)	
(c)	15 (hours)	**B1**	3.1b
		(1)	
(d)	A C E F G J L M	**B1**	2.2a
		(1)	
			(8 marks)

Notes	
a1B1	e.g. Reference to D (or F or G) is preceded by B only, E depends on both A and B (oe). Reference to J is preceded by E only, K depends on E **and** F and/or I L and M have the same **start** node **and finish** node
(b)	Condone lack of, or incorrect, numbered events throughout. 'Dealt with correctly' means that the activity starts from the correct event but need not necessarily finish at the correct event e.g. 'K dealt with correctly' requires the correct precedences for this activity, i.e. E, F and I labelled correctly and leading into the same node and K starting from that node but do not consider the end event for K. **Activity on node is M0** If an arc is not labelled, for example, if the arc for activity E is not labelled (but the arc is present) then this will lose the first A mark and the final (CSO) A mark – they can still earn the second A mark on the bod. If two or more arcs are not labelled then mark according to the scheme. Assume that a solid line is an activity which has not been labelled rather than a dummy (even if in the correct place for where a dummy should be). **Ignore incorrect or lack of arrows on the activities for the first four marks only**
b1M1	At least eight activities labelled on arc, one start and at least two dummies placed.
b1A1	Activities A, B, C, D and E dealt with correctly and first dummy (from end B to end A) and arrow dealt with correctly.
b2A1	Activities F, G, H and J dealt with correctly and "second" dummy (from end E to end F) and arrow dealt with correctly.
b3A1	Activities I, K, L and M and "final" dummy and arrow dealt with correctly.
b4A1	CSO All arrows present and correctly placed with one finish, no additional dummies and no additional activities. **Please check all arcs carefully for arrows – if there are no arrows on any dummies then M1 only.** **Note that additional (but unnecessary) 'correct' dummies that still maintain precedence for the network should only be penalised with the final A mark if earned. Note that this answer is not unique (e.g. L and M are interchangeable or this dummy could be at the start of M)**
c1B1	CAO
d1B1	CAO

Question	Scheme	Marks	AOs
3(a)	e.g. Graph is **semi-Eulerian** because • exactly **two nodes/vertices** are of **odd** degree. • **D and G** are of **odd** degree.	**B1**	1.2
		(1)	
(b)(i)		**M1** **A1** (ACEB) **A1** (FDH) **A1ft** (GJ)	1.1b 1.1b 1.1b 1.1b
(ii)	Quickest path A to J is A C E F G J Shortest time is 29 (minutes)	**A1** **A1ft**	2.2a 1.1b
		(6)	
(c) (i)	A(CB)D + E(F)G = 17 + 14 = 31 A(C)E + D(HJ)G = 12 + 17 = 29 * A(CEF)G + DE = 26 + 6 = 32 Repeat AC, CE, DH, HJ, JG	**M1** **A1** **A1** **A1**	3.1b 1.1b 1.1b 2.2a
(ii)	Journey time = 153 – 14 + "29" = 168 (minutes)	**A1ft**	2.2a
		(5)	
(d) (i) (ii)	Start at G 23 (minutes)	**B1** **B1**	2.2a 2.2a
		(2)	
			(14 marks)

Notes	
a1B1	Correct statement. Accept Semi-Eulerian as only (vertices) D and G are odd (oe). Must include bold text. Condone missing "exactly" and/or "degree".
	In (b) all values at each node must be checked carefully, so the order of working values must be correct for the corresponding A marks to be awarded. **Order of labelling must also be checked carefully.** **Order of labelling must be in a strictly increasing sequence. Errors in the final values and working values are penalised before errors in the order of labelling.**
bi1M1	A larger working value replaced by a smaller value for at least two distinct vertices, B, D, E, G, H or J.
bi1A1	All values at A, C, E and B correct and working values in the correct order.
bi2A1	All values at F, D and H correct and working values in the correct order.
bi3A1ft	All values at G and J correct on follow through and working values in the correct order.
bi4A1	Correct path.
bii1A1ft	If their answer is not 29 then follow through their final value at J.
ci1M1	Three distinct pairings of A, D, E and G.
ci1A1	**Any** two rows correct including pairings **and** totals.
ci2A1	**All** three rows correct including pairings **and** totals.
ci3A1	CAO Five correct arcs clearly stated. Must be AC, CE, DH, HJ, JG.
cii1A1ft	CAO ft their "29", but must be their smallest from a choice of three totals.
diB1	CAO
diiB1	CAO (Repeat DE = 6 only, so save 29-6 = 23 minutes). No ft.

Question	Scheme	Marks	AOs
4(a)	$5x + 4y \leq 80$	**B1**	2.5
		(1)	
(b)(i)	$y \geq 4$ $2x + y \leq 28$ $3x \geq 2y$	 **B1** **M1** **A1**	 3.3 3.3 2.2a
(ii)	 Figure 3	**B1** **B1**	1.1b 2.2a
		(5)	
(c)	$(2^2/_3, 4)$ $P = 41\ ^1/_3$ 41.33 $(7\ ^3/_{11}, 10\ ^{10}/_{11})$ $P = 112\ ^8/_{11}$ 112.73 $(12, 4)$ $P = 116$ 116 $(10\ ^2/_3, 6\ ^2/_3)$ $P = 118\ ^2/_3$ 118.67 Optimal vertex $(10\ ^2/_3, 6\ ^2/_3)$ 11 sponge (cakes), 6 fruit (cakes)	**B1** **B1** **M1** **A1** **B1**	1.1b 1.1b 3.4 1.1b 3.2a
		(5)	
			(11 marks)

Notes	
a1B1	CAO Must be the correct inequality.
bi1B1	$y \geq 4$ and $2x + y \leq 28$ (oe) both correct.
bi1M1	$3x$ □ $2y$ where □ is any inequality sign or =, or $2x \geq 3y$
bi1A1	$3x \geq 2y$ correct
bii1B1	Any two lines correctly drawn. (Use the following to help you judge; send to review any that are worthy of credit). For $y = 4$ within one small square of (2,4) and (12,4) For $2x + y = 28$ within one small square of at least two of (0,28), (8,12) (12,4) or (14,0) For $3x = 2y$ within one small square of (0,0) and (8,12)
bii2B1	All three lines correctly drawn (with shading) and *R* correctly labelled.
c1B1	Two of the three non-optimal vertices correct or one correct with corresponding P value correct (P values should be exact or rounded to 2dp). Accept correct top-heavy fractions for coordinates and P values.
c2B1	Two non-optimal vertices correct with corresponding P values correct.
c1M1	Attempt to solve simultaneous equations for vertex (10 2/3, 6 2/3). May be implied by correct optimal vertex
c1A1	Correct optimal vertex and corresponding P value.
c3B1	CAO with context. If candidate has the incorrect feasible region (e.g following $2x = 3y$) award this mark even if the integer solution is outside their feasible region.
SC	Alt. Method – Candidate only considers integer solutions (3,4) P = 44 (8,10) P = 114 (12,4) P = 116 Optimal: (11,6) P = 118 **B1** Two non-optimal vertices correct with P value **B1** Three non-optimal vertices correct with P value **M1A1** correct optimal vertex and P value **B1** CAO with context

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