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**Advanced Subsidiary**

**Paper 1: Pure Mathematics**

**Paper**

**PAPER C Mark Scheme**

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| States or implies the formula for differentiation from first principles.  **1 Mark Scheme** | **B1** |
| Correctly applies the formula to the specific formula and expands and simplifies the formula. | **M1** |
| Factorises the ‘*h*’ out of the numerator and then divides by *h* to simplify. | **A1** |
| States that as *h* → 0, 15*x*2 + 15*xh* + 5*h*2 → 15*x*2 o.e.so derivative = 15*x*2 \* | **A1\*** |
|  | **(4 marks)** |

**NOTES:** Use of δ*x* also acceptable.

Students must show a complete proof (without wrong working) to achieve all 4 marks.

Not all steps need to be present, and additional steps are also acceptable.

**2 Mark Scheme**

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| alevel_ut_p1_u8_markscheme_aw1 | Graph has correct shape and does not touch  *x*-axis. | **M1** |
| The point (0, 1) is given or labelled. | **A1** |
|  | | **(2 marks)** |
| Translation 1 unit right (or positive *x* direction) or by | | **B1** |
| Translation 5 units up (or positive *y* direction) or by | | **B1** |
|  | | **(2 marks)** |
|  | | **Total 4 marks** |

**3a Mark Scheme**

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| States that | **M1** |
| States or | **M1** |
| States or | **A1** |
| Draws the conclusion that asis a multiple ofthe two lines *PQ* and *AB* must be parallel. | **A1** |
|  | **(4 marks)** |
| cm = 6 cm cao  **3b Mark Scheme** | **B1** |
|  | **(1 mark)** |
|  | **Total 5 marks** |

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| **4 Mark Scheme**  cid:image001.png@01D2F97D.9E481CC0 | Asymptote drawn at *x* = 6 | **B1** |
| Asymptote drawn at *y* = 5 | **B1** |
| Pointlabelled. Condone clearly on *y* axis. | **B1** |
| Pointlabelled.  Condoneclearly on *x* axis. | **B1** |
| Correctly shaped graph drawn in the correct quadrants formed by the asymptotes. | **B1** |
|  | **(5 marks)** |

**5 Mark Scheme**

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| Correctly shows that either f(3) = 0, f(−2) = 0 or  = 0 | **M1** |
| Draws the conclusion that (*x* – 3), (*x* + 2) or (2*x* + 1) must therefore be a factor. | **M1** |
| Either makes an attempt at long division by setting up the long division, or makes an attempt to find the remaining factors by matching coefficients. For example, stating    or    or | **M1** |
| For the long division, correctly finds the the first two coefficients.  For the matching coefficients method, correctly deduces that  *a* = 2 and *c* = 2 or correctly deduces that *r* = 2 and *q* = −3 or correctly deduces that *u* = 1 and *w* = –6 | **A1** |
| For the long division, correctly completes all steps in the division.  For the matching coefficients method, correctly deduces that  *b* = 5 or correctly deduces that *p* = −5 or correctly deduces that *v* = –1 | **A1** |
| States a fully correct, fully factorised final answer:  (*x* – 3)(2*x* + 1)(*x* + 2) | **A1** |
|  | **(6 marks)** |

**NOTES:** Other algebraic methods can be used to factorise h(*x*).

For example, if (*x* – 3) is known to be a factor then

 by balancing (M1)

 by factorising (M1)

 by factorising (A1)

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| Attempt is made at expanding  Accept seeing the coefficients 1, 5, 10, 10, 5, 1  **6a Mark Scheme**  or seeing | **M1** |
| Fully correct answer is stated: | **A1** |
|  | **(2 marks)** |
| States that *p*, or the probability of rolling a 4, is  **6b Mark Scheme** | **B1** |
| States that *q*, or the probability of not rolling a 4, is | **B1** |
| States or implies that the sum of the first 3 terms (or 1 − the sum of the last 3 terms) is the required probability.  For example,  or 1 − | **M1** |
| or  or  or | **M1** |
| Eithero.e. or awrt 0.104 | **A1** |
|  | **(5 marks)** |
|  | **Total 7 marks** |

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| States or implies that o.e.  **7a Mark Scheme** | **M1** |
| Recognises that the cosine rule is needed to solve for  by stating | **M1** |
| Makes correct substitutions into the cosine rule.  o.e. | **M1** |
| or awrt −0.614 (seen or implied by correct answer). | **M1** |
| *A* = 127.9° cao | **A1** |
|  | **(5 marks)** |
| States formula for the area of a triangle.  **7b Mark Scheme**  Area = | **M1** |
| Makes correct substitutions using their values from above.  Area = | **M1ft** |
| Area = 27 (units2) | **A1ft** |
|  | **(3 marks)** |
|  | **Total 8 marks** |

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| Use of the gradient formula to begin attempt to find *k*.  or  (i.e. correct substitution into gradient formula and equating to ). | **M1** |
| 2*k* + 6 = −15 + 9*k*  21 = 7*k*  *k* = 3\* (must show sufficient, convincing and correct working). | **A1\*** |
|  | **(2 marks)** |
| Student identifies the coordinates of either *A* or *B*. Can be seen or implied, for example, in the subsequent step when student attempts to find the equation of the line.  *A(*5, −2) or *B*(1, 4). | **B1** |
| Correct substitution of their coordinates into *y* = *mx* + *b* or *y* − *y*1 = *m*(*x* − *x*1) o.e. to find the equation of the line. For example,  or  or  or | **M1** |
| or | **A1** |
|  | **(3 marks)** |
| Midpoint of *AB* is (3, 1) seen or implied. | **B1** |
| Slope of line perpendicular to *AB* is, seen or implied. | **B1** |
| Attempt to find the equation of the line (i.e. substituting their midpoint and gradient into a correct equation). For example,  or | **M1** |
| or .  Also accept any multiple of providing *a*, *b* and *c* are still integers. | **A1** |
|  | **(4 marks)** |
|  | **Total 9 marks** |

**8c Mark Scheme**

**8b Mark Scheme**

**8a Mark Scheme**

**9a Mark Scheme**

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| 115 (m) is the height of the cliff (as this is the height of the ball when *t* = 0). Accept answer that states 115 (m) is the height of the cliff plus the height of the person who is ready to throw the stone or similar sensible comment. | **B1** |
|  | **(1 mark)** |
| Attempt to factorise the – 4.9 out of the first two (or all) terms.  **9b Mark Scheme**  or | **M1** |
| or | **M1** |
| o.e. (N.B. 122.65625 =)  Accept the first term written to 1, 2, 3 or 4 d.p. or the full answer as shown. | **A1** |
|  | **(3 marks)** |
| Statement that the stone will reach ground level when  *h*(*t*) = 0, or is seen.  **9ci Mark Scheme** | **M1** |
| Valid attempt to solve quadratic equation (could be using completed square form from part **b**, calculator or formula). | **M1** |
| Clearly states that *t* = 6.25 s (accept *t* = 6.3 s) is the answer, or circles that answer and crosses out the other answer, or explains that *t* must be positive as you cannot have a negative value for time. | **A1** |
| **9cii Mark Scheme** | **(3 marks)** |
| hmax = awrt 123 ft A from part b. | **B1ft** |
| t =  or t = 1.25 ft C from part b. | **B1ft** |
|  | **(2 marks)** |
|  | **Total 9 marks** |

**NOTES: c:** Award 4 marks for correct final answer, with some working missing. If not correct B1 for each of *A*, *B* and *C* correct.

If the student answered part **b** by completing the square, award full marks for part **c**, providing their answer to their part **b** was fully correct.

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| seen or implied in later working. | **B1** | |
| Makes an attempt to use the sine rule, for example, writing | **M1** | |
| States or implies that  and  **NOTE:** Award ft marks for correct work following incorrect values for sin 120° and sin 45° | **A1** | |
| Makes an attempt to solve the equation for *x*. Possible steps could include:  **10ba Mark Scheme**  **10aa Mark Scheme**  or  or  or  or  or  or | **M1ft** | |
| or  or o.e. | **A1ft** | |
| Makes an attempt to rationalise the denominator by multiplying top and bottom by the conjugate. Possible steps could include: | **M1ft** | |
| States the fully correct simplifed version for *x*. \* | **A1\*** | |
| **NOTE:** Award ft marks for correct work following incorrect values for sin 120° and sin 45° | **(7 marks)** | |
| States or implies that the formula for the area of a triangle is  or or | | **M1** | |
| or . | | **M1** | |
| Finds the correct answer to 2 decimal places. 0.26 | | **A1** | |
| **NOTE:** Exact value of area is  If 0.26 not given, award M1M1A0 if exact value seen. | | **(3 marks) Total 10 marks** | |

**11ca Mark Scheme**

**11ba Mark Scheme**

**11aa Mark Scheme**

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| Makes an attempt to find  Raising *x* powers by 1 would constitute an attempt. | | **M1** |
| Shows a fully correct integral with limits. | | **A1** |
| Makes an attempt to substitute the limits into their expression. For example,  or  is seen. | | **M1ft** |
| Rearranges to a 3-term quadratic equation (with = 0). | | **M1ft** |
| Correctly factorises the LHS: (9*a* – 1)(*a* – 1) = 0 or uses a valid method for solving a quadratic equation (can be implied by correct answers). | | **M1ft** |
| States the two fully correct answers  or *a* = 1  For the first solution accept awrt 0.111 | | **A1** |
|  | | **(6 marks)** |
| **Figure 1**  alevel_ut_p1_u7_markscheme_aw1 | Straight line sloping downwards with positive *x* and *y* intercepts. Ignore portions of graph outside 0 ⩽ *x* ⩽ 2 | **M1** |
| Fully correct sketch with points (0, 10), and (, 0) labelled. Ignore portions of graph outside 0 ⩽ *x* ⩽ 2 | **A1** |
|  | **(2 marks)** |
|  | Statements to the effect that the (definite) integral will only equal the area (1) if the function is above the *x*-axis (between the limits)  AND  when *a* = 1, 2*a* = 2, so part of the area will be above the *x*-axis and part will be below the *x*-axis. | **B1** |
|  | Greater than 1. | **B1** |
|  |  | **(2 marks)** |
|  |  | **Total 10 marks** |

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| States that the perimeter of the track is  The choice of the variable *x* is not important, but there should be a variable other than *r*.  **12aa Mark Scheme** | **M1** |
| Correctly solves for *x*. Award method mark if this is seen in a subsequent step. | **A1** |
| States that the area of the shape is | **B1** |
| Attempts to simplify this by substituting their expression for *x*. | **M1** |
| States that the area is \* | **A1\*** |
| **12ba Mark Scheme** | **(5 marks)** |
| Attempts to differentiate *A* with respect to *r* | **M1** |
| Finds | **A1** |
| Shows or implies that a maximum value will occur when | **M1** |
| Solves the equation for *r*, stating | **A1** |
| Attempts to substitute for *r* in , for example writing | **M1** |
| Solves for *A*, stating | **A1** |
|  | **(6 marks)** |
|  | **Total 11 marks** |

**NOTES: 12b:** Ignore any attempts at deriving second derivative and related calculations.

**13ba Mark Scheme**

**13aa Mark Scheme**

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| Uses the equation of a straight line in the form  or  o.e. | | **M1** | |
| Makes correct substitution.  o.e. | | **A1** | |
|  | | **(2 marks)** | |
| Either correctly rearranges their equation by exponentiation  For example,  or takes the log of both sides of the equation . For example, . | | **M1** | |
| Completes rearrangement so that both equations are in directly comparable form  and  or and . | | **M1** | |
| States that *a* = 40 000 | | **A1** | |
| States that | | **A1** | |
| **NOTE:** 2nd M mark can be implied by correct values of *a* and *b*. | | **(4 marks)** | |
| *a* is the initial value of the car o.e. | | **B1** | |
| *b* is the annual proportional decrease in the value of the car o.e. (allow if explained in figures using their *b*. For example, (since *b* is ≈0.87) the car loses 13% of its value each year.) | | **B1** | |
| **NOTE:**  Accept answers that are the equivalent mathematically. For example, for *b*. the value of the car in 87% of the value the previous year. | | **(2 marks)** | |
| Substitutes 7 into their formula from part b. Correct answer is £15 157, accept awrt £15 000 | **B1ft** | |
|  | **(1 mark)** | |
| Uses  with their values of *a* and *b* or writes  (could be inequality). | **M1** | |
| Solves to find *t* = 10 years. | **A1ft** | |
|  | **(2 marks)** | |

**13ca Mark Scheme**

**13da Mark Scheme**

**13ea Mark Scheme**

**13f Mark Scheme**

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| Acceptable answers include.  The model is not necessarily valid for larger values of *t.*  Value of the car is not necessarily just related to age.  Mileage (or other factors) will affect the value of the car. | **B1** |
|  | **(1 mark)** |
|  | **Total 12 marks** |