|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **1a** | Makes an attempt to rearrangeto make *t* the subject. For example,is seen. | **M1** | 2.2a | 5thConvert between parametric equations and cartesian forms using substitution. |
| Correctly states | **A1** | 1.1b |
| Makes an attempt to substituteintoFor example,is seen. | **M1** | 2.2a |
| Simplifies the expression showing all steps.For example, | **A1** | 1.1b |
|  | **(4)** |  |  |
| **1b** | Interprets the gradient of line being −1 asand finds  | **M1** | 2.2a | 5thConvert 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 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **2** | Recognises that the identity can be used to find the cartesian equation. | **M1** | 2.2a | 6thConvert between parametric equations and cartesian forms using trigonometry. |
| StatesorAlso states | **M1** | 1.1b |
| Substitutesandinto | **M1** | 1.1b |
| Solves to find, accept *x* < 1 or  | **A1** | 1.1b |
| (4 marks) |
| Notes |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **3a** | Statesand | **M1** | 1.1b | 6thConvert between parametric equations and cartesian forms using trigonometry. |
| Recognises that the identitycan be used to find the cartesian equation. | **M1** | 2.2a |
| Makes the substitution to find | **A1** | 1.1b |
|  | **(3)** |  |  |
| **3b** | States or implies that the curve is a circle with centre (−4, 3) and radius 7 | **M1 ft** | 2.2a | 6thSketch graphs of parametric functions. |
| Substitutesto find *x* = −11 and *y* = 3 (−11, 3)Substitutes to find *x* ≈ 2.06 and *y* = 6.5 (2.06, 6.5)Could also substitute *t* = 0 to find *x* = −4 and *y* = 10 (−4, 10) | **M1 ft** | 1.1b |
| **Figure 1** | Draws fully correct curve. | **A1 ft** | 1.1b |
|  | **(3)** |  |  |
| **3c** | Makes an attempt to find the length of the curve by recognising that the length is part of the circumference. Must at least attempt to find the circumference to award method mark.  | **M1 ft** | 1.1b | 6thSketch graphs of parametric functions. |
| Uses the fact that the arc isof the circumference to writearc length = | **A1 ft** | 1.1b |
|  | **(2)** |  |  |
| (8 marks) |
| Notes**3b**Award ft marks for correct sketch using incorrect values from part **a**.**3c**Award ft marks for correct answer using incorrect values from part **a**.**3c**Alternative method: use, withand. Award one mark for the attempt and one for the correct answer. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **4a** | Shows or implies that if *y* = 0, *t* = 1 | **M1** | 1.1b | 7thSolve coordinate geometry problems involving parametric equations. |
| Finds the coordinates of *P*.  | **A1** | 1.1b |
|  | **(2)** |  |  |
| **4b** | Attempts to find a cartesian equation of the curve. For example, *t* = *x* − 2 is substituted into | **M1** | 2.2a | 7thSolve coordinate geometry problems involving parametric equations. |
| Correctly finds the cartesian equation of the curveAccept any equivalent answer. For example, | **A1** | 1.1b |
|  | **(2)** |  |  |
| **4c** | Finds | **M1** | 2.2a | 7thSolve coordinate geometry problems involving parametric equations. |
| Substitutes *t* = −1 to find *x* = 1 and | **M1** | 1.1b |
| Finds the gradient of the normal | **M1** | 1.1b |
| Substitutes *t* = −1 to find *x* = 1 and *y* = −2 | **A1** | 1.1b |
| Makes an attempt to find the equation of the normal. For example, is seen. | **M1** | 1.1b |
| States fully correct answer | **A1** | 1.1b |
|  | **(6)** |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **4d** | Substitutesandintoobtaining  | **M1 ft** | 2.2a | 7thSolve coordinate geometry problems involving parametric equations. |
| Manipulates and simplifies this equation to obtain | **M1 ft** | 1.1b |
| Factorises and solves to find *t* = −1 or *t* = −11 | **M1 ft** | 1.1b |
| Substitutes *t* = −11 to find *x* = −9 and , i.e. | **A1 ft** | 1.1b |
|  | **(4)** |  |  |
| (14 marks) |
| Notes**4c**Award ft marks for correct answer using incorrect values from part **b**. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **5a** | Interprets the stone hitting the ground as when  | **M1** | 3.4 | 8thUse parametric equations in modelling in a variety of contexts. |
| Makes an attempt to use the quadratic formula to find *t*.For example,is seen. | **M1** | 2.2a |
| Finds | **M1** | 1.1b |
| Deducesm. Accept awrt 24.6 | **A1** | 3.2a |
|  | **(4)** |  |  |
| **5b** | Finds | **M1** | 2.2a | 8thUse parametric equations in modelling in a variety of contexts. |
| Demonstrates an understanding that the greatest height will occur when. For example, | **M1** | 3.1a |
| Solves to find | **M1** | 1.1b |
| Makes an attempt to find the greatest height by substituting intoFor example, | **M1 ft** | 3.2a |
| Finds *y* ==13.265… m. Accept awrt 13.3 m. | **A1 ft** | 1.1b |
|  | **(5)** |  |  |
| (9 marks) |
| Notes**5b**can also be found using. This is an acceptable method.**5b**Award ft marks for correct sketch using incorrect values from earlier in part **b**. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **6a** | Rearrangesto obtain | **M1** | 1.1b | 8thUse parametric equations in modelling in a variety of contexts. |
| SubstitutesintoFor example,is seen. | **M1** | 1.1b |
| Finds | **A1** | 1.1b |
|  | **(3)** |  |  |
| **6b** | Deduces that the width of the arch can be found by substituting  into  | **M1** | 3.4 | 8thUse parametric equations in modelling in a variety of contexts. |
| Finds *x* = 0 and *x* = 160 and deduces the width of the arch is 160 m. | **A1** | 3.2a |
|  | **(2)** |  |  |
| **6c** | Deduces that the greatest height occurs when  | **M1** | 3.4 | 8thUse parametric equations in modelling in a variety of contexts. |
| Deduces that the height is 100 m. | **A1** | 3.2a |
|  | **(2)** |  |  |
| (7 marks) |
| Notes |