

# 

### Semester One Examination, 2019

### 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: 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 this examination

## 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 material. 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 | Working  time (minutes) | Marks available | Percentage of examination |
| Section One:  Calculator-free | 8 | 8 | 50 | 52 | 35 |
| Section Two:  Calculator-assumed | 13 | 13 | 100 | 98 | 65 |
|  | | |  | **Total** | 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 preferably using a blue/black pen.  
Do not use erasable or gel pens.

3. You must be careful to confine your answer to the specific question asked and to follow any instructions that are specified to a particular question.

4. 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.

5. It is recommended that you do not use pencil, except in diagrams.

6. Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

7. The Formula sheet is not to be handed in with your Question/Answer booklet.

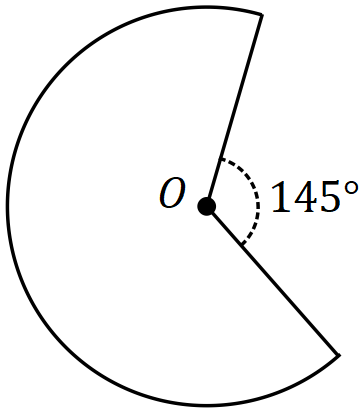
Section Two: Calculator-assumed 65% (98 Marks)

This section has**thirteen (****13)** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time: 100 minutes.

Question 9 (5 marks)

A sector of a circle of radius cm is shown below.



(a) Show that the perimeter of the sector is cm, when rounded to the nearest cm.

(3 marks)

|  |
| --- |
| **Solution** |
| Interior angle:  Arc length:  Perimeter: cm |
| **Specific behaviours** |
| ✓ interior angle   arc length   total perimeter |

(b) Determine the area of the sector. (2 marks)

|  |
| --- |
| **Solution** |
| Area:  cm2 |
| **Specific behaviours** |
| ✓ area of circle   area of sector |

Question 10 (7 marks)

(a) Calculate the value of given that and when and .

(2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correct value of   correct answer |

(b) The future value, , of an annuity can be calculated using the formula below.

Consider an annuity with values and .

(i) Calculate the future value, rounding your answer to the nearest dollar. (3 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ evidence of correct substitution   calculates   value to nearest dollar |

(ii) Calculate the change in when the value of is changed from to . (2 marks)

|  |
| --- |
| **Solution** |
| Increase of |
| **Specific behaviours** |
|  calculates   correct increase |

Question 11 (8 marks)

(a) A triangle has sides of length cm, cm and cm. State, with reasons, whether the triangle is right-angled. (2 marks)

|  |
| --- |
| **Solution** |
| Hence triangle is right-angled as the side lengths satisfy **Pythagoras' theorem**. |
| **Specific behaviours** |
| ✓ shows use of   explanation (must use bolded words) |

(b) A m long ladder leans against a m tall wall with the foot of the ladder m away from the base of the wall on level ground.

(i) Draw a two-dimensional sketch of this situation, showing the ladder extending beyond the top of the wall. (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ sketch with right-angle   includes lengths |

(ii) Calculate the distance the ladder extends beyond the top of the wall. (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ length touching wall   distance extended |

(iii) The foot of the ladder is moved along the ground and away from the base of the wall until the top of the ladder is just touching the top of the wall. Determine how far the foot of the ladder was moved. (2 marks)

|  |
| --- |
| **Solution** |
| Distance from bottom of wall:  Moved |
| **Specific behaviours** |
| ✓ distance from wall   distance moved |

Question 12 (6 marks)

A researcher at a weather station uses the following formula to calculate , the absolute humidity of the air, where is the relative humidity and is the air temperature.

(a) Calculate when and . (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ substitutes correctly   correct value |

The formula for was used to create the spreadsheet below for various values of and .

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | |  | | | | |
|  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

(b) Calculate the value of the entries and shown in the spreadsheet. (2 marks)

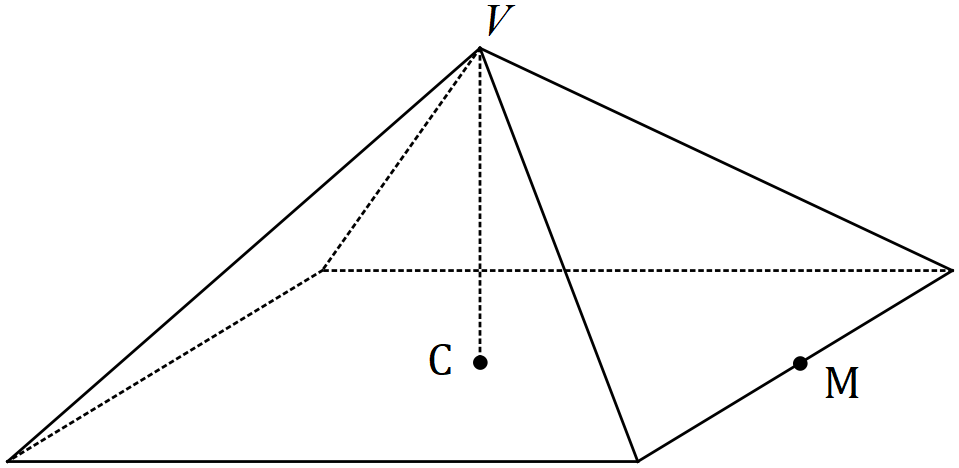
|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ value of   value of |

(c) One of the entries in the spreadsheet is incorrect. State the value of and the value of for the cell in which the incorrect value lies and calculate the correct value of . (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correct values of and   correct value of |

Question 13 (6 marks)

A bakery sells a specialty cake in the shape of a square-based pyramid. The sides of the square are all cm and the vertex of the pyramid, , lies cm directly above the centre of the square base, . The mid-point of one of the sides of the square is .



(a) Determine the volume of the cake. (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ indicates area of base   correct volume |

(b) Calculate the length . (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ indicates lengths and   correct distance |

(c) The four triangular faces are iced at a cost of cents per square cm. Determine the cost of icing the cake, in dollars and cents. (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correct TSA   correct cost |

Question 14 (9 marks)

The weekly sales of Sumsang phones (the Ten, Plus and Note models) at retail outlets , and is shown in matrix .

(a) In total, how many Note models were sold? (1 mark)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correct number |

(b) What does the element in matrix represent? (1 mark)

|  |
| --- |
| **Solution** |
| The number of Plus models sold by store A |
| **Specific behaviours** |
| ✓ mentions store and model |

(c) Determine the matrix , where , and explain what shows. (2 marks)

|  |
| --- |
| **Solution** |
| The total number of phones sold at each of the stores during the week. |
| **Specific behaviours** |
| ✓ correct   correct explanation |

(d) Determine the matrix , where , and explain what shows. (2 marks)

|  |
| --- |
| **Solution** |
| The total number of each model sold during the week. |
| **Specific behaviours** |
| ✓ correct   correct explanation |

(e) The Ten, Plus and Note models are sold for , and respectively.

(i) Use this information to write matrix that can be multiplied by matrix to yield a sensible result. (1 mark)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correct matrix |

(ii) Multiply matrices and together and explain what the result shows. (2 marks)

|  |
| --- |
| **Solution** |
| The total sales income from selling all the phones at all the stores. |
| **Specific behaviours** |
| ✓ correct product, as matrix   correct explanation |

Question 15 (7 marks)

A shop sold three sizes of the same brand of soy sauce. The mL bottle cost , the mL bottle cost and the mL bottle cost .

Retail laws require the shop to display the price per mL for each bottle, to the nearest cent.

(a) Calculate the price per mL for all three sizes of soy sauce. (3 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ uses unit cost for one size   correct 100 mL price for one size   all three prices correct |

(b) Use the unit prices to list the bottle sizes in order of value, from best to worst. (1 mark)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correct order |

(c) Determine the maximum price, to the nearest cent, for a mL bottle of the same sauce if the shop wanted it to be better value than the other three sizes in terms of unit price.

(2 marks)

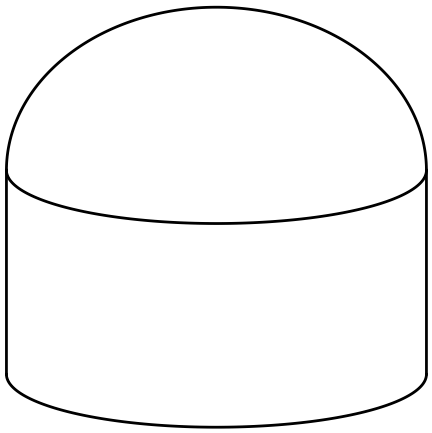
|  |
| --- |
| **Solution** |
| To be best value, price must be less, so . |
| **Specific behaviours** |
| ✓ calculates price to be equal best   correct price |

(d) Suggest one reason that a shopper may prefer a size other than that which offers the best value in terms of unit price. (1 mark)

|  |
| --- |
| **Solution** |
| - avoid wastage  - don't have enough money, etc, etc |
| **Specific behaviours** |
| ✓ sensible reason |

Question 16 (6 marks)

A wood turner crafted solid shape as shown below - a hemisphere of radius cm atop a cylinder with the same radius and height cm.



(a) The wood turner started out with a block of wood in the shape of a rectangular prism with dimensions cm. Determine the volume of wood that was removed from this block to end up with shape . (3 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ cylinder volume   hemisphere volume   correct volume removed |

(b) Shape was then cut vertically into two congruent halves. Determine the area of one of the cut faces. (3 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
|  uses correct cross-sections  ✓ semi-circle area   correct total |

Question 17 (12 marks)

A spreadsheet to track a monthly car budget is shown below, with all amounts in dollars. The figures for months 1, 2 and 3 show the actual expenditure for each item.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Item | Monthly Budget | Month 1 | Month 2 | Month 3 | 3-Month Total |
| Loan payment |  |  |  |  |  |
| Insurance |  |  |  |  |  |
| Maintenance |  |  |  |  |  |
| Fuel |  |  |  |  |  |
| Total |  |  |  |  |  |

(a) Determine the values of and in the spreadsheet. (3 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ one correct value   at least 3 correct values   all correct values |

(b) A motoring organisation recommends allocating no more than of a person's monthly income to running a car. Would a person on a salary of pa and using the total monthly budget figure above meet this target? Justify your answer. (3 marks)

|  |
| --- |
| **Solution** |
| Since the budget total is but the recommended maximum is only , they do not meet the target. |
| **Specific behaviours** |
| ✓ calculates monthly salary   calculates correct percentage   explains why they do not meet target |

(c) Over the three months shown, the total actual expenditure for two items exceeded their budgeted figures.

(i) Which items were these? (1 mark)

|  |
| --- |
| **Solution** |
| Maintenance and fuel |
| **Specific behaviours** |
| ✓ correct items |

(ii) Determine which of these two items exceeded their budgeted figure by the largest percentage. (3 marks)

|  |
| --- |
| **Solution** |
| Maintenance:  Fuel:  Maintenance exceeded by the largest percentage. |
| **Specific behaviours** |
| ✓ % figure for maintenance  ✓ % figure for fuel   states correct item |

(d) The monthly budget figure for insurance includes a tax. Determine the cost of the insurance without this tax. (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ indicates appropriate method   correct cost, to nearest cent |

Question 18 (8 marks)

Single people aged between and , living at home and looking for work qualify for the youth allowance of per fortnight, unless they earn more than in that time, in which case no allowance is paid.

In any fortnight that they earn between and , the allowance will be reduced by cents in the dollar for earnings over .

In any fortnight that they earn between and , the allowance will be reduced by plus cents in the dollar for earnings over .

Determine, with justification, the fortnightly youth allowance paid to each of the following.

(a) Alex, who earns per week. (2 marks)

|  |
| --- |
| **Solution** |
| Full allowance of |
| **Specific behaviours** |
| ✓ indicates fortnightly earnings   correct allowance |

(b) Bay, who has a part time job paying per hour for hours each fortnight. (3 marks)

|  |
| --- |
| **Solution** |
| Will lose  Allowance of |
| **Specific behaviours** |
| ✓ indicates fortnightly earnings   indicates correct deduction   correct allowance |

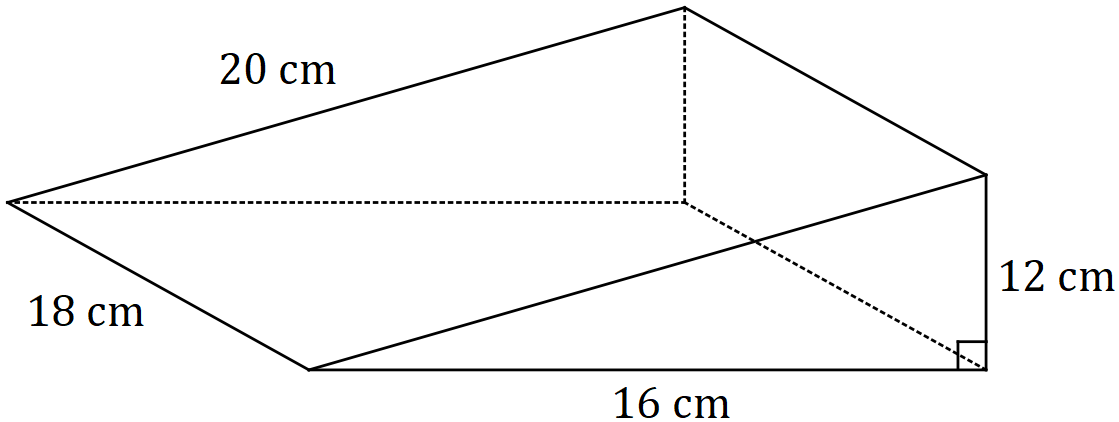
(c) Cara, who is paid per hour for working hours a day for days a week.

(3 marks)

|  |
| --- |
| **Solution** |
| Will lose  Allowance of |
| **Specific behaviours** |
| ✓ indicates fortnightly earnings   indicates correct deduction   correct allowance |

Question 19 (8 marks)

A right-triangular prism has dimensions shown in the diagram below.



(a) Determine the total surface area of the prism. (3 marks)

|  |
| --- |
| **Solution** |
| Triangular ends:  Rectangles:  TSA: cm2 |
| **Specific behaviours** |
| ✓ indicates area of triangle   indicates area of rectangle   correct TSA |

(b) An eighth-size model is made of the prism, i.e. using a scale of . Calculate the total surface area of this model. (2 marks)

|  |
| --- |
| **Solution** |
| Area scale factor:  Area: cm2 |
| **Specific behaviours** |
| ✓ indicates area scale factor   correct area |

(c) Determine the volume of the original prism. (1 mark)

|  |
| --- |
| **Solution** |
| Volume: cm3 |
| **Specific behaviours** |
| ✓ correct volume |

(d) Another scale model is made of the prism, so that the dimensions of the sloping face are now cm by cm. Calculate the volume of this scale model. (2 marks)

|  |
| --- |
| **Solution** |
| Scale factor: . Volume sf  Volume: cm3 |
| **Specific behaviours** |
| ✓ indicates scale factor for length and volume   correct volume |

Question 20 (8 marks)

(a) An investor pays into a new account offering interest of pa, with interest payable every days. The investor closes the account and withdraws the principal and interest just after the first interest payment.

Calculate the amount they withdraw. (3 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correctly substitutes   calculates interest   correct withdrawal |

(b) Another person invested with a bank that offered an interest rate of pa.

(i) Determine the value of the investment after two years when interest is compounded annually. (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correctly substitutes   correct value |

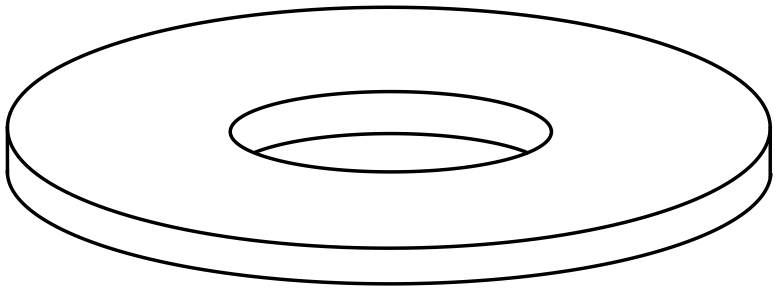
(ii) The person was advised that they would be better off after two years if they invested the same sum with another bank that was offering an interest rate of pa compounded monthly. State, with justification, whether this was good advice.

(3 marks)

|  |
| --- |
| **Solution** |
| Advice was good - they were better off. |
| **Specific behaviours** |
| ✓ correctly substitutes   correct value  ✓ correct conclusion |

Question 21 (8 marks)

The washer shown below is made of plastic and has an internal radius of mm, an external radius of mm and is mm thick.



(a) The plastic used to make the washers costs cents per litre. Given that one litre is cubic centimetres, determine the cost of making of the washers. (4 marks)

|  |
| --- |
| **Solution** |
| Outer volume:  Inner volume:  Total volume:  Cost: |
| **Specific behaviours** |
| ✓ outer volume   inner volume   volume of all washers   correct cost |

(b) Calculate the total surface area of one washer, giving your answer in mm2. (4 marks)

|  |
| --- |
| **Solution** |
| Outer cylinder:  Inner circles:  Inner walls:  TSA: mm2 |
| **Specific behaviours** |
| ✓ outer cylinder   inner circles   inner walls   correct TSA |

Supplementary page

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

Supplementary page

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

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