|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1 | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **(a)** | Makes an attempt to substitute *k* = 1, *k* = 2 and *k* = 4 into | **M1** | 1.1b | 5th  Understand disproof by counter example. |
| Shows that ,  and  and these are prime numbers. | **A1** | 1.1b |
|  | **(2)** |  |  |
| **(b)** | Substitutes a value of *k* that does not yield a prime number.  For example,  or | **A1** | 1.1b | 5th  Understand disproof by counter example. |
| Concludes that their number is not prime.  For example, states that 9 = 3 × 3, so 9 is not prime. | **B1** | 2.4 |
|  | **(2)** |  |  |
| (4 marks) | | | | |
| **Notes** | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 2 | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
|  | Finds | **M1** | 1.1b | 5th  Find the magnitude of a vector in 3 dimensions. |
| States | **M1** | 1.1b |
| Solves to find. Accept awrt 101.3° | **A1** | 1.1b |
|  | **(3)** |  |  |
| (3 marks) | | | | |
| **Notes** | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 3 | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **(a)** | Deduces fromthat | **M1** | 1.1b | 5th  Understand the concept of roots of equations. |
| States | **M1** | 1.1b |
| Multiplies by 63 and then takes the cube root: | **A1** | 1.1b |
|  | **(3)** |  |  |
| **(b)** | Attempts to use iterative procedure to find subsequent values. | **M1** | 1.1b | 6th  Solve equations approximately using the method of iteration. |
| Correctly finds: | **A1** | 1.1b |
|  | **(2)** |  |  |
| (5 marks) | | | | |
| Notes  **(b)** Award M1 if finds at least one correct answer. | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 4 | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
|  | Recognises that two subsequent values will divide to give an equal ratio and sets up an appropriate equation. | **M1** | 2.2a | 4th  Understand simple geometric sequences. |
| Makes an attempt to solve the equation. For example, or | **M1** | 1.1b |
| Factorises to get | **M1** | 1.1b |
| States the correct solution: *k* = 6.  or *k* = 0 is trivial may also be seen, but is not required. | **A1** | 1.1b |
| (4 marks) | | | | |
| Notes | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 5 | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
|  | Makes an attempt to set up a long division.  For example:  is seen. | **M1** | 2.2a | 6th  Decompose algebraic fractions into partial fractions − three linear factors. |
| Award 1 accuracy mark for each of the following:  seen, 4*x* seen, −6 seen. | **A3** | 1.1b |
| Equates the various terms to obtain the equation:    Equating the coefficients of *x*:  Equating constant terms: | **M1** | 2.2a |
| Multiplies one or or both of the equations in an effort to equate one of the two variables. | **M1** | 1.1b |
| Finds *W* = −1 and *V* = 2. | **A1** | 1.1b |
| (7 marks) | | | | |
| **Notes** | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 6 | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
|  | Use Pythagoras’ theorem to show that the length oforor states | **M1** | 2.2a | 6th  Solve problems involving arc length and sector area in context. |
| Makes an attempt to findor.  For example,is seen. | **M1** | 2.2a |
| Correctly states thator | **A1** | 1.1b |
| Makes an attempt to find the area of the sector with a radius of 4 and a subtended angle of  For example,is shown. | **M1** | 2.2a |
| Correctly states that the area of the sector is | **A1** | 1.1b |
| Recognises the need to subtract the sector area from the area of the rhombus in an attempt to find the shaded area.  For example,is seen. | **M1** | 3.2a |
| Recognises that to find the total shaded area this number will need to be multiplied by 2. For example, | **M1** | 3.2a |
| Using clear algebra, correctly manipulates the expression and gives a clear final answer of | **A1** | 1.1b |
| (8 marks) | | | | |
| **Notes** | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 7 | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **(a)** | Makes an attempt to rearrangeto make *t* the subject. For example,is seen. | **M1** | 2.2a | 5th  Convert between parametric equations and cartesian forms using substitution. |
| Correctly states | **A1** | 1.1b |
| Makes an attempt to substituteinto  For example,is seen. | **M1** | 2.2a |
| Simplifies the expression showing all steps.  For example, | **A1** | 1.1b |
|  | **(4)** |  |  |
| **(b)** | Interprets the gradient of line being −1 asand finds | **M1** | 2.2a | 5th  Convert between parametric equations and cartesian forms using substitution. |
| Substitutes *t* = −1 to find *x* =and *y* =  And substitutes *t* = 0 to find *x* = 1 and *y* = 2 | **M1** | 1.1b |
| Makes an attempt to use Pythagoras’ Theorem to find the length of the line: | **M1** | 1.1b |
| Correctly finds the length of the line segment,or states | **A1** | 1.1b |
|  | **(4)** |  |  |
| (8 marks) | | | | |
| Notes | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 8 | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **(a)** | Differentiates obtaining and differentiates obtaining | **M1** | 1.1b | 6th  Differentiate using the product rule. |
| Makes an attempt to substitute the above values into the product rule formula: | **M1** | 2.2a |
| Finds | **M1** | 1.1b |
| Fully simplfies using correct algebra to obtain | **A1** | 2.4 |
|  | **(4)** |  |  |
| **(b)** | Makes an attempt to substitute *t* = 2 into | **M1 ft** | 1.1b | 6th  Differentiate using the product rule. |
| Correctly findsand concludes that asthe toy soldier was decreasing in height after 2 seconds. | **B1 ft\*** | 3.5a |
|  | **(2)** |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **(c)** | = 0 or at a turning point. | **M1 ft** | 1.1b | 6th  Differentiate using the product rule. |
| Solvesto find  Can also state | **A1 ft** | 1.1b |
|  | **(2)** |  |  |
| (8 marks) | | | | |
| Notes  **(b)** Award ft marks for a correct answer using an incorrect answer from part **a**.  **B1:** Can also stateas the numerator ofis negative and the denominator is positive.  Award ft marks for a correct answer using an incorrect answer from part **a**. | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 9 | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **(a)** | Recognises the need to write | **M1** | 2.2a | 6th  Integrate using trigonometric identities. |
| Recognises the need to write | **M1** | 2.2a |
| Multiplies out the bracket and makes a further substitution | **M1** | 2.2a |
| States the fully correct final answer | **A1** | 1.1b |
|  | **(4)** |  |  |
| **(b)** | States or implies that | **M1** | 1.1b | 6th  Integrate using the reverse chain rule. |
| States fully correct integral | **M1** | 2.2a |
| Makes an attempt to substitute the limits. For example,  is seen. | **M1 ft** | 1.1b |
| Begins to simplify the expression | **M1 ft** | 1.1b |
| States the correct final answer | **A1 ft** | 1.1b |
|  | **(5)** |  |  |
| (9 marks) | | | | |
| Notes  **(b)** Student does not need to state ‘+C’ to be awarded the second method mark.  **(b)** Award ft marks for a correct answer using an incorrect initial answer. | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 10 | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
|  | 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** | 3.1 | 7th  Complete proofs using proof by contradiction. |
| 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** | 2.2a |
| Solves  to make *b* the subject and rewrites the resulting expression as a single fraction: | **M1** | 1.1b |
| 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** | 2.4 |
| (4 marks) | | | | |
| **Notes** | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 11 | Scheme | | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **(a)** | **Figure 1** | Graph has a distinct V-shape. | **M1** | 2.2a | 5th  Sketch the graph of the modulus function of a linear function. |
| Labels vertex | **A1** | 2.2a |
| Finds intercept with the *y*-axis. | **M1** | 1.1b |
| Makes attempt to find  *x*-intercept, for example states that | **M1** | 2.2a |
| Successfully finds both  *x*-intercepts. | **A1** | 1.1b |
|  | | **(5)** |  |
| **(b)** | Recognises that there are two solutions. For example, writing  and | | **M1** | 2.2a | 5th  Solve equations involving the modulus function. |
| Makes an attempt to solve both questions for *x*, by manipulating the algebra. | | **M1** | 1.1b |
| Correctly states *x* =  or *x* = . Must state both answers. | | **A1** | 1.1b |
| Makes an attempt to substitute to find *y*. | | **M1** | 1.1b |
| Correctly finds *y* and states both sets of coordinates correctlyand | | **A1** | 1.1b |
|  | | **(5)** |  |  |
| (10 marks) | | | | | |
| Notes | | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 12 | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **(a)** |  | **M1** | 1.1b | 7th  Use addition formulae and/or double-angle formulae to solve equations. |
| Usesandto write:  Award one mark for each correct use of a trigonometric identity. | **A2** | 2.2a |
|  | **(3)** |  |  |
| **(b)** | States that: | **B1** | 2.2a | 7th  Use addition formulae and/or double-angle formulae to solve equations. |
| Simplifies this to write: | **M1** | 1.1b |
| Correctly finds  Additional answers might be seen, but not necessary in order to award the mark. | **M1** | 1.1b |
| 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** | 1.1b |
|  | **(4)** |  |  |
| (7 marks) | | | | |
| Notes  **6b**  Award all 4 marks if correct final answer is seen, even if some of the 6*θ* angles are missing in the preceding step. | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 13 | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **(a)** | Correctly writes  as:  or | **M1** | 2.2a | 6th  Understand the binomial theorem for rational n. |
| Completes the binomial expansion: | **M1** | 2.2a |
| Simplifies to obtain | **A1** | 1.1b |
| Correctly writes as:  or | **M1** | 2.2a |
| Completes the binomial expansion: | **M1** | 2.2a |
| Simplifies to obtain | **A1** | 1.1b |
| Simplifies by subtracting to obtain  Reference to the need to subtract, or the subtracting shown, must be seen in order to award the mark. | **A1** | 1.1b |
|  | **(7)** |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **(b)** | Makes an attempt to substitute *x* = 0.01 into f(*x*).  For example,  is seen. | **M1** | 1.1b | 6th  Understand the binomial theorem for rational n. |
| States the answer 1.5997328 | **A1** | 1.1b |
|  | **(2)** |  |  |
| **(c)** | Makes an attempt to substitute *x* = 0.01 into  For example  is seen. | **M1 ft** | 1.1b | 6th  Understand the binomial theorem for rational n. |
| States the answer 1.59974907… Accept awrt 1.60. | **M1 ft** | 1.1b |
| Finds the percentage error: 0.0010% | **A1 ft** | 1.1b |
|  | **(3)** |  |  |
| (12 marks) | | | | |
| Notes  (a) If one expansion is correct and one is incorrect, or both are incorrect, award the final accuracy mark if they are subtracted correctly.  **(c)** Award all 3 marks for a correct answer using their incorrect answer from part (a). | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 14 | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **(a)** | Uses  substituting *a* = 5 and *d* = 3 to get | **M1** | 3.1b | 5th  Use arithmetic sequences and series in context. |
| Simplifies to state | **A1** | 1.1b |
|  | **(2)** |  |  |
| **(b)** | Use the sum of an arithmetic series to state | **M1** | 3.1b | 5th  Use arithmetic sequences and series in context. |
| States correct final answer | **A1** | 1.1b |
|  | **(2)** |  |  |
| (4 marks) | | | | |
| Notes | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 15 | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
|  | Understands that integration is required to solve the problem. For example, writes | **M1** | 3.1a | 6th  Use definite integration to find areas between curves. |
| Uses the trigonometric identityto rewrite aso.e. | **M1** | 2.2a |
| Shows | **A1** | 1.1b |
| Demonstrates an understanding of the need to find  using integration by parts. For example,  o.e. is seen. | **M1** | 2.2a |
| States fully correct integral | **A1** | 1.1b |
| Makes an attempt to substitute the limits | **M1** | 2.2a |
| States fully correct answer: eitheroro.e. | **A1** | 1.1b |
| (7 marks) | | | | |
| Notes  Integration shown without the limits is acceptable for earlier method and accuracy marks. Must correctly substitute limits at step 6 | | | | |