

General Certificate of Education
Advanced Level Examination

MATHEMATICS A

Discrete 1

Paper A

MARKING GUIDE

This guide is intended to be as helpful as possible to teachers by providing concise solutions and indicating how marks should be awarded. There are obviously alternative methods that would also gain full marks.

Method marks (M) are awarded for knowing and using a method.

Accuracy marks (A) can only be awarded when a correct method has been used.

(B) marks are independent of method marks.



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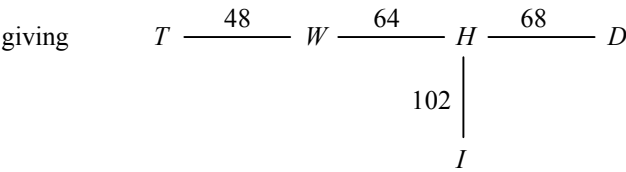
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D1 Paper A – Marking Guide

1. (a)

	order:	4	3	5	1	2
		Durness	Helmsdale	Inverness	Thurso	Wick
Durness		—	68	123	81	92
Helmsdale		68	—	102	72	64
Inverness		123	102	—	148	127
Thurso		81	72	148	—	48
Wick		92	64	127	48	—

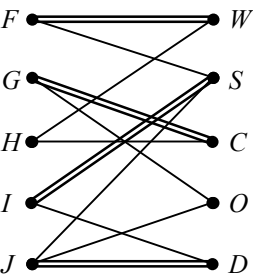


M2 A2

(b) 282 km

A1 (5)

2. (a)



M1 A1

- (b) initial matching shown by
search for alternating path giving e.g. $H - C = G - O$ (breakthrough)
change status giving $H = C - G = O$
complete matching e.g. $F - W, G - O, H - C, I - S, J - D$

M1 A1
M1
A1 (6)

3. (a)

x	a	b	$(a - b) < 0.01?$
100	50	26	No
–	26	14.923	No
–	14.923	10.812	No
–	10.812	10.0305	No
–	10.0305	10.00004	No
–	10.00004	10	Yes

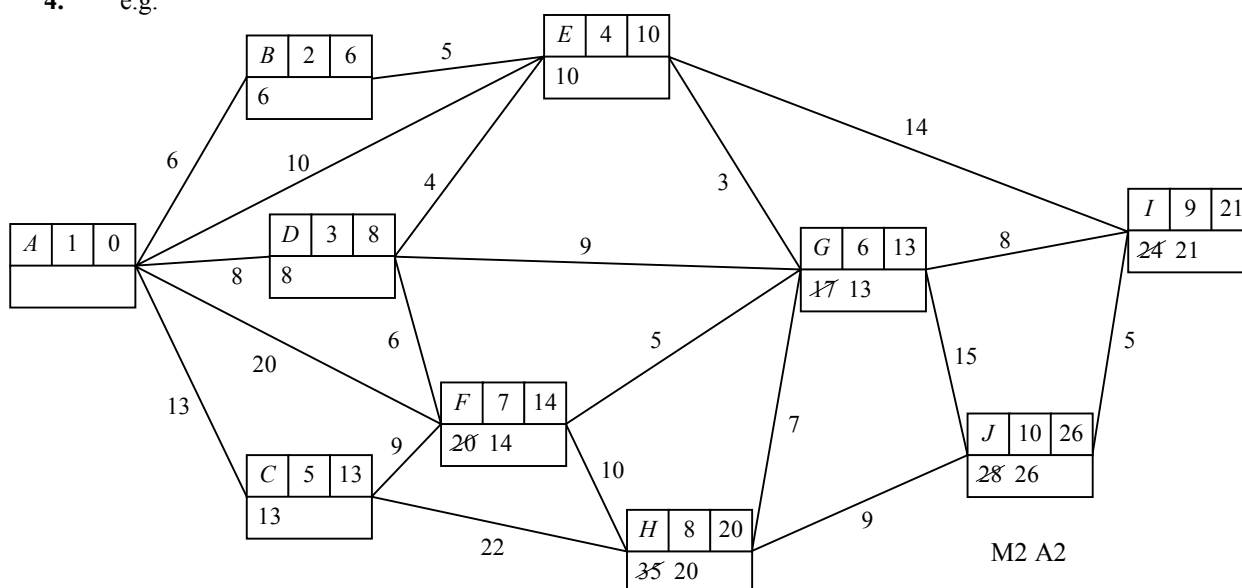
Final Output = 10

M2 A4

(b) it finds the square root of 100

B1 (7)

4. e.g.



label J – label I = 5 = weight IJ
 label I – label G = 8 = weight GI
 label G – label E = 3 = weight EG
 label E – label A = 10 = weight AE
 so $A E G I J$ is path of least weight; weight = 26

M1
A2 (7)

5. (a) e.g. there are 4 odd vertices, at each of these must arrive, leave and arrive again \therefore need to leave again to continue so must repeat

B2

(b) odd vertices are C, F, H and I

B1

shortest CF and HI = 132 + 134 = 266

CH and FI = 147 + 116 = 263

CI and FH = 233 + 72 = 305; \therefore lowest is 263

M1 A1

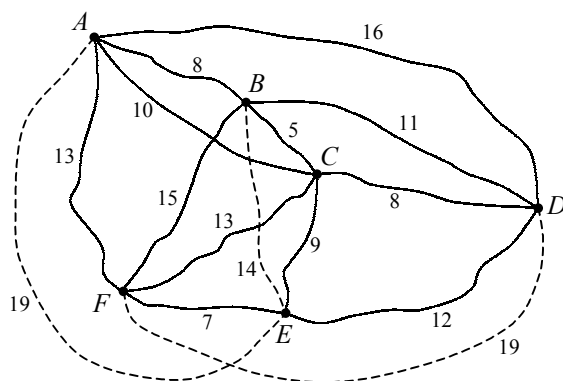
\therefore should repeat CD, DH and FI

A1

total = sum of all arcs + 263 = 902 + 263 = 1165 m

M1 A1 (8)

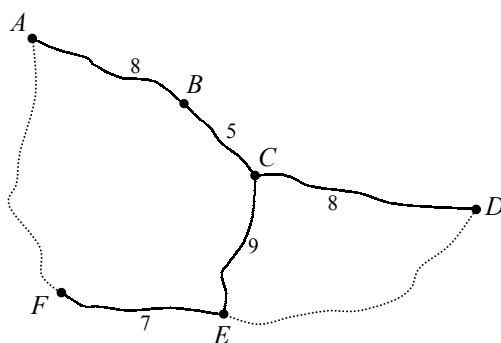
6. (a)



add $AE = 19$, $BE = 14$, $DF = 19$

M1 A1

(b)



M1 A1

weight of MST = 37 miles

initial upper bound = $2 \times 37 = 74$ miles

use AF saving $8 + 5 + 9 + 7 - 13 = 16$

use DE saving $8 + 9 - 12 = 5$

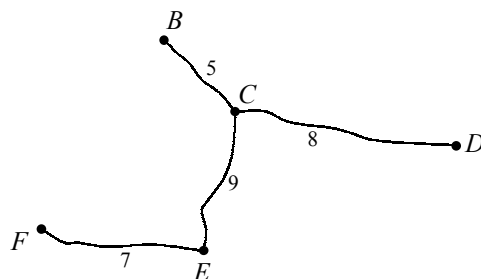
new upper bound = $74 - 16 - 5 = 53$ miles

A1

M1 A1

A1

(c)



M1

lower bound = weight of MST + $2 \times$ edge of least weight from A

= $(5 + 8 + 9 + 7) + (2 \times 8) = 45$ miles

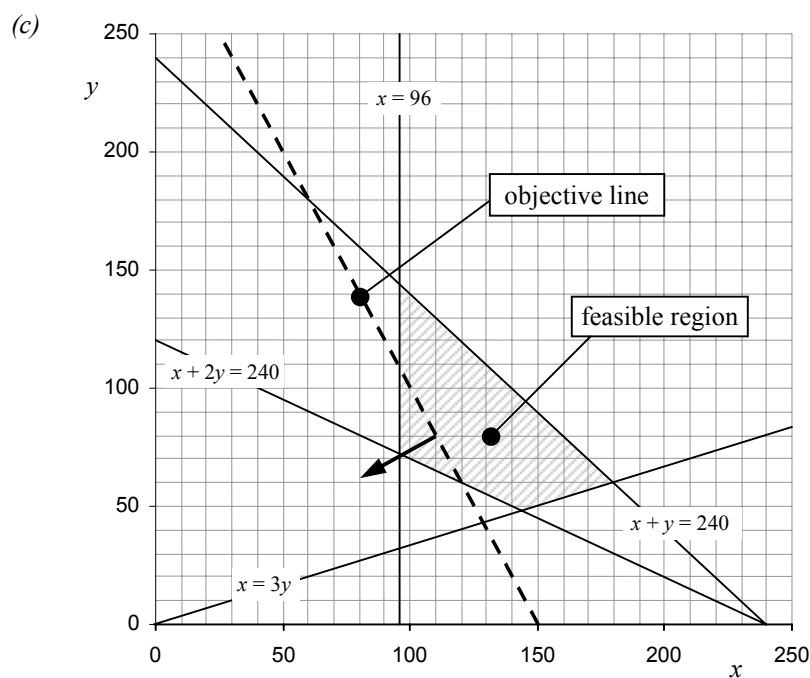
M1

A1

(11)

7. (a) $x + y + z = 240 \therefore z = 240 - x - y$ B1
- (b) $C = 4x + 12y + 20z = 4x + 12y + 20(240 - x - y) = 4800 - 16x - 8y$ M1 A1
 $x \geq 0.4 \times 240 \Rightarrow x \geq 96$ B1
 $x \leq 3y$ B1
 $y \geq z \Rightarrow y \geq 240 - x - y \Rightarrow x + 2y \geq 240$ B1
 $z \geq 0 \Rightarrow 240 - x - y \geq 0 \Rightarrow x + y \leq 240$ B1

\therefore minimize $C = 4800 - 16x - 8y$
 subject to $x \geq 96$
 $x \leq 3y$
 $x + 2y \geq 240$
 $x + y \leq 240$
 and $x \geq 0, y \geq 0$



- (d) minimum cost where $x = 96$ meets $x + 2y = 240$ M1
 $\therefore x = 96, y = 72, z = 72$ 96 m² lawn, 72 m² paving, 72 m² flower beds A1
 cost = £2688 A1

(16)

Total (60)

Performance Record – D1 Paper A

[illegible]