**Set 13**

**MARK SCHEME**

**PURE MATHEMATICS**

**A level Practice Paper**

|  |  |
| --- | --- |
| Correctly factorises the denominator of the left-hand fraction:  **1** | **M1** |
| Multiplies the right-hand fraction by  For example:  is seen. | **M1** |
| Makes an attempt to distribute the numerator of the right-hand fraction.  For example:  is seen. | **M1** |
| Fully simplified answer is seen.  Accept either  or | **A1** |
| **TOTAL: 4 marks** |  |

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| --- | --- |
| Uses  substituting *a* = 5 and *d* = 3 to get  **2a** | **M1** |
| Simplifies to state | **A1** |
| **2b** | **(2 marks)** |
| Use the sum of an arithmetic series to state | **M1** |
| States correct final answer | **A1** |
|  | **(2 marks)** |
| **TOTAL: 4 marks** |  |

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| --- | --- |
| Deduces from  that  **3a** | **M1** |
| States | **M1** |
| Multiplies by 63 and then takes the cube root: | **A1** |
|  | **(3 marks)** |
| Attempts to use iterative procedure to find subsequent values.  **3b** | **M1** |
| Correctly finds: *x*1 = 4.716 *x*2 = 4.802 *x*3 = 4.812 *x*4 = 4.814 | **A1** |
|  | **(2 marks)** |
| **TOTAL: 5 marks** |  |

**NOTES: 3b**

Award M1 if finds at least one correct answer.

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| --- | --- |
| Shows that  **4a** | **M1** |
| Shows that | **M1** |
| Shows | **M1** |
| Recognises that | **A1** |
|  | **(4 marks)** |
| When *θ* is small,  **4b** | **A1** |
|  | **(1 mark)** |
| **TOTAL: 5 marks** |  |

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| Writes out the first *n* terms of the arithmetic sequence in both ascending and descending form  **5a** | **M1** |
| Attempts to add these two sequences | **M1** |
| States | **A1** |
|  | **(3 marks)** |
| Makes an attempt to find the sum. For example,  is seen.  **5b** | **M1** |
| States correct final answer. *S* = 40 000 | **A1** |
|  | **(2 marks)** |
| **TOTAL: 5 marks** |  |

**NOTES: 5a** Do not award full marks for an incomplete proof.

**5a** Do award second method mark if student indicates that (2*a + (n* − 1)*d* appears *n* times.

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| Makes an attempt to set up a long division. For example:  is seen.  **6** | **M1** |
| Award 1 accuracy mark for each of the following:  seen, 2*x* seen, −21 seen.  For the final accuracy mark  either *D* = 138 or  or the remainder is 138 must be seen. | **A4** |
| **TOTAL: 5 marks** |  |

**NOTES:**

This question can be solved by first writing  and then solving for *A*, *B*, *C* and *D*. Award 1 mark for the setting up the problem as described. Then award 1 mark for each correct coefficient found. For example:

Equating the coefficients of *x*3: *A* = 1

Equating the coefficients of *x*2: 6 + *B* = 8, so *B* = 2

Equating the coefficients of *x*: 12 + *C* = −9, so *C* = −21

Equating the constant terms: −126 + *D* = 12, so *D* = 138

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| --- | --- |
| Begins the proof by assuming the opposite is true.  **7**  ‘ Assumption: there is a finite amount of prime numbers.’ | **B1** |
| Considers what having a finite amount of prime numbers means by making an attempt  to list them: Let all the prime numbers exist be | **M1** |
| Consider a new number that is one greater than the product of all the existing prime numbers:  Let | **M1** |
| Understands the implication of this new number is that division by any of the existing prime  numbers will leave a remainder of 1. So none of the existing prime numbers is a factor of *N*. | **M1** |
| Concludes that either *N* is prime or *N* has a prime factor that is not currently listed. | **B1** |
| Recognises that either way this leads to a contradiction, and therefore there is an infinite  number of prime numbers. | **B1** |
| **TOTAL: 6 marks** |  |

**NOTES:** If *N* is prime, it is a new prime number separate to the finite list of prime numbers, .

If *N* is divisible by a previously unknown prime number, that prime number is also separate to the finite list of prime numbers.

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| Makes an attempt to differentiate *y* = ln 3*x* using the chain rule, or otherwise.  8 | **M1** |
| Differentiatesto obtain | **A1** |
| Evaluates at | **A1** |
| Evaluates at *x* = 1 | **M1** |
| Attempts to substitute values into E.g.  is seen. | **M1 ft** |
| Shows logical progression to simplify algebra, arriving at: | **A1** |
| **TOTAL: 6 marks** |  |

**NOTES:** Award ft marks for a correct attempt to substitute into the formula using incorrect values.

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| Clearly states that  9a | **A1** |
| Makes an attempt to integrate the remaining two terms.  Raising a power by 1 would constitute an attempt. | **M1** |
| States the fully correct answer | **A1** |
|  | **(3 marks)** |
| Makes an attempt to substitute the limits into the expression.  9b  For example,is seen. | **M1** |
| Begins to simplify this expression. For example, is seen. | **M1** |
| States the fully correct answer  or states , *n* = 6 and  Also accept or equivalent. | **A1** |
|  | **(3 marks)** |
| **TOTAL: 6 marks** |  |

10a

|  |  |
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| Correctly states | **M1** |
| Correctly states  or states | **M1** |
| Adds the two above expressions and states | **A1** |
|  | **(3 marks)** |
| States that  10b | **M1** |
| Makes an attempt to integrate. Changing cos to sin constitutes an attempt. | **M1** |
| Correctly states the final answero.e. | **A1** |
|  | **(3 marks)** |
| **TOTAL: 6 marks** |  |

**NOTES: 10b**

Student does not need to state ‘+C’ to be awarded the first method mark.

Must be stated in the final answer.

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| Understands that integration is required to solve the problem.  For example, writes | **M1** |
| Uses the trigonometric identity  to rewrite aso.e. | **M1** |
| Shows | **A1** |
| Demonstrates an understanding of the need to find  using integration by parts.  For example,  o.e. is seen. | **M1** |
| States fully correct integral | **A1** |
| Makes an attempt to substitute the limits | **M1** |
| States fully correct answer:  either or o.e. | **A1** |
| **TOTAL: 7 marks** |  |

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| 12a | **M1** |
| Usesandto write:  Award one mark for each correct use of a trigonometric identity. | **A2** |
|  | **(3 marks)** |
| States that:  12b | **B1** |
| Simplifies this to write: | **M1** |
| Correctly finds  Additional answers might be seen, but not necessary in order to award the mark. | **M1** |
| States  Note that  For these values 3*θ* lies in the third quadrant, thereforeandare both negative and cannot be equal to a positive surd. | **A1** |
|  | **(4 marks)** |
| **TOTAL: 7 marks** |  |

**NOTES: 12b**

Award all 4 marks if correct final answer is seen, even if some of the 6*θ* angles are missing in the preceding step.

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| Graph has a distinct V-shape.  13a | **M1** |
| Labels vertex | **A1** |
| Finds intercept with the *y*-axis. | **M1** |
| Makes attempt to find *x*-intercept, for example states that | **M1** |
| Successfully finds both *x*-intercepts. | **A1** |
|  | **(5 marks)** |
| Recognises that there are two solutions.  13b  For example, writing  and | **M1** |
| Makes an attempt to solve both questions for *x*, by manipulating the algebra. | **M1** |
| Correctly states *x* =  or *x* = . Must state both answers. | **A1** |
| Makes an attempt to substitute to find *y*. | **M1** |
| Correctly finds *y* and states both sets of coordinates correctlyand | **A1** |
|  | **(5 marks)** |
| **TOTAL: 10 marks** |  |

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| --- | --- |
| Demonstrates an attempt to find the vectors,and  14a | **M1** |
| Finds,and | **A1** |
| Demonstrates an attempt to find,and | **M1** |
| Finds  Finds  Finds | **A1** |
| Demonstrates an understanding of the need to use the Law of Cosines.  Either  (or variation) is seen, or attempt to substitute into formula  is made | **M1 ft** |
| Makes an attempt to simplify the above equation. For example,  is seen. | **M1 ft** |
| Shows a logical progression to state | **B1** |
|  | **(7 marks)** |
| States or implies thatis isosceles.  14b | **M1** |
| Makes an attempt to find the missing angles | **M1** |
| States. Accept awrt 56.8° | **A1** |
|  | **(3 marks)** |
| **TOTAL: 10 marks** |  |

**NOTES: 14b**

Award ft marks for a correct answer topart **a** using their incorrect answer from earlier inpart **a**.

|  |  |
| --- | --- |
| Shows or implies that if *y* = 0, *t* = 1  15a | **M1** |
| Finds the coordinates of *P*. | **A1** |
|  | **(2 marks)** |
| Attempts to find a cartesian equation of the curve.  15b  For example, *t* = *x* − 2 is substituted into | **M1** |
| Correctly finds the cartesian equation of the curve  Accept any equivalent answer. For example, | **A1** |
|  | **(2 marks)** |
| Finds  15c | **M1** |
| Substitutes *t* = −1 to find *x* = 1 and | **M1** |
| Finds the gradient of the normal | **M1** |
| Substitutes *t* = −1 to find *x* = 1 and *y* = −2 | **A1** |
| Makes an attempt to find the equation of the normal. For example, is seen. | **M1** |
| States fully correct answer | **A1** |
|  | **(6 marks)** |
| Substitutesandintoobtaining  15d | **M1 ft** |
| Manipulates and simplifies this equation to obtain | **M1 ft** |
| Factorises and solves to find *t* = −1 or *t* = −11 | **M1 ft** |
| Substitutes *t* = −11 to find *x* = −9 and , i.e. | **A1 ft** |
|  | **(4 marks)** |
| **TOTAL: 14 marks** |  |

**NOTES: 15c** Award ft marks for correct answer using incorrect values from part **b**.

**(TOTAL: 100 MARKS)**