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| **NAME:** | **TEACHER:** |

**Level 2 Mathematics and Statistics**

**2012**

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| 91261 Apply algebraic methods in solving problems |

# Credits: Four

**You should answer ALL parts of ALL the questions in this booklet.**

You should show ALL your working for ALL questions.

The questions in this booklet are NOT in order of difficulty.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

**YOU MUST HAND THIS BOOKLET TO YOUR TEACHER AT THE**

**END OF THE EXAMINATION.**

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| **For Assessor’s use only Achievement Criteria**  |
| **Achievement** | Achievement**with Merit** | **Achievement****with Excellence** |
| Apply algebraic methods in solving problems. | Apply algebraic methods, using relational thinking, in solving problems. | Apply algebraic methods, using extended abstract thinking, in solving problems. |
|  Overall Level of Performance |

You are advised to spend 60 minutes answering the questions in this booklet.

Assessor’s

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**QUESTION ONE:**

(a) Solve:

 (i) 

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 (ii) 

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(b) Find the logarithm of 16 to base 2.

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(c) A quadratic equation has solutions  and 

 Write the equation in the form 

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(d) Prove that the square of any odd number, decreased by 1, is divisible by 8.

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(e) Factorise .

 Thus find .

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**QUESTION TWO**

Assessor’s

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(a) Simplify

 (i) 

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(b) The radioactive element polonium decays according to the model

 

 where *A* is the initial amount and

 *t* is the time in days.

 (i) As time increases, without bound, what happens to the amount of polonium?

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 (ii) If the amount of polonium left after 280 days is 20 mg what was the initial amount

 present?

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 (c) Jason invested some money in an interest bearing account earning interest at the rate of

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 4.2% per annum.

 The value of his investment, *I* , after *t* years can be modelled by the equation

 

 where *P* is the Principal amount.

 (i) If Jason invested a Principal amount of $5000, calculate the value of Jason’s interest

 bearing account after 3 years.

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 (ii) For any value of the Principal amount calculate the time taken for the investment

 to double in value under the model given.

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(d) A circular pond is surrounded by a path 1 metre wide.

 The area of the path is  of the area of the pool.

Assessor’s

use only

 Find the radius of the pond.

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**QUESTION THREE**

Assessor’s

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(a) Factorise 

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(b)Solve

 (i) 

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 (ii) 

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(c) A missile is projected vertically upwards where its height *h* metres after *t* seconds is

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 modelled by the equation .

 (i) Use algebraic methods to find when the missile returns to the ground.

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 (ii) How long is the missile above 32 metres?

 Write your answer exactly, not as a decimal number.

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(d) Given the equation: 

Assessor’s

use only

 (i) Write this as a quadratic equation in *x*, in the standard form *.*

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 (ii) If this quadratic equation has real roots then what are the possible values for *y*?

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|  **Extra paper for continuing your answers, if required.**Assessor’suse only**Clearly number the question(s).** |

**Question**

**Number**

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**ASSESSMENT SCHEDULE**

####  91261 Apply algebraic methods in solving problems

|  |  |  |
| --- | --- | --- |
| **Achievement**  | **Achievement with Merit**  | **Achievement with Excellence**  |
|  *Apply algebraic methods in solving problems* involves:• selecting and using methods • demonstrating knowledge of algebraic  concepts and terms • communicating using appropriate  representations. |  *Apply algebraic method, using relational thinking*, *in solving problems* involves one or more of: • selecting and carrying out a logical  sequence of steps • connecting different concepts or  representations • demonstrating understanding of  concepts • forming and using a model;and also relating findings to a context, or communicating thinking using appropriate mathematical statements. |  *Apply algebraic methods, using extended abstract thinking, in solving problems* involves one or more of: • devising a strategy to investigate or solve a problem • identifying relevant concepts in context • developing a chain of logical reasoning, or  proof • forming a generalisation;and also using correct mathematical statements, or communicating mathematical insight. |

Sufficiency for each question:

N0: No response, no relevant evidence.

N1: Attempt at ONE question.

N2: 1 **u** OR partial solution in TWO questions

A3: 2 **u**

A4: 3 **u**

M5: 1 **r**

M6: 2 **r**

E7: 1 **t**

E8: 2 **t**

**Judgement Statement**

NOTE: This is an estimate as no examinations have yet been held.

|  |  |  |  |  |
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|  | **Not Achieved** | **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| **Score range** | 0 - 6 | 7 - 13 | 14 - 18 | 19 -24 |

| Question ONE | Evidence | Achievement (u) | Merit (r) | Excellence (t) |
| --- | --- | --- | --- | --- |
|  |  | **Apply algebraic methods in solving problems.** | *Apply algebraic methods, using relational thinking, in solving problems.* | *Apply algebraic methods using extended abstract thinking, in solving problems.* |
| 1a(i) |  | Equation solved. |  |  |
| 1a(ii) |   | Equation solved. |  |  |
| 1b | 4 | Correct answer found. |  |  |
| 1c | Equation must be  | Correct equation written in any form. | Correct equation found in correct form. |  |
| 1d | Let the odd number be 2*x* +1  =  = This has a factor of 4 and a factor of 2 [because *x*(*x*+1) must be the product of an odd and an even number ie even] and thus the factor of 4 and 2 give a factor of 8.. | Expression for an odd number found and used. | Partially solved the problem. | Devised a strategy and developed a chain of logical reasoning to solve the problem. |
| 1e |   | One quadratic expression fully factorised. | fully factorised. | Problem solved. |

| Question TWO | Evidence | Achievement (u) | Merit (r) | Excellence (t) |
| --- | --- | --- | --- | --- |
|  |  | **Apply algebraic methods in solving problems.** | *Apply algebraic methods, using relational thinking, in solving problems.* | *Apply algebraic methods using extended abstract thinking, in solving problems.* |
| 2a(i) |  | Expression fully simplified. |  |  |
| 2a(ii) |  | Expression fully simplified. |  |  |
| 2b(i) | As *t* increases without bound  ie the amount of polonium decreases towards zero. | Full explanation. [Gets smaller and smaller is not sufficient]. |  |  |
| 2b(ii) |  mg | Correct equation. | Problem solved. |  |
| 2c(i) |  = $5656.83 | Problem solved. |  |  |
| 2c(ii) | years | Correct equation set up to solve. | A correct strategy employed and logically reasoned and developed throughout to solve the problem for a specific Principal but has not solved for the general case. | A correct strategy employed and logically reasoned and developed throughout to solve the problem for the general case. |
| 2d | Let radius of pond be *r.* [m ] | Correct equation. | Partially solved the problem. | A correct strategy employed and logically reasoned and developed throughout to solve the problem. |

| Question THREE | Evidence | Achievement (u) | Merit (r) | Excellence (t) |
| --- | --- | --- | --- | --- |
|  |  | **Apply algebraic methods in solving problems.** | *Apply algebraic methods, using relational thinking, in solving problems.* | *Apply algebraic methods using extended abstract thinking, in solving problems.* |
| 3a |  | Expression factorised. |  |  |
| 3b(i) |   | Equation solved. |  |  |
| 3b(ii) |  | Expression fully factorised.ORCross multiplied and TWO solutions found (includes *x* = 2). | Problem solved. |  |
| 3c(i) | *t* = 0 or *t* = 7ie returns to ground after 7 seconds. | Solved quadratic equation. | Problem solved. |  |
| 3c(ii) | *t* = 0 or *t* = 7 or Difference is  seconds above 32 metres. | Quadratic equation solved. | Problem solved approx to get 6.40 seconds. | Problem solved. |
| 3d(i) |   | Correct quadratic equation. |  |  |
| 3d(ii) | Using “”  | Set up idea to begin solution. | Quadratic solved but problem only partially solved. | A correct strategy employed and logically reasoned and developed throughout to solve the problem.Accept < signs. |