Networks - Roads

Extended investigation
Solutions and marking key

Part 2: In-class validation

Question 1(a)

Solution	
RTNRMHSLEPTR or RTNRMHSLEPT Any route could be given as no limitations are provided	
Mathematical behaviours	Marks
• identifies series of edges in network	1

Question 1(b)

Solution	
47 or 44	
Mathematical behaviours	Marks
• calculates distance	1

Question 1(c)

Solution	
No Vertex R was re-visited	
Mathematical behaviours	Marks
• identifies network is not Hamiltonian • explains conclusion	1 1

Question 1(d)

Solution

Route	Starting intersection	Route – order of roads travelled	Distance
1	R	RMHSLEPTNR	41 km
2	M	MHSLEPTNRM	41 km
3	L	LSHMRNTPEL	41 km
4	E	ELSHMRNTPE	41 km

Mathematical behaviours	Marks
• calculates distance	1
• identifies four routes each with a different starting point	4

Question 1(e)

Solution	
The driver should not travel on any route from R to H, S, E or T	
Mathematical behaviours	Marks
• identifies one route other than RT on which not to travel	1
• identifies two further routes on which not to travel	1

Question 1(f)

Solution	
MHRSLEPTN (35 km) MHSLEPTNR (29 km) MHSLERNTP (28 km) Other possibilities exist. Routes can start at any vertex.	
Mathematical behaviours	Marks
• identifies 3 paths of different lengths	3

Question 1(g)

Solution	
MHSLERNTP It is the shortest route so less petrol used and lowest cost	
Mathematical behaviours	Marks
• identifies shortest route • links answer to context of question.	1 1

Question 2(a)

Solution	
11 km	
Mathematical behaviours	Marks
• interprets network	1

Question 2(b)(i)

Solution	
TNRH (12) TNRMH (24) TNRELSH (19) TPERMH (28) TPELSRMH (38)	
Mathematical behaviours	Marks
• identifies 5 different routes	5

Question 2(b)(ii)

Solution	
26	
Mathematical behaviours	Marks
• identifies shortest and longest routes • calculates difference	1 1

Question 3(a)

Solution
Eulerian

Mathematical behaviours	Marks
• demonstrates knowledge of terminology	1

Question 3(b)

Solution	
From M to H and then R, you need to get back to M to go over RM and this means repeating the edge MH or MR to get back to the other edges.	
Mathematical behaviours	Marks
• describes an attempted route	1
• explains need to repeat edge	1

Question 3(c)

Solution	
The number of odd nodes in the network is not 0 or 2	
Mathematical behaviours	Marks
• demonstrates knowledge of odd nodes for Eulerian trail	1
• identifies number of odd nodes	1

Question 3(d)

Solution	
Make roads ET or HS (connecting any two odd vertices)	
Mathematical behaviours	Marks
• identifies one pair of odd vertices to connect	1
• identifies a second pair of odd vertices to connect	1

Question 3(e)

Solution	
ELS**HS**RHMRTNREPT SLEP**TE**RTNRSHRMH	
Mathematical behaviours	Marks
• uses first new road to make a route with no edges repeated	2
• uses second new road to make a route with no edges repeated	2

Question 3(f)

Solution	
Neither route is shorter Every edge is travelled each time	
Mathematical behaviours	Marks
• identifies every edge is used	1
• identifies the same distance	1

Question 4(a)

Solution	
Add a loop at any intersection Add an extra edge between any two vertices	
Mathematical behaviours	Marks
• identifies first feature of a network that is not simple	1
• identifies second feature of a network that is not simple	1

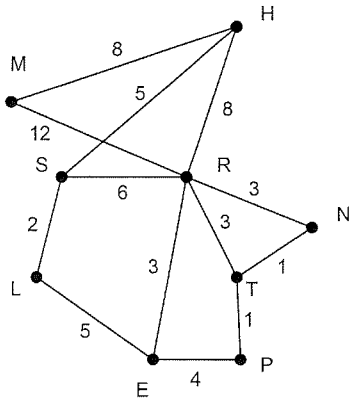
Question 4(b)

Solution	
It can be draw in the plane (2-D) without edges crossing	
Mathematical behaviours	Marks
• describes planarity	1

Question 4(c)

Solution	
$v + f - e = 2$ $9 + 6 - 13 = 2$	
Mathematical behaviours	Marks
• identifies number of edges	1
• identifies number of faces	1
• identifies number of vertices	1
• substitutes using Euler's formula	1

Question 4(d)

Solution


Mathematical behaviours	Marks
• all edges maintained	1
• all vertices maintained	1
• two edges cross	1

Question 4(e)

Solution
(i) flyover, tunnel (ii) occupies less space on the ground (iii) costs more to build, pollution confined to smaller area

Mathematical behaviours	Marks
• relates theory to context in three specific ways.	3