

Commentary on candidate evidence

The candidate evidence has achieved the following marks for each question of this question paper.

Question 6

Candidate 1

The candidate was awarded **3 marks**.

In part (a), the candidate produced an incorrect first derivative, therefore mark 1 was not awarded. The candidate produced a correct, simplified expansion which they processed correctly in part (b), so marks 2 to 4 were awarded.

Candidate 2

The candidate was awarded **0 marks**.

In part (a), the candidate produced an incorrect third derivative, therefore mark 1 was not awarded. They did not simplify their expansion, therefore mark 2 was not awarded. In part (b), the candidate produced an incorrect expression in terms of $2x$, so mark 3 was not awarded, and their final expansion did not follow from their original expression, therefore mark 4 was not awarded.

Candidate 3

The candidate was awarded **4 marks**.

In part (a), the candidate correctly carried out all differentiation and substitution, and produced a correct, simplified expansion, so marks 1 and 2 were awarded. In part (b), the candidate correctly produced a simplified expansion from first principles, therefore marks 3 and 4 were awarded.

Question 7(b)

Candidate 4

The candidate was awarded **2 marks**.

The candidate correctly applied the quotient rule to their answer from part (a). In accordance with the detailed marking instructions regarding incorrect notation, marks 3 and 4 were awarded. They did not simplify their final expression, so mark 5 was not awarded.

Candidate 5

The candidate was awarded **2 marks**.

The candidate correctly applied the quotient rule to their answer from part (a). In accordance with the detailed marking instructions regarding incorrect notation, marks 3 and 4 were awarded. They did not multiply by dt/dx so mark 5 was not awarded.

Candidate 6

The candidate was awarded **1 mark**.

In applying the quotient rule to their answer from part (a), the candidate produced an expression with the correct denominator and one correct term in the numerator. In accordance with the detailed marking instructions regarding incorrect notation, mark 3 was awarded. The other term in the numerator was incorrect, therefore mark 4 was not awarded. The candidate's final expression contained terms in x so mark 5 was not awarded.

Question 12

Candidate 7

The candidate was awarded **8 marks**.

The candidate omitted '=0' in their auxiliary equation, therefore mark 1 was not awarded. The rest of their response was complete and correct, so marks 2 to 9 were awarded.

Candidate 8

The candidate was awarded **8 marks**.

The candidate correctly produced an auxiliary equation, a complementary function, and a particular integral with its derivatives, so marks 1 to 3 were awarded. The candidate squared the second derivative when substituting into the original equation, so mark 4 was not awarded. The resulting equation and all following steps were all processed correctly, so marks 5 to 9 were awarded on follow-through.

Candidate 9

The candidate was awarded **7 marks**.

The candidate correctly produced an auxiliary equation and a complementary function, so marks 1 and 2 were awarded. They calculated values of A and B before introducing a particular integral, therefore mark 6 was not awarded. Their particular integral and its derivatives were correct, so mark 3 was awarded, and marks 4, 5, 7 and 8 were awarded on follow-through. The candidate omitted 'y=' in the particular solution, therefore mark 9 was not awarded.

Question 14

Candidate 10

The candidate was awarded **5 marks**.

The candidate correctly determined the integrating factor, produced an integral equation, integrated and rearranged. In accordance with the detailed marking instructions, marks were not withheld for the omission of ' dx ' and all five marks were awarded.

Candidate 11

The candidate was awarded **2 marks**.

The candidate gave the correct form of the integrating factor so mark 1 was awarded. They processed this incorrectly, therefore mark 2 was not awarded. The candidate correctly used their expression in an integral equation, so mark 3 was awarded on follow-through. They did not produce a correct integration so mark 4 was not awarded. The candidate dealt incorrectly with the constant of integration when rearranging, therefore mark 5 was not awarded.

Candidate 12

The candidate was awarded **3 marks**.

The candidate made a transcription error in copying the differential equation therefore mark 1 was not awarded. They found the correct integrating factor, so mark 2 was awarded. The candidate produced an integral equation based on their differential equation, therefore mark 3 was awarded on follow-through. They did not integrate correctly so mark 4 was not awarded. The candidate correctly rearranged the result of their integration, therefore mark 5 was awarded.

Question 15

Candidate 13

The candidate was awarded **3 marks**.

The candidate did not give sufficient evidence of substitution into the right-hand side of the identity so mark 1 was not awarded. They expressed the inductive hypothesis later in the proof and considered the case $n=k+1$ therefore mark 2 was awarded. The candidate processed the algebra correctly, so marks 3 and 4 were awarded. They incorrectly expressed the required implication in their final statement therefore mark 5 was not awarded.

Candidate 14

The candidate was awarded **4 marks**.

The candidate demonstrated sufficient substitution, stated the inductive hypothesis, considered the case $n=k+1$ and carried out the necessary algebra to give a single term, so marks 1 to 4 were awarded. They did not express the sum explicitly in terms of $k+1$ therefore mark 5 was not awarded.

Candidate 15

The candidate was awarded **4 marks**.

The candidate demonstrated sufficient substitution so mark 1 was awarded. Although they referred in their final statement to the assumption that the result was true for $n=k$, they omitted the expressions that should have followed their summation signs, so mark 2 was not awarded. The candidate carried out the necessary algebra to give a single term, expressed the sum explicitly in terms of $k+1$, and gave a suitable final statement, so marks 3 to 5 were awarded.

Question 17

Candidate 16

The candidate was awarded **3 marks**.

The candidate correctly determined dV/dh and dV/dt , and stated the relationship between derivatives, therefore marks 1 to 3 were awarded. They incorrectly rearranged the expression for dV/dt , so mark 4 was not awarded.

Candidate 17

The candidate was awarded **2 marks**.

The candidate correctly determined dV/dh and stated the relationship between derivatives, therefore marks 1 and 3 were awarded. They made an arithmetical error in combining their partial expressions for dV/dt , so mark 2 was not awarded. The candidate gave an incorrect unit in their final answer so mark 4 was not awarded.

Candidate 18

The candidate was awarded **2 marks**.

The candidate correctly determined dV/dh and dV/dt , so marks 1 and 2 were awarded. They gave an incorrect relationship between derivatives and substituted incorrectly into their expression, so marks 3 and 4 were not awarded.