**Year 11 to Year 12 Transition Paper**

**Circles**

**Mark Scheme**

| **Question** | **Working** | **Answer** | **Mark** | **Notes** |
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| **1** |  | Circle radius 4 Centre (3,0) and(−1,0) and (7,0) labelled | M1 | For centre (3,0) implied by drawing or label or a circle of radius 4 or intersections on the *x*-axis at −1or 7 implied by drawing or labels |
|  |  |  | M1 | for 2 of centre (3,0) implied by drawing or label intersections on the *x*-axis at −1 and 7 implied by drawing or labelcircle drawn with radius 4  |
|  |  |  | A1 | for a fully correct answer |
| **(3 marks)** |

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| **Question**  | **Scheme** | **Marks** |
| **2(a)** |  or  | M1 |
|   | A1 |
|  | **(2)** |
| **(b)** |  | M1 |
| A1 oe |
|  | **(2)** |
| **(c)** |  | B1 |
|  | M1 |
|  | M1 |
|  | A1 |
|  | **(4)** |
| **(8 marks)** |

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| **Question** | **Scheme** | **Marks** |
| **3** | **You may mark (a) and (b) together**  |  |
| **(a)** | Obtain LHS as  | M1 |
|  | Centre is  | A1**(2)** |
| **(b)** | Uses  or where their centre was at *r* = √50 or 5√2  | M1A1  **(2)** |
| **(c)** | Substitute *x* = 0 in either form of equation of circle and solve resulting quadratic to give *y* = **or**    | M1A1**(2)** |
| **(d)** | Gradient of radius joining centre to (2,0) is Gradient of tangent is So equation is  and so *x* + 7*y* 2 = 0 | M1M1M1, A1**(4)** |
| **(10 marks)** |
| **Alternative Methods which may be seen** |
| **(a)** | Method 2: Comparing with to write down centre directly. Condone sign errors for this Mmark**.** Centre is  | **M1****A1****(2)** |
| **(b)** | Method 2: Using . So  *r* = √50 or 5√2  | **M1 A1****(2)** |
| **(d)** | Method 3: Using Implicit Differentiation  **or**  | **M1** |
| So equation is  and so *x* + 7*y* 2 = 0 | **M1** |
| **M1, A1****(4)** |
| Method 4: Making *y* the subject of the formula and differentiating  |  |
| so  | **M1** |
| At *x* = 2,  | **M1** |
| So equation is   | **M1** |
| Chooses and so *x* + 7*y* 2 = 0 | **A1** |

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| **Question** | **Scheme** | **Marks** |
| **4(a)** |  |  |
| Uses any appropriate method to find the coordinates of the centre, e.g achieves . Accept (±5,±3) as indication of this.  | M1 |
| Centre is  | A1**(2)** |
| **(b)****Way 1** | Uses  to give or  (not 30 – 25 – 9) | M1 |
| *r* = 2  | A1cao(2) |
| **Or Way 2** | Using from  (Needs formula stated or correct working) | M1 |
| *r* = 2  | A1(2) |
| **(c)****Way 1** | Use *x* = 4 in *an* equation of circle and obtain equation in *y* only | M1 |
| e.g  or   |
| Solve their quadratic in *y* and obtain **two** solutions for *y*  | dM1 |
| e.g.  so *y* =  | A1(3) |
| **Or Way 2** |  | Divide triangle *PTQ* and use Pythagoras with ,  | M1 |
| Find *h* and evaluate  . May recognise (1,√3, 2) triangle. | dM1 |
| So *y* =  | A1**(3)** |
| (7 marks) |

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| **Question** | **Scheme** | **Marks** |
| **5** | The equation of the circle is  | M1 A1 |
| The radius of the circle is  or  or  | M1 |
| So or equivalent | A1  |
| **(4 marks)** |

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| **Question** | **Scheme** | **Marks** |
| **6 (a)** | , *k* > 0 | M1 |
|  Attempts to use  | M1 |
|  Obtains  | A1 |
|  | **(3)** |
| **(b)** | Gradient of radius from centre to (4, –5) = –2 (must be correct) | B1 |
| Tangent gradient =  | M1 |
| Equation of tangent is  | M1 |
| So equation is *x* – 2*y* –14 = 0  | A1 |
|  | **(4)** |
| **(7 marks)** |

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| **Question** | **Scheme** | **Marks** |
| **7(a) (i)****(ii)** | The centre is at (10, 12) | B1: *x* = 10 | B1 B1 |
| B1: *y* = 12 |
| Uses  | M1 |
| Completes the square for both *x* and *y* in an attempt to find *r*.Allow errors in obtaining their *r*2 but must find square root |  |
|   | A correct numerical expression for *r*including the square root and can implied by a correct value for *r* | A1 |
|  *r* = 7 |  | A1 |
|  | **(5)** |
| **(b)** |  | Correct use of Pythagoras | M1 |
|  |  | A1 |
|  | **(2)** |
| **(c)** |  |  | M1 |
|  |  | A1 |
|  | **(2)** |
| **(9 marks)** |

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| **Question** | **Scheme** | **Marks** |
| **8(a)** |  **AG** | Correct method (no errors) for finding the mid-point of giving  | B1\* |
|  | **(1)** |
| **(b)** |  or or or  | Applies distance formula in order to find the radius. | M1 |
| Correct application of formula. | A1 |
|  | , *k* is a positive value. | M1 |
|   (Not ) | A1 |
|  | **(4)** |
| **(c)** | {For } , {so the point lies on *C*.} | B1 |
|  | **(1)** |
| **(d)** |  | This must be seen in part (d). | B1 |
|  | Using a perpendicular gradient method. | M1 |
|  |  | M1 |
|  |  or  | A1 cao |
|  | **(4)** |
| **(10 marks)** |

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| **Question** | **Scheme** | **Marks** |
| **9(a)** | Obtain  | M1 |
| Obtain  | A1 |
| Centre is N.B. This may be indicated on **diagram only** as (10, 8) | A1**(3)** |
| **(b)** | See (= ) or  | M1 |
| *r* = 5 \* (this is a printed answer so need one of the above two reasons) | A1**(2)** |
| **(c)** | Use *x* = 13 in either form of equation of circle and solve resulting quadratic to give *y* = | M1 |
| e.g so *y=* |  |
|  so *y* = |  |
| *y* = 4 or 12 ( on EPEN mark one correct value as A1A0 and both correct as A1 A1) | A1, A1**(3)** |
| **(8 marks)** |

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| **Question** | **Scheme** | **Marks** |
| **10(a)** |  |  |
| Attempts  | M1 |
| (i) Centre   | A1 |
| (ii) Radius  oe Eg   | A1 |
|  | **(3)** |
| **(b)** | C:\Users\alistair\Downloads\desmos-graph (91).pngAttempts to add/subtract '*r*' from '2'   | M1 |
| A1ft |
|  | **(2)** |
| **(5 marks)** |

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| **Question** | **Scheme** | **Marks** |
| **11(a)** |  |  |
|  |  see notes. | M1 |
| Centre is  |  | A1 **cao (2)** |
| **(b)** | So  |  | M1 |
|  (Award A0 for ).  | A1 **(2)** |
| **(c)** | When  | Putting in *C* or their *C*. | M1 |
|  or , etc | A1 aef |
|  | Attempt to use formula or a method of completing the square in order to find  | M1 |
|  |  | A1 **cao cso****(4)** |
| **(8 marks)** |

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| **Question** | **Scheme** | **Marks** |
| **12(a)** |  | M1 |
|  | **d**M1 |
|  | A1**cso** |
|  | **(3)** |
| **(b)** |  | M1A1 |
|  | **(2)** |
| **(5 marks)** |

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| **Question**  | **Scheme** | **Marks** |
| **13(a)** | Equation of form  , *k* >0 | M1 |
| Equation of form, with values for *a* and *b* | M1 |
|  | A1 |
|  | **(3)** |
| **(b)** |  Let centre of circle   |  |
|  *PX* 2 *=*  or *PX* =  | M1 |
| ( ) with numerical *PX* | dM1 |
|   (allow 20.0) | A1 **cso** |
|  | **(3)** |
| **(6 marks)** |

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| **Question** | **Scheme** | **Marks** |
| **14(a)** | Finds circle equation (*x* ± 2)2 + (*y*  6)2 = (10 ± (–2))2 + (11  6)2 | **M1** |
| Checks whether (10, 1) satisfies their circle equation | **M1** |
| Obtains (*x* + 2)2 + (*y* – 6)2 = 132 and checks that (10 + 2)2 + (1 – 6)2 = 132 and so states that (10, 1) lies on *C* (\*) | **A1**  |
|  | **(3)** |
| **(b)** | Finds radius gradient  or  (*m*) | **M1** |
| Finds gradient perpendicular to their radius using  | **M1** |
| Finds (equation and) *y*-intercept of tangent (see note below) | **M1** |
| Obtains a correct value for *y*-intercept of their tangent, i.e. 35 or –23 | **A1** |
| Deduces gradient of second tangent  | **M1** |
| Finds (equation and) *y*-intercept of second tangent | **M1** |
| So obtains distance *PQ =* 35 + 23 = 58 (\*) | **A1**  |
|  | **(7)** |
| **(10 marks)** |

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| **Question** | **Scheme** | **Marks** |
| **15(a)**  | Attempts to find the radius  or radius 2 | M1 |
| Attempts   | M1 |
| Correct equation  | A1 |
|   | **(3)** |
| **(b)** |  Gradient of radius where *O* is the centre of *C*   | M1 |
|  Equation of *l* is   | dM1 |
|  Any correct form   | A1 |
|  Method of finding *k* Substitute  into their   | M1 |
|    | A1 |
|  | **(5)** |
| **(8 marks)** |

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| **Question** | **Scheme** | **Marks** |
| **16(a)** | Attempts to complete the square  | M1 |
| (i) Centre   | A1 |
| (ii) Radius 5 | A1 |
|  | **(3)** |
|  **(b)** | Uses a sketch or otherwise to deduce is a critical value | B1 |
| Substitute  in  | M1 |
|  Collects terms to form correct 3TQ  | A1 |
| Attempts  for their *a*, *b* and *c* leading to values for *k*   | M1 |
|  Uses  and chooses the outside region (see note) for **their** critical values (Both *a* and *b* must have been expressions in *k*) | dM1 |
|  Deduces  oe | A1 |
|  | **(6)** |
| **(9 marks)** |