Examiners' Report
Principal Examiner Feedback

Summer 2025

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

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Question 1

This was a very accessible opener, with a significant number of learners scoring full marks, however a surprising number of learners did not score highly being full marks despite it being a very accessible question.

Part a) was generally answered very well with a majority of learners scoring at least two out of the three available marks, and most securing full marks. Very few descending sorts or quick sorts were seen, and most were able to show just the final results of each pass rather than every comparison. A small group of learners chose to write out every swap, and not just the result at the end of the pass, which was very time consuming for them on an already tightly timed paper. It was most common to just stop after the 5^{th} pass, with no 6^{th} pass or "sort complete" statement made. Some learners used a more unusual "cross arrow" notation, where learners were trying to show all the swaps that took place in a single line – this was confusing to follow and more often than not led to a mistake in one of the passes.

Part b) saw a number of learners use Kruskal's or a version of the nearest neighbour algorithm, or considering and rejecting arcs in a hybrid version of Prim's and Kruskal's. Several learners chose to draw the distance matrix in order to perform Prim's, which was an unnecessary use of their time. The third arc dictated whether a candidate had correctly used Prim's, and therefore if the wrong algorithm was used, the candidate lost both the method and the accuracy mark. Nonetheless a majority scored all marks here.

Part c) provided easy marks for those who had correctly used Prim's in part b), but also the opportunity for full marks even if Kruskal's had been used in part b). There were a few errors in adding up the arc lengths, with a variety of total lengths in the range 85-89. Almost all learners who had a correct MST in b) also scored the two marks in c), and thus a large majority scored both of these marks).

Question 2

The first two parts of this question were very standard definitions and procedures and therefore very accessible to all learners, however the advanced understanding required for the final two parts were able to clearly discriminate between learners who could follow procedure and those at the higher end of the scoring scale who really understood it.

Part a) was generally well answered with a majority of learners scoring this mark for a correct explanation. The most common non-scoring response was to only consider the dependency of E on A and B, which was not acceptable in the context of the whole network. Those attempting to use the unique argument sometimes failed to mention both the start and end notes, and a loss of the B mark in this question was often due to lack of accuracy rather than a wrong idea.

Part b) was generally very well drawn overall, with a large number of responses scoring full marks. The most common error was to share the same start and end node for L and M, thus losing the last two marks, otherwise learners handled the network well (though some of the responses were not user-friendly to navigate. A small number of activity-on-node responses were attempted; learners should be aware that this scores no marks. A few did not have a single start node, which also scored no marks. Lack of arrows on the dummies caused some to gain only the M mark. A more common error tended to be either the lack of Activity J, or

additional activities when the candidate's lines were not long enough or they used additional dummies.
Part c) was answered correctly on approximately half of the scripts. It was still well attempted, however a full range of multiples of 3 seen from 9 to 39 which demonstrated a lack of understanding of this particular application.
Part d) was only answered correctly by the most able learners. Those that did get 15 generally found at least some of the non-critical activities, often listing only a small number of the required list. Those that first identified the critical path generally found the full set.

Question 3
This was a standard Dijkstra/Route Inspection question, and the first half of the question was generally very well-answered. Again, the second half created a level of differentiation among the learners.
Part (a) was generally well answered with the majority of learners knowing that the graph was semi-Eulerian. As the mark scheme did not insist on the work "exactly", many learners were able to secure this first mark. Learners were able to give a clear textbook definition or state that nodes D and G were odd. Very few gave an incorrect answer or did not give a reason.
Part b) was a standard application of Dijkstra's algorithm and many learners scored full marks; getting the correct quickest path and shortest time. A few learners did not show regard for the order of working values and were penalised heavily for this, but generally the majority scored highly.
If mistakes were made, this was most common with the working values at D (missing 18), H (missing 26) or F (additional values). Other marks lost came from errors in the order of labelling, or missing values, although very few learners required the follow through mark and the path and length were generally correct, even with errors on the diagram.
Part (c); although most learners found the correct set of nodes to pair up, the Route Inspection component caused significantly more challenge, with a surprising number of blank and nil responses on this question. Of those who understood the assignment, learners generally found correct pairings of the odd nodes and at least two correct totals. A number of learners interpreted the question to mean that the pairing involving AE could not be found; these learners lost at least 2 and usually 3 marks. Errors occurred in AC and DG (total 30 using DFG) or AD and EG total 32. A pleasing majority of those who found the correct optimal arcs also stated fully the arcs to be repeated, showing improvement from previous sessions. However, a majority of learners struggled with cii), failing to delete the arc AE's weight and giving an answer of 182.
Part d), again, discriminated well between the strongest learners and was not completed by a significant number. A reasonable number selected G as the start point (potentially as a guess), however E, D and A were popular incorrect alternatives. A relatively low number of learners correctly found dii), potentially due to misunderstanding the consideration of the pairings correctly, but also due to incorrect pairings in part c).

Question 4

Once again, this question was accessible to the vast majority of responses and was well placed at the end of the paper with a range of marks being awarded. Full marks were seen, but not often. The question was still well attempted with no evidence that learners were running short of time.

Part a) was generally completed well although some learners lost the mark by failing to find the integer coefficients or failing to multiply by 4 effectively ending up with a constant of 20 or 100.

Part b) also provided marks for the majority of learners; most gained the first mark although some used x instead of y for the first inequality. It was common to see errors of $x \geq 4$ although the $3x \geq 2y$ inequality often caused the most issues and was therefore allocated two out of the three available marks for this part. Indeed, every combination of 3, x, 2, y and direction of inequality was seen with reasonably even frequency. A large majority of learners also scored the first B mark in bii) for drawing $2x + y \leq 28$ and $y \geq 4$. However, unsurprisingly, the issues in finding the final constraint then led to further inaccuracies in drawing this constraint, and as such only a minority of learners scored the final B mark in b). A few also lost the final mark by failing to label their R.

Part c) produced a range of responses with varying degrees of understanding as to the requirement. A significant number of learners did not follow the instruction to use vertex testing, and instead either used the objective line method or just focused on the optimal point and completed integer testing just around this point. If they had the correct optimal point then this could still score well, but if errors had been made in (b) it was common to see lots of incorrect working leading to only one mark in part (c), most commonly from testing (12,4) and achieving P=116. Those who did test all the vertices by solving the equations found the coordinates, but many failed to calculate P with at least 2d.p. of accuracy or at all. Some learners correctly identified the region but assumed it was triangular and only looked for three vertices. Many learners gave a detailed attempt at multiple points; however they reached a final incorrect answer of 10 or 11 sponge cakes with 7 fruit cakes. The final mark was surprisingly accessible, with some learners achieving the correct values despite errors in their inequalities or their graphs. Those that found the optimal vertex generally concluded the correct number of cakes in context.

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