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Curriculum Council

WACE
Western Australian Certificate of Education

Western Australian Certificate of Education
Examination, 2010

Question/Answer Booklet

MATHEMATICS 2A/2B

Section Two: Calculator-assumed

Please place your student identification label in this box

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

In words _____

_____

Time allowed for this section

Reading time before commencing work: ten minutes
Working time for this 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, pencils, pencil sharpener, eraser, correction fluid/tape, ruler, highlighters

Special items: drawing instruments, templates, notes on two unfolded sheets of A4 paper, and up to three calculators satisfying the conditions set by the Curriculum Council for this course

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	Working time (minutes)	Marks available	Percentage of exam
Section One: Calculator-free	6	6	50	40	
Section Two: Calculator-assumed	13	13	100	80	
			Total	120	100

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2010*. Sitting this examination implies that you agree to abide by these rules.

2. Write your answers in the spaces provided in this Question/Answer Booklet. 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(s) that you are continuing to answer at the top of the page.

3. **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 an answer to any question, ensure that you cancel the answer you do not wish to have marked.

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

See next page

Additional working space

Question number: _____

Additional working space

Question number: _____

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Section Two: Calculator-assumed **(80 Marks)**

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

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(s) that you are continuing to answer at the top of the page.

Working time: 100 minutes.

Question 7 **(8 marks)**

Brian designs a three-character password made from the characters A, B, # and 1, without using a character more than once in the password. There are 24 different possible passwords which are listed below.

A B #	B A #	# A B	1 A B
A B 1	B A 1	# A 1	1 A #
A # B	B # A	# B A	1 B A
A # 1	B # 1	# B 1	1 B #
A 1 B	B 1 A	# 1 A	1 # A
A 1 #	B 1 #	# 1 B	1 # B

(a) Brian states that the probability that his password will end in the # character is 0.4. Is Brian correct? Justify your answer. (2 marks)

(b) Using the list above, determine the probability that Brian's password

(i) contains the # character. (1 mark)

(ii) ends in the letter A. (1 mark)

(iii) starts with the number 1 **or** ends with the # character. (1 mark)

See next page

Question 19 **(5 marks)**

Consider the first four rows given below.

Question		Result	
$1\times2+11$	=	13	row 1
$2\times3+11$	=	17	row 2
$3\times4+11$	=	23	row 3
$4\times5+11$	=	31	row 4
			row 5
			row 6

(a) Extend the pattern by completing rows 5 and 6. (2 marks)

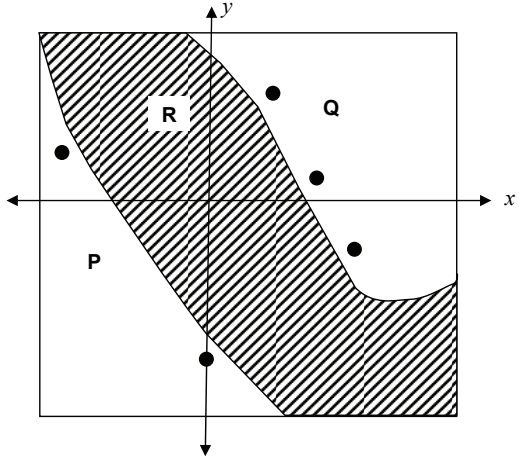
(b) Determine the result for row 25. (1 mark)

(c) Con looked at the above results and conjectured that every result is a prime number (a number with only two factors, 1 and itself). Test three further cases and comment on whether they support or refute his conjecture. (2 marks)

End of questions

Question 18 **(6 marks)**

A bridge is to be built to connect land P and land Q, which are separated by river R as shown in the diagram below (not drawn to scale).



The government wants to minimise the cost of building the bridge, so it is in favour of building the shortest bridge possible. Five points have been chosen: A(–5, 2), B(0, –6), C(4, 1), D(6, –4) and E(2, 5).

(a) Correctly label each of the points A, B, C, D and E on the diagram above. (2 marks)

(b) It has already been determined that a bridge from A to D would be 1250 metres long, while a bridge from B to E would be 1120 metres long. Given that 1 unit is 100 metres, decide which bridge should be built and how long (to the nearest 10 metres) it would be. Justify your answer. (4 marks)

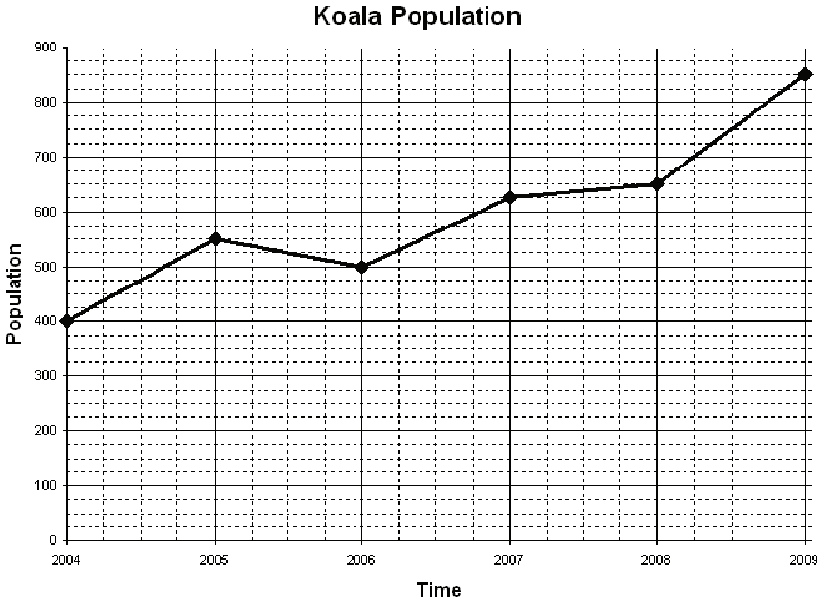
(c) Ava decides to make her own three-character password from the characters %, V and 5, without using a character more than once in the password.

(i) List all of the possible passwords Ava could make. (2 marks)

(ii) Brian tries to guess Ava's password. What is the probability that Brian guesses Ava's password correctly with only one guess? (1 mark)

Question 8 **(7 marks)**

(a) The population of koalas in a national park is recorded at the start of every year. The data collected from 2004–2009 are plotted below.



(i) Describe the trend in the population of koalas against time. (1 mark)

(ii) What assumption has been made by the joining of the points in the graph above? (1 mark)

(iii) Estimate the population half-way through the year 2005. (1 mark)

(iv) Approximately when did the population first exceed 700? Give your answer as a month and year, e.g. October 2005. (1 mark)

Question 17 **(6 marks)**

Sisters Breanna and Stephanie are each given $40 to spend at the second-hand book fair. All non-fiction books are sold at one fixed price and all fiction books are sold at a different fixed price. Breanna buys eight non-fiction and five fiction books and is given $1 change. Stephanie buys four non-fiction and ten fiction books and receives $4 change.

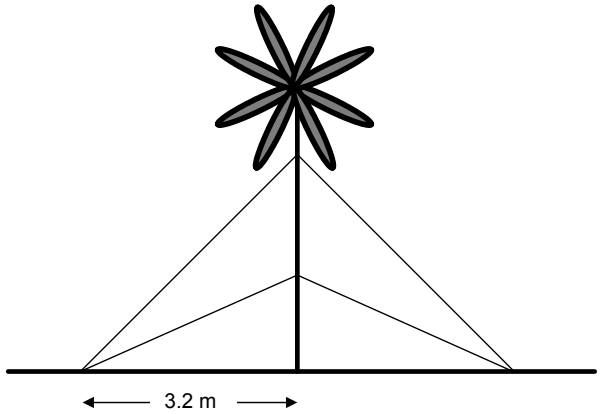
(a) Let n be the price of a non-fiction book and f the price of a fiction book. Write two linear equations from the above information. (2 marks)

(b) Determine algebraically the cost of buying a non-fiction book. Give your answer in dollars and cents. (2 marks)

(c) Their little sister Alicia is only given $20 to spend. She wants to buy five fiction and two non-fiction books. Does she have enough money? Justify your answer. (2 marks)

Question 16 **(6 marks)**

A palm tree has been moved from a plant nursery to a private garden in the north of Western Australia. The tree must stand vertically on horizontal ground, so it is supported by a number of wires. All of these wires have one end attached to the ground 3.2 metres from the base of the tree. The other ends are attached to points that are either one-third or two-thirds of the way up the trunk of the tree.



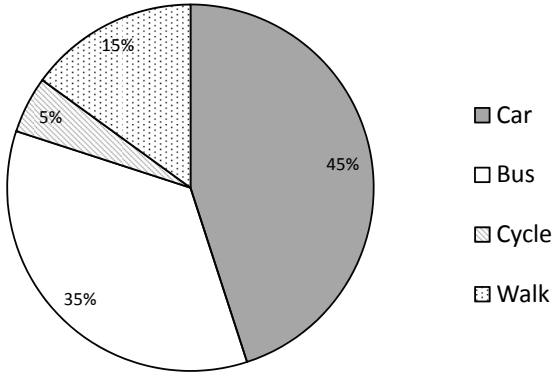
After planting, the trunk height of the palm is 6 metres.

(a) Determine the length of one of the short wires, to the nearest 10 cm. (2 marks)

(b) Use trigonometry to determine the angle a short wire makes with the ground, to the nearest degree. (2 marks)

(c) Determine the angle between a short wire and a long wire, to the nearest degree. (2 marks)

(b) Annie and Jimmy surveyed a group of teenagers to find out how they travelled to their part-time jobs one Saturday. They drew a pie chart to show the results.



(i) If 14 teenagers caught buses to their jobs on the Saturday, how many teenagers did Annie and Jimmy survey? (2 marks)

(ii) A teenager is selected at random from the group surveyed. What is the probability that they walked or cycled to their job on the Saturday? (1 mark)

Question 9 **(5 marks)**

(a) Consider the sequence of numbers below.

24, 60, 150, 375, …

(i) State a recursive rule in words for this sequence. (1 mark)

(ii) Write a recursive rule for this sequence using algebraic notation. (2 marks)

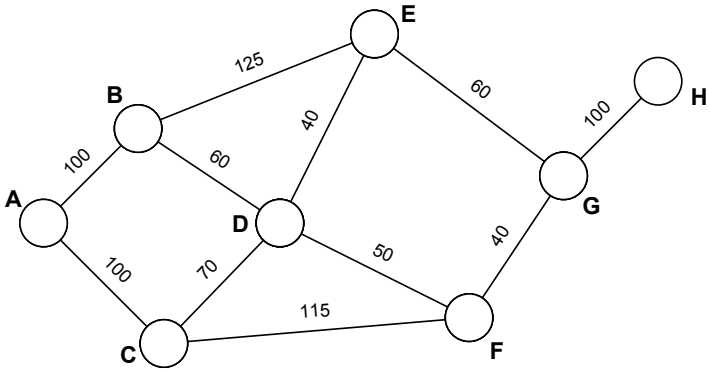
(b) The sequence of numbers: 12, 67, 342, 1717 … can be defined recursively as:

$$T_{n+1} = 5T_n + k, \quad T_1 = 12$$

(i) Determine the value of k. (1 mark)

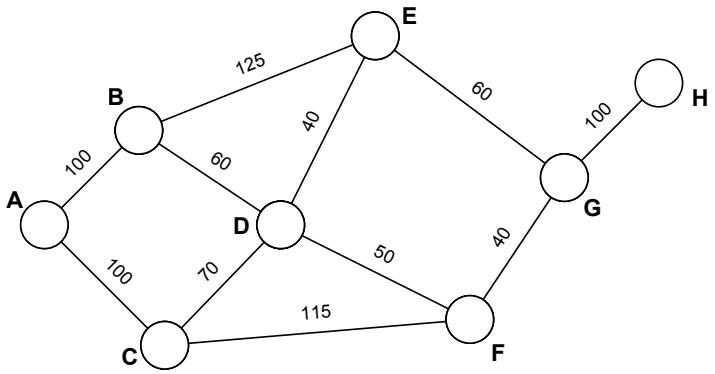
(ii) Determine the value of n when this sequence first exceeds one million. (1 mark)

(c) Explain how, if at all, the shortest path from Block A to Block H is affected if you must travel via Block C. (2 marks)



Question 15 **(5 marks)**

The network below shows the distances (metres) and connections between a series of classroom blocks, A to H, at a local high school.



(a) Is the network of classroom blocks traversable? Explain why/why not. (1 mark)

(b) Determine the shortest way to travel from Block A to Block H and state this shortest distance. (2 marks)

Question 10 **(6 marks)**

(a) When Granny cooks some rice, she adds 4 cups of water to 3 cups of rice.

How many cups of water does she need for 5 cups of rice? Give your answer as a mixed numeral, e.g. $6\frac{1}{2}$ cups. (2 marks)

(b) A pack of 64 Ymiracle nappies costs $21.95. A bulk package of Peonies containing 144 nappies costs $52.49.

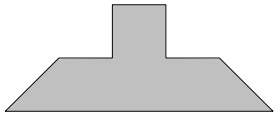
Which brand is the better buy? Justify your answer. (2 marks)

(c) Margaret runs a boutique. She makes a profit of between 10% and 40% on the cost price of all clothes sold.

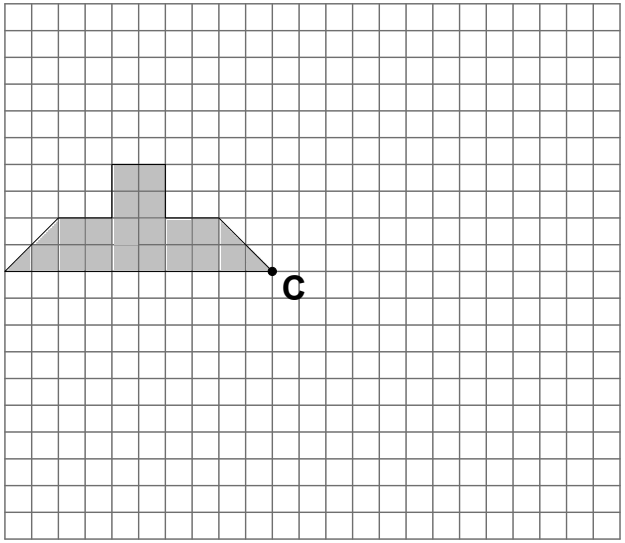
Margaret sells a dress for $280 with the profit in her desired range. Determine the lowest and highest price Margaret could have paid for the dress. (2 marks)

Question 11 **(6 marks)**

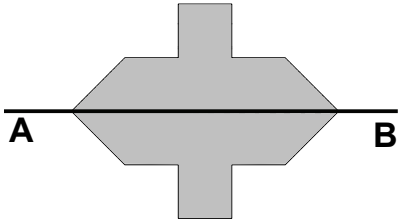
Consider the shaded shape drawn below.



(a) Rotate the shaded shape 90° clockwise about the point C. (2 marks)



(b) The diagram below shows the original shape reflected about the line AB. Consider the original shape and image as one combined object.

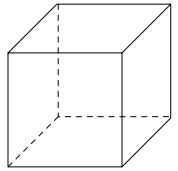


(i) How many lines of symmetry does this combined object have? (1 mark)

(ii) What is the order of rotational symmetry for this combined object? (1 mark)

Question 14 **(4 marks)**

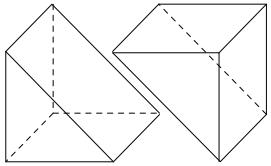
Consider the solid cube shown below.



10 cm

(a) Determine the total surface area of this cube. (1 mark)

This solid cube is to be cut into two equal pieces, as shown in the diagram below.



(b) What difference in total surface area does this cut make when compared to the total surface area of the cube obtained in (a)? Show working to justify your answer. (3 marks)

Question 13 **(6 marks)**

At the start of spring, Jennifer planted 120 tulip bulbs. She watered them regularly and after three weeks measured their height. The results are displayed in the frequency table below.

Height of tulip, h (cm)	Frequency
$0 \leq h < 5$	2
$5 \leq h < 10$	0
$10 \leq h < 15$	0
$15 \leq h < 20$	0
$20 \leq h < 25$	12
$25 \leq h < 30$	27
$30 \leq h < 35$	34
$35 \leq h < 40$	21
$40 \leq h < 45$	12
$45 \leq h < 50$	5
$50 \leq h < 55$	7

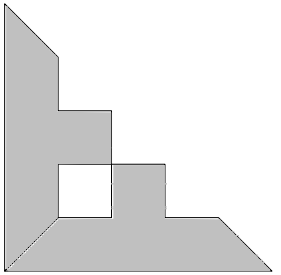
(a) Determine the mean height of the tulips, correct to one decimal place. (2 marks)

(b) Determine the class interval that contains the median. (1 mark)

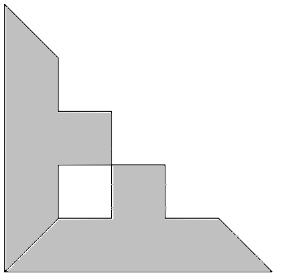
(c) Determine the proportion of tulips that were less than 30 cm high. (1 mark)

(d) Jennifer wants to display some of her tulips at the annual spring fair. To be eligible, tulips must be at least 30 cm high. What is the highest percentage of Jennifer's tulips that could be displayed at the fair? (2 marks)

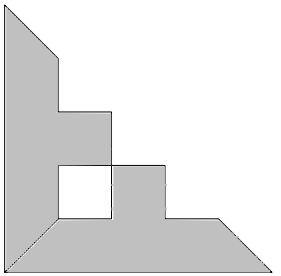
(c) A new combined object (shown below) could have been produced either by a reflection or a rotation of the original shape.



(i) If the transformation was a reflection, draw in the line that the original shape was reflected about. (1 mark)

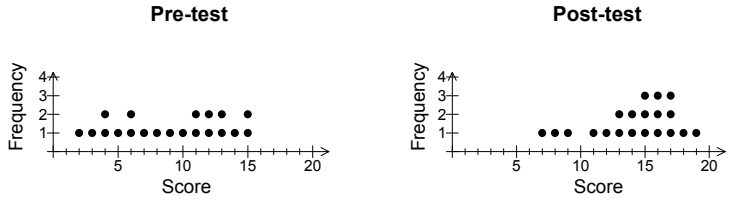


(ii) If the transformation was a rotation, mark the point C where the original object was rotated about. (1 mark)



Question 12 **(10 marks)**

Moya the mathematics teacher wanted to check whether the students in her class had improved their understanding of chance. She gave the students a pre-test (out of 20) at the beginning of the topic and a post-test (out of 20) at the end. The score for each student on each test is displayed in the dot frequency graphs below.



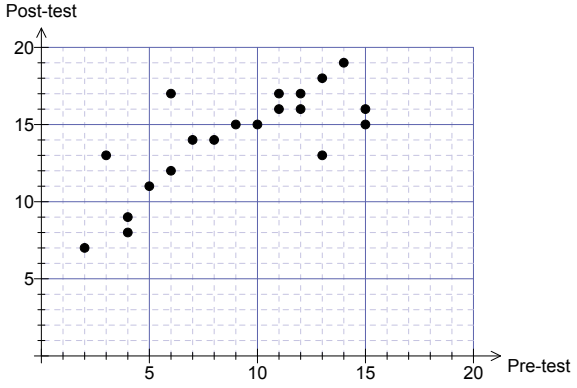
(a) The teacher commented: 'Looking at the dot frequency graphs, it is clear that everyone improved from the pre-test'. Why is this statement false? (1 mark)

(b) Some summary statistics have been provided. Complete the table by calculating the remaining summary statistics. (3 marks)

Statistic	Mean	Median	Range
Pre-test			13
Post-test	14.1	15	

(c) Compare the two data sets, commenting on the distribution of the graphed data. Has the class as a whole improved from the pre-test to the post-test? (2 marks)

The test results were plotted on the scatterplot as shown below.



Use the scatterplot and any previous information to answer the following:

(d) What result did the student who scored 12 in the post-test achieve in the pre-test? (1 mark)

(e) Draw in a trend line on the scatterplot above. (1 mark)

(f) Show how to use your trend line to predict a post-test score for a student who scored 18 in the pre-test but was absent for the post-test. Comment on the reliability of your prediction. (2 marks)