

# Rossmoyne Senior High School

### Semester One Examination, 2016

### Question/Answer Booklet

# MATHEMATICS

**SOLUTIONS**

**APPLICATIONS**

**UNIT 1**

## Section Two:

## Calculator-assumed

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

 In words

 Your name

## Time allowed for this section

Reading time before commencing work: ten minutes

Working time for section: one hundred minutes

## Materials required/recommended for this section

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

This Question/Answer Booklet

Formula Sheet (retained from Section One)

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

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

Special items: drawing instruments, templates, notes on two unfolded sheets of A4 paper, and up to three calculators approved for use in the WACE examinations

## 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 Two: Calculator-assumed 65% (98 Marks)

This section has**twelve (****12)** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time for this section is 100 minutes.

Question 8 (5 marks)

A company pays casual workers for delivering leaflets to homes according to the following scale:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of leaflets delivered per home | 1 | 2 | 3 | 4 |
| Pay rate per home ($) | 0.30 | 0.36 | 0.40 | 0.42 |

For example, a worker who delivers three different leaflets to each of 20 homes would be paid .

(a) A worker delivers two leaflets to 550 homes one day. Calculate their pay. (1 mark)

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

(b) Another worker delivered four leaflets to each of 280 homes and a further three leaflets to another 135 homes. Calculate their pay. (2 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates individual pays✓ adds pays together |

(c) For the same cost as delivering one leaflet to 2 100 homes, how many homes could have four leaflets delivered? (2 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates cost✓ determines number of homes |

Question 9 (8 marks)

A young person is drawing up a budget to see how much it would cost to purchase and run a small motor car over a year.

|  |  |
| --- | --- |
|  | Frequency of payment |
| Expense | Weekly ($) | Monthly ($) | Half-yearly ($) | Yearly ($) |
| Fuel | 24 |  |  | 1248 |
| Tyres |  | 16 |  | 192 |
| Servicing |  |  | 180 | 360 |
| Registration |  |  | 285 | 570 |
| Insurance |  | 112 |  | 1344 |
| Motor club |  | 12 |  | 144 |
| Loan repayment | 132 |  |  | 6864 |

(a) Calculate the missing yearly payments, assuming there are exactly 52 weeks in a year, and write these figures in the last column of the table above. (3 marks)

|  |
| --- |
| **Solution** |
| See table |
| **Specific behaviours** |
| ✓ both weekly amounts, ✓ both monthly amounts, ✓ both half-yearly amounts |

(b) Name one of the above expenses that is an example of a variable expense. (1 mark)

|  |
| --- |
| **Solution** |
| Names fuel or tyres, as these depend on distance driven |
| **Specific behaviours** |
| ✓ names expense |

(c) Calculate the amount that the young person should budget to run a motor car

(i) over a year. (1 mark)

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

(ii) each week. (1 mark)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ calculates weekly amount |

(d) If the car cost $15 985 and is expected to depreciate by 16% in the first year but only 8% in the second year, calculate the total depreciation over the first two years. (2 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates depreciated value of car for each year✓ determines total depreciation |

Question 10 (8 marks)

A frame to support an advertising flag is to be made from four thin metal pipes, PQ, QR, PR and QS as shown below. Known lengths are  cm,  and  cm.



(a) If the metal pipe costs $15.50 per metre, determine the cost of the pipe used to make the frame. (3 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates PS and SR✓ calculates total length✓ calculates cost |

(b) The cloth used to make the flag, shaded grey in the diagram, costs $45 per square metre. Determine the cost of the cloth required. (3 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ converts to lengths to metres✓ calculates area✓ calculates cost |

(c) If labour costs are 240% of total material costs, determine the total cost of the advertising flag. (2 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates labour cost✓ calculates total cost |

Question 11 (9 marks)

A supermarket is offering the same brand of frozen peas for sale in three different sized packets: 1.5 kg for $10.25, 750 g for $5.83 or 250 g for $1.85.

(a) Rank the packet sizes from worst to best buy, justifying your ranking. (3 marks)

|  |
| --- |
| **Solution** |
|  Worst to best order is 750 g, then 250 g then 1.5 kg. |
| **Specific behaviours** |
| ✓ calculates 2 out of 3 unit costs correctly✓ calculates all 3 unit costs correctly✓ orders from worst to best |

(b) The supermarket has limited stocks of the 500 g size of frozen peas and want to price these packets to be the worst buy of all four sizes. Calculate the minimum price they should charge for this size packet, to the nearest 10 cents. (2 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ uses worst price from (i) to calculate cost of 500 g packet✓ rounds to nearest 10c |

(c) The supermarket is considering an offer to customers so that they can purchase four of the 250 g packets for the price of a 750 g packet. What percentage discount is this per packet? (2 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates $ discount✓ expresses as % of full price |

(d) The prices include 10% GST. Determine

(i) the amount of GST included in the price of the 750 g packet. (1 mark)

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

(ii) the price of the 1.5 kg packet without GST. (1 mark)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates ex GST price |

Question 12 (7 marks)

Light vehicle licence fees in Western Australia are calculated using the formula shown below:

Fee $=$ Vehicle fee per 100kg $×$ Total weight (rounded up to the nearest 100kg) $÷$ 100 + $19.45.

The table below shows the light vehicle licence fees calculated using the above formula, in dollars, for a range of vehicle types and rounded up weights.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Total weight (rounded up) | 100 kg | 200 kg | 1000 kg | 1400 kg | 1500 kg | 1600 kg |
| Vehicle | Fee per 100kg |  |  |  |  |  |  |
| Motor car | $19.99 | 39.44 | 59.43 | 219.35 | 299.31 | 319.30 | A |
| Motorcycle | $39.98 | 59.43 | 99.41 | 419.25 | 579.17 | 619.15 | 659.13 |
| Caravan | $5.00 | 24.45 | 29.45 | B | 89.45 | 94.45 | 99.45 |

(a) Use the table to determine the licence fee for

(i) a motorcycle with a rounded up weight of 200 kg. (1 mark)

|  |
| --- |
| **Solution** |
| $99.41 |
| **Specific behaviours** |
| ✓ states fee |

(ii) a motor car weighing 1 415 kg. (1 mark)

|  |
| --- |
| **Solution** |
| $319.30 |
| **Specific behaviours** |
| ✓ states fee |

(b) Calculate the values of A and B in the table. (2 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates A✓ calculates B |

(c) Calculate how much cheaper it is to licence a 1 140 kg caravan than a 215 kg motorcycle in WA. (3 marks)

|  |
| --- |
| **Solution** |
|  $59.94 cheaper |
| **Specific behaviours** |
| ✓ calculates motorcycle fee✓ calculates caravan fee✓ calculates difference |

Question 13 (7 marks)

A company logo is shown below, formed by three concentric circles of radii 5, 10 and 15 cm that are divided up into four quadrants by two straight lines intersecting at right-angles.



(a) A model of the logo is to be made, using thin wire for the circles and lines. Calculate the total length of wire needed. (3 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates circumferences✓ includes four radii✓ sums all lengths |

(b) Calculate the total shaded area of the logo. (4 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ re-shades logo✓ calculates large sector✓ calculates small sector✓ calculates difference |

Question 14 (10 marks)

The Newstart Allowance is a government payment to help individuals aged 22 years or more who are looking for work. The maximum fortnightly payment for a single person with no children is $523.40.

Newstart Allowance recipients can earn up to $102 per fortnight before tax before their payment is affected. Income above $102 and up to $252 per fortnight reduces the fortnightly payment by 50 cents in the dollar and income above $252 per fortnight reduces the payment by 60 cents in the dollar.

(a) Determine the fortnightly Newstart Allowance paid to the following:

(i) a person who earns $120 per week. (3 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates fortnightly income✓ calculates deduction✓ calculates payment |

(ii) a person who works part time in a job paying $22.75 per hour for 12 hours each week. (4 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates fortnightly income✓ calculates first deduction✓ calculates second deduction✓ calculates payment |

(b) Over what fortnightly amount will an individual, who qualifies for Newstart Allowance, no longer receive any payment? (3 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates deduction required at 60c rate✓ sets up equation✓ solves equation |

Question 15 (9 marks)

Large steel washers used in the construction of bridges have an external radius of 9.5 cm, an internal radius of 3.5 cm and a thickness of 1.25 cm.



(a) Determine the volume of one washer. (3 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates area of circles✓ calculates x-section area✓ calculates volume |

(b) For transportation, the washers are packed into bins that can carry a maximum weight of 500 kg. If one cubic centimetre of steel used to make these washers weighs 7.7 grams, determine how many washers can be packed into one bin, to the nearest ten. (3 marks)

|  |
| --- |
| **Solution** |
|  Pack 210 washers into bin |
| **Specific behaviours** |
| ✓ calculates weight of one washer✓ converts weight to kg✓ calculates number, rounding to nearest ten |

(c) The surface of the washer is coated with a rust-proofing agent. Determine the surface area of one washer. (3 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates top/bottom✓ calculates inner/outer✓ calculates total SA |

Question 16 (8 marks)

(a) An investor bought 750 shares in a company for $12.75 each through an online broker that charged a brokerage fee of 0.35% on the value of the shares. The company forecast a dividend of 95 cents per share.

(i) Calculate the total cost of buying the shares. (3 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates value of shares✓ calculates brokerage fee✓ states total cost |

(ii) Calculate the expected dividend for these 750 shares. (1 mark)

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

(b) Use the following information on two companies to determine which company has the lowest price-to-earnings ratio. (4 marks)

* Acorn: Annual earnings of $7.3 million, with a total of 8 million shares issued and a market price of $14.80 per share.
* Billet: A market price of $6.60 per share, with last dividend of 8.5c per share and 25% of the annual earnings paid as dividend.

|  |
| --- |
| **Solution** |
|  Hence Acorn has lowest P/E ratio. |
| **Specific behaviours** |
| ✓ calculates EPS for Acorn✓ calculates EPS for Billet✓ calculates P/E ratios✓ states lowest P/E ratio |

Question 17 (10 marks)

Pyramid ABCDE has a square base of side 24 cm and four sloping edges of length 37 cm, as shown in the diagram below.



(a) Calculate the length of EG, where G is the midpoint of BC. (2 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ uses Pythagoras' theorem✓ calculates length |

(b) Determine the area of triangle BCE. (1 mark)

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

(c) Determine the total surface area of all five faces of the pyramid. (2 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates base area✓ calculates TSA |

(d) Calculate the length of FC, where F is the midpoint of AC. (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ uses Pythagoras' theorem✓ calculates length |

(e) Show that the perpendicular height of the pyramid, EF, is 33 cm, to the nearest cm.

 (1 mark)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ uses Pythagoras' theorem |

(f) Calculate the volume of the pyramid. (2 marks)

|  |
| --- |
| **Solution** |
|  *NB Using exact values throughout will give*   |
| **Specific behaviours** |
| ✓ uses volume formula✓ determines volume |

Question 18 (8 marks)

The ticket sales for an amateur dramatic production are shown in the matrix T below for three nights of the show. Adult tickets cost $18 each and child tickets were $5 each.



(a) Represent the ticket prices in a suitable matrix P and then use matrix multiplication to calculate matrix S, the product of P and T. (2 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ writes 1x2 matrix P with correct coefficients✓ multiplies P and T |

(b) Explain what information matrix S shows. (1 mark)

|  |
| --- |
| **Solution** |
| S shows the income from ticket sales on each of the three nights. |
| **Specific behaviours** |
| ✓ suitable explanation |

(c) By how much did the income from the Saturday show exceed the Thursday performance?

 (1 mark)

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

(d) Show how to multiply matrix S by another matrix to obtain a matrix that shows the total income over all three nights of the show. (2 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ shows 3x1 matrix, ✓ calculates product |

(e) Some members of the society felt that in the future, children should attend for free and adult tickets should cost an extra $2.50 to make up the shortfall. Determine whether this increase would have made up the shortfall over these three nights. (2 marks)

|  |
| --- |
| **Solution** |
| Yes, the plan more than makes up for the shortfall - an extra $65 dollars |
| **Specific behaviours** |
| ✓ Shows new total income (not necessary to see new matrices)✓ Comments that plan does make up shortfall |

Question 19 (9 marks)

The currency exchange rates in Australian dollars for four countries are shown in the table below.

|  |  |  |  |
| --- | --- | --- | --- |
| Country/Region | Currency | Buy | Sell |
| Germany | Euro | 0.7242 | 0.6371 |
| Japan | Yen | 94.46 | 80.80 |
| India | Rupee | 60.76 | 46.48 |
| South Africa | Rand | 13.32 | 11.17 |

(a) Explain why an Australian traveller going on holiday to South Africa would use the rate of 11.17 to estimate how many rand they will get when they convert their dollars. (1 mark)

|  |
| --- |
| **Solution** |
| The bank is selling them a foreign currency and so must use the sell rate. |
| **Specific behaviours** |
| ✓ explanation |

(b) The midrate is the average of the buying and selling rates. Calculate the midrate for Indian rupees. (1 mark)

|  |
| --- |
| **Solution** |
|  rupees |
| **Specific behaviours** |
| ✓ calculates midrate |

(c) A student was returning from Japan with 8 100 yen after a holiday. How much would they receive in Australian dollars? (1 mark)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ calculates amount using buy rate |

(d) A traveller exchanged $5 000 into euros, but then cancelled their trip and converted their money back into Australian dollars. How much did they lose on these transactions?

 (3 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ converts to euros using sell rate✓ converts back to A$ using buy rate✓ calculates loss |

(e) Specialist software can be purchased online from a German company for 149 euros or from a Japanese company for 19 900 yen. Compare the costs in Australian dollars and hence calculate how much can be saved by buying from the cheapest company.

 (3 marks)

|  |
| --- |
| **Solution** |
|   |
| **Specific behaviours** |
| ✓ uses sell rates (will have to sell A$ to obtain required currency)✓ converts both prices into A$✓ calculates saving |

Additional working space

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

Additional working space

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

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