**PAPER L**

**MARK SCHEME**

**PURE MATHEMATICS**

**A level Practice Papers**

|  |  |
| --- | --- |
|  Makes an attempt to substitute *k* = 1, *k* = 2 and *k* = 4 into **1a** | **M1** |
| Shows that ,  and  and these are prime numbers. | **A1** |
|  | **(2 marks)** |
|  Substitutes a value of *k* that does not yield a prime number.**1b**For example,  or  | **A1** |
| Concludes that their number is not prime.For example, states that 9 = 3 × 3, so 9 is not prime. | **B1** |
|  | **(2 marks)** |
| **TOTAL: 4 marks** |  |

|  |  |
| --- | --- |
|  Recognises the need to write**2** | **M1** |
| Selects the correct trigonometric identity to write . Could also write  | **M1** |
| Makes an attempt to find | **M1** |
| Correctly states answer | **A1** |
| **TOTAL: 4 marks** | **(4 marks)** |

**3**

|  |  |
| --- | --- |
|  Begins the proof by assuming the opposite is true.‘Assumption: given a rational number *a* and an irrational number *b*, assume that *a −b* is rational.’ | **B1** |
| Sets up the proof by defining the different rational and irrational numbers. The choice of variables does not matter. Let As we are assuming *a − b* is rational, let  So  | **M1** |
| Solves  to make *b* the subject and rewrites the resulting expression as a single fraction:  | **M1** |
| Makes a valid conclusion., which is rational, contradicts the assumption *b* is an irrational number. Therefore the difference of a rational number and an irrational number is irrational. | **B1** |
| **TOTAL: 4 marks** | **(4 marks)** |

|  |  |
| --- | --- |
|  Differentiatesto obtain **4a** | **M1** |
| Writes | **A1** |
|  | **(2 marks)** |
|  Use the identity to write **4b** | **M1** |
| Attempts to substituteandinto  | **M1** |
| Correctly substitutes to find  and states  | **A1** |
|  | **(3 marks)** |
| **TOTAL: 5 marks** |  |

|  |  |
| --- | --- |
|  Writes tan*x* and sec*x* in terms of sin *x* and cos *x*. eg **5a** | **M1** |
| Manipulates the expression to find | **M1** |
| Simplifies to find  | **A1** |
|  | **(3 marks)** |
| States thator**5b** | **B1** |
| Writes thator | **M1** |
| Finds | **A1** |
|  | **(3 marks)** |
| **TOTAL: 6 marks** |  |

|  |  |
| --- | --- |
|  States **6a** | **M1** |
| Makes correct substitutions:  | **M1** |
| Uses the appropriate trigonometric addition formula to write:  | **M1** |
| Groups the terms appropriately  | **A1** |
|  | **(4 marks)** |
|  Explains that as *h* → 0,and**6b** | **M1** |
| Concludes that this leaves So if  | **A1** |
|  | **(2 marks)** |
| **TOTAL: 6 marks** |  |

**7**

|  |  |
| --- | --- |
|  Makes an attempt to set up a long division.For example:  is seen. | **M1** |
| Award 1 accuracy mark for each of the following: seen, 4*x* seen, −6 seen. | **A3** |
| Equates the various terms to obtain the equation:Equating the coefficients of *x*: Equating constant terms:  | **M1** |
| Multiplies one or or both of the equations in an effort to equate one of the two variables. | **M1** |
| Finds *W* = −1 and *V* = 2. | **A1** |
| **TOTAL: 7 marks** |  |

|  |  |
| --- | --- |
|  States the range is  or **8a** | **B1** |
|  | **(1 mark)** |
|  Recognises that  and **8b** | **M1** |
| Makes an attempt to solve both of these equations. | **M1** |
| Correctly states . Equivalent version is acceptable. | **A1** |
| Correctly states . Equivalent version is acceptable. | **A1** |
| Makes an attempt to substitute one equation into the other in an effort to solve for *k*. For example, and  is seen. | **M1 ft** |
| Correctly solves to find  | **A1 ft** |
| States the correct range for *k*.  | **B1** |
|  | **(2 marks)** |
| **TOTAL: 8 marks** |  |

**NOTES 8b:** Award ft marks for a correct method using an incorrect answer from earlier in the question.

**Alternative Method**

Draws line with gradientpassing through vertex and calculates , so answer is 

**M1**: States the *x*-coordinate of the vertex of the graph is 4

**M1**: States the *y*-coordinate of the vertex of the graph is −5

**M1**: Writes down the gradient ofor implies it later in the question.

**M1**: Attempts to use  with  and 

**A1**: Finds o.e.

**B1**: States the correct range for *k*: 

**9a**

|  |  |
| --- | --- |
|  Makes an attempt to rearrangeto make *t* the subject. For example,is seen. | **M1** |
| Correctly states | **A1** |
| Makes an attempt to substituteintoFor example,is seen. | **M1** |
| Simplifies the expression showing all steps.For example, | **A1** |
|  | **(4 marks)** |
|  Interprets the gradient of line being −1 asand finds **9b** | **M1** |
| Substitutes *t* = −1 to find *x* =and *y* =And substitutes *t* = 0 to find *x* = 1 and *y* = 2 | **M1** |
| Makes an attempt to use Pythagoras’ Theorem to find the length of the line: | **M1** |
| Correctly finds the length of the line segment,or states  | **A1** |
|  | **(4 marks)** |
| **TOTAL: 8 marks** |  |

|  |  |
| --- | --- |
|  Makes an attempt to find **10**Writingor writingconstitutes an attempt. | **M1** |
| Correctly states | **A1** |
| Makes an attempt to substitute the limits *x* = ln *b* and *x* = ln 2 intoFor example,and is seen. | **M1 ft** |
| Uses laws of logarithms to begin to simplify the expression. Eitheror is seen. | **M1 ft** |
| Correctly states the two answers as and  | **A1 ft** |
| States that | **M1 ft** |
| Makes an attempt to solve this equation.For example,is seen. | **M1 ft** |
| Correctly states the final answer *b* = 7 | **A1 ft** |
| **TOTAL: 8 marks** |  |

**NOTES:**

Student does not need to state ‘+C’ in an answer unless it is the final answer to an indefinite integral.

Award ft marks for a correct answer using an incorrect initial answer.

|  |  |
| --- | --- |
|  Recognises that it is a geometric series with a first term  and common ratio11a | **M1** |
| Attempts to use the sum of a geometric series. For example,  or  is seen. | **M1\*** |
| Finds  | **A1** |
|  | **(3 marks)** |
|  States  or 11b | **M1** |
| Begins to simplify.  or  | **M1** |
| Applies law of logarithms correctly or  | **M1** |
| States  | **A1** |
|  | **(4 marks)** |
|  Uses the sum of an arithmetic series to state11c | **M1** |
| Solves for *d*. *d* = £11.21 | **A1** |
|  | **(2 marks)** |
| **TOTAL: 9 marks** |  |

**NOTES 11a:**

**M1**

Award mark if attempt to calculate the amount of money after 1, 2, 3,….,8 and 9 months is seen.

|  |  |
| --- | --- |
|  Makes an attempt to find the resultant force by adding the three force vectors together.12a | **M1** |
| Finds | **A1** |
|  | **(2 marks)** |
|  States  or writes12b | **M1** |
| Finds | **A1** |
|  | **(2 marks)** |
|  Demonstrates an attempt to find 12cFor example, | **M1** |
| Findsm s−2 | **A1** |
|  | **(2 marks)** |
|  States12d | **M1** |
| Makes an attempt to substitute values into the equation. | **M1 ft** |
| Findsm | **A1 ft** |
|  | **(3 marks)** |
| **TOTAL: 9 marks** |  |

**NOTES: 12d**

Award ft marks for a correct answer topart **d** using their incorrect answer frompart **c**.

13a

|  |  |
| --- | --- |
|  Finds  and  | **M1** |
| Change of sign and continuous function in the interval root | **A1** |
|  | **(2 marks)** |
|  Makes an attempt to differentiate h(*t*)13b | **M1** |
| Correctly finds | **A1** |
| Findsand | **M1** |
| Attempts to find  | **M1** |
| Finds | **A1** |
|  | **(5 marks)** |
|  Demonstrates an understanding that *x* = 19.3705 and *x* = 19.3715 13c are the two values to be calculated. | **M1** |
| Finds  and  | **M1** |
| Change of sign and continuous function in the interval root | **A1** |
|  | **(3 marks)** |
| **TOTAL: 10 marks** |  |

**NOTES: 13a**

Minimum required is that answer states there is a sign change in the interval and that this implies a root in the given interval.

|  |  |
| --- | --- |
|  Correctly writes  as:  or 14a | **M1** |
| Completes the binomial expansion: | **M1** |
| Simplifies to obtain  | **A1** |
| Correctly writes as:  or  | **M1** |
| Completes the binomial expansion:  | **M1** |
| Simplifies to obtain  | **A1** |
| Simplifies by subtracting to obtain The need to subtract, or the subtracting shown, must be seen in order to award the mark. | **A1** |
|  | **(7 marks)** |
|  Makes an attempt to substitute *x* = 0.01 into f(*x*). For example,  is seen.14b | **M1** |
| States the answer 1.5997328 | **A1** |
|  | **(2 marks)** |
|  Makes an attempt to substitute *x* = 0.01 into 14c | **M1 ft** |
| States the answer 1.59974907… Accept awrt 1.60. | **M1 ft** |
| Finds the percentage error: 0.0010% | **A1 ft** |
|  | **(3 marks)** |
| **TOTAL: 12 marks** |  |

**NOTES:**

14a

If one expansion is correct and one is incorrect, or both are incorrect, award the final accuracy mark if they are subtracted correctly.

**14c**

Award all 3 marks for a correct answer using their incorrect answer from part **a**.

**(TOTAL: 100 MARKS)**