

# Rossmoyne Senior High School

### Semester One Examination, 2016

### Question/Answer Booklet

# MATHEMATICS

**SOLUTIONS**

**APPLICATIONS**

**UNIT 1**

## Section One:

## Calculator-free

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Student Number: In figures |  |  |  |  |  |  |  |  |

 In words

 Your name

## Time allowed for this section

Reading time before commencing work: five minutes

Working time for section: fifty minutes

## Materials required/recommended for this section

***To be provided by the supervisor***

This Question/Answer Booklet

Formula Sheet

***To be provided by the candidate***

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: nil

## Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

## Structure of this paper

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Section | Number of questions available | Number of questions to be answered | Workingtime (minutes) | Marks available | Percentage of exam |
| Section One:Calculator-free | 7 | 7 | 50 | 52 | 35 |
| Section Two:Calculator-assumed | 12 | 12 | 100 | 98 | 65 |
|  | **Total** | 150 | 100 |

## Instructions to candidates

1. The rules for the conduct of examinations are detailed in the school handbook. Sitting this examination implies that you agree to abide by these rules.
2. Write your answers in this Question/Answer Booklet.
3. You must be careful to confine your response to the specific question asked and to follow any instructions that are specified to a particular question.
4. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
* Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
* Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.
1. **Show all your working clearly**. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required to receive full marks. If you repeat any question, ensure that you cancel the answer you do not wish to have marked.
2. It is recommended that you **do not use pencil**, except in diagrams.
3. The Formula Sheet is **not** to be handed in with your Question/Answer Booklet.

Section One: Calculator-free 35% (52 Marks)

This section has**seven (****7)** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time for this section is 50 minutes.

Question 1 (5 marks)

(a) Evaluate

(i) . (1 mark)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ evaluates calculation |

(ii)  when . (1 mark)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ substitutes and evaluates calculation |

(b) Given , determine

(i) A when  and . (1 mark)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ substitutes and evaluates calculation |

(ii) h when  and . (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ substitutes and simplifies✓ solves for h |

Question 2 (8 marks)

A casual worker submitted the weekly time sheet below. On Saturdays and Sundays, casuals are paid time and a half and double time respectively.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Time sheet | Normal hourly pay rate | $20 |  |  |  |
|  | Mon | Tue | Wed | Thu | Fri | Sat | Sun |
| Hours worked | - | - | - | 3.5 | 5.5 | 4 | 5 |

(a) How many hours did the casual worker work during this week? (1 mark)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ states hours worked |

(b) How much did the casual worker earn

(i) on Friday? (1 mark)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates earnings |

(ii) on Saturday? (1 mark)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates earnings |

(iii) for this week's work? (2 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates Thursday's and Sunday's earnings✓ calculates total earnings |

(c) The previous week, the casual worker had $30 deducted for PAYG tax from their total earnings of $400. What percentage of their week's earnings was this? (2 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ writes calculation to determine percentage✓ determines percentage |

(d) If casual workers were awarded a 4% pay increase, what would the new normal hourly rate become? (1 mark)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates new rate |

Question 3 (5 marks)

The number of different bus services that run between four locations is shown in the table below and also in the matrix M.

|  |  |  |
| --- | --- | --- |
|  |  | To |
|  |  | A | B | C | D |
| From | A | 0 | 1 | 1 | 0 |
| B | 2 | 0 | 2 | 0 |
| C | 1 | 1 | 0 | 1 |
| D | 0 | 0 | 1 | 0 |

 

(a) Briefly explain the information shown in the matrix  (1 mark)

|  |
| --- |
| **Solution** |
| The number of ways to travel from one location to another using two bus services. |
| **Specific behaviours** |
| ✓ explanation |

(b) Complete the diagram below to show the information in the table. (2 marks)



|  |
| --- |
| **Solution** |
| See diagram |
| **Specific behaviours** |
| ✓ adds the four missing edges✓ includes direction on one edge from B to C |

(c) State the number of ways to travel from D to B using two bus services. (1 mark)

|  |
| --- |
| **Solution** |
| One way |
| **Specific behaviours** |
| ✓ |

(d) How many more ways are there to travel from B to C than from C to B, using either one or two bus services? (1 mark)

|  |
| --- |
| **Solution** |
| B to C: , C to B: . There are 2 more ways. |
| **Specific behaviours** |
| ✓ states number of ways. |

Question 4 (10 marks)

Consider matrices , ,  ,  and .

(a) Explain which two, if any, of the five matrices can be added together. (2 marks)

|  |
| --- |
| **Solution** |
| None of the matrices, because no two of them have the same dimensions. |
| **Specific behaviours** |
| ✓ states none✓ states reason |

(b) Calculate . (2 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates product✓ determines final matrix |

(c) Determine the values of x and y if . (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ determines x✓ determines y |

(d) Calculate , where I is the identity matrix. (2 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates square✓ determines final result |

(e) Determine an order in which all five matrices can be multiplied together and state the dimensions of the resulting matrix. (2 marks)

|  |
| --- |
| **Solution** |
|  or . Dimensions of result are . |
| **Specific behaviours** |
| ✓ lists either order✓ states dimensions |

Question 5 (7 marks)

(a) Write the following scales as a ratio in simplest form, without units.

(i) 5 cm : 1 m. (1 mark)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ states simplified ratio |

(ii) 20 mm : 1 km. (1 mark)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ states simplified ratio |

(b) The length of a house is 12.6 m. Determine the length of the house on a drawing with a scale of 1:200. (2 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ converts using scale✓ states units |

(c) Two similar triangles are shown below. Determine the lengths x and y. (3 marks)



|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates scale factor✓ determines x✓ determines y |

Question 6 (8 marks)

A model sculpture stood 45 cm tall and had a surface area of 2 500 cm2. When the actual sculpture was completed, it was a perfect enlargement of the model and stood 4.5 m tall.

*You may wish to recall that 10 000 cm2 = 1 m2 and 1 000 000 cm3 = 1 m3.*

Determine

(a) the linear scale factor of the model to the actual sculpture. (2 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ adjust units✓ determines scale factor |

(b) the surface area of the actual sculpture, in square metres. (3 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ determines area scale factor✓ multiplies by area scale factor✓ adjusts units |

(c) the volume of the model in cubic centimetres, given that the actual sculpture had a volume of 5 m3. (3 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ adjust units✓ determines volume scale factor✓ divides by volume scale factor |

Question 7 (9 marks)

Fred, Gail and Harry worked in a motor vehicle dealership. During May they sold 11, 14 and 12 cars and 5, 1 and 2 vans respectively. In the following month, the three sold a total of 30 cars and 10 vans, of which Fred sold 13 cars and 4 vans and Gail sold 9 cars and 3 vans.

(a) Organise the above information into two matrices to show the number of cars and vans sold by Fred, Gail and Harry during May and June. (3 marks)

|  |
| --- |
| **Solution** |
|  *NB May choose 3x2 instead of 2x3 matrices* |
| **Specific behaviours** |
| ✓ writes matrix for May✓ calculates missing values for Harry for June✓ writes matrix for June |

(b) Write a matrix calculation to determine the change in the number of cars and vans sold by Fred, Gail and Harry from May to June, and write the answer to this calculation. (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ writes May matrix subtracted from June matrix✓ writes difference |

(c) Fred, Gail and Harry are paid $5 000, $ 4 800 and $ 4 500 per month respectively. They are also paid bonuses of $200 for each car they sell and $300 for each van in any given month.

(i) Write down a calculation involving three matrices, that would result in a matrix showing the monthly pay owed to Fred, Gail and Harry for the month of May.

 (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ pre-multiplies May matrix by bonus matrix✓ adds monthly wages matrix |

(ii) Evaluate your answer to (i). (2 mark)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ multiplies matrices✓ adds matrices |

Additional working space

Question number: \_\_\_\_\_\_\_\_\_

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