



Western Australian Certificate of Education  
Examination, 2010

Question/Answer Booklet

Government of Western Australia  
Curriculum Council



MATHEMATICS  
2C/2D  
Section Two:  
Calculator-assumed

Please place your student identification label in this box

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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.

ACKNOWLEDGEMENTS

- Section Two**
- Question 9**  
Data source: Australian Taxation Office. (2010). *Individual income tax rates: 2009–10*. Retrieved March, 2010, from [www.ato.gov.au/individuals/content.asp?doc=/content/12333.htm](http://www.ato.gov.au/individuals/content.asp?doc=/content/12333.htm).
- Question 11**  
Data source: Western Australian Office of Road and Safety. (n.d.). *Number of road crashes in Western Australia 1995–2004, by days of the week*. Retrieved March, 2010, from <http://www.ors.wa.gov.au>.
- Question 15**  
Data source: Australian Government. Bureau of Meteorology. (n.d.). Retrieved March, 2010, from <http://www.bom.gov.au/>.
- Question 16**  
Data source: Government of Western Australia. (2007). Department of Commerce. *Fuel Watch*. Retrieved March, 2010, from <http://www.fuelwatch.wa.gov.au>.
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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	7	7	50	40	
Section Two: Calculator-assumed	12	12	100	80	
Total				120	100

Instructions to candidates

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

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Additional working space

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MATHEMATICS 2C/2D

22

CALCULATOR-ASSUMED

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CALCULATOR-ASSUMED 3 MATHEMATICS 2C/2D (80 Marks)

Section Two: Calculator-assumed

This section has 12 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 8

(3 marks)

Using your calculator, determine the value of  $a^2\sqrt{b}$ , where  $a = 1.387 \times 10^4$  and  $b = 9.203 \times 10^{-2}$ .

(a) Write down the answer given by your calculator. (1 mark)

(b) Write the answer in scientific notation, correct to three significant figures. (2 marks)

Question 9

(5 marks)

**Tax rates 2009–10**

Taxable income	Tax on this income
\$0 – \$6000	Nil
\$6001 – \$35 000	15c for each \$1 over \$6000
\$35 001 – \$80 000	\$4350 plus 30c for each \$1 over \$35 000
\$80 001 – \$180 000	\$17 850 plus 38c for each \$1 over \$80 000
\$180 001 and over	\$55 850 plus 45c for each \$1 over \$180 000

The table above, from the Australian Taxation Office website, shows the tax rates for the 2009–10 financial year.

Luke has a taxable income of \$93 874.

- (a) Calculate the amount of tax Luke will be required to pay. (3 marks)

- (b) Louise, Luke's partner, has stayed at home throughout the 2009–10 financial year to take care of their young child. For the 2010–11 financial year, they decide to job share, with each earning half of Luke's previous full-time taxable income.

Assuming tax rates stay the same, what effect would this 2010–11 arrangement have on the total amount of tax paid by both Luke and Louise compared with that paid by Luke for the 2009–10 financial year? (2 marks)

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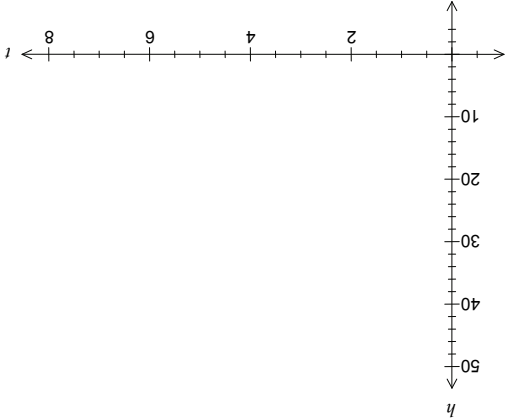
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Question 19

(6 marks)

A ball machine sitting on level ground is projecting baseballs into the air so that baseballers can practise their outfield catches. The height ( $h$ ), in metres, is given by  $h = 25t - 4.9t^2 + 1$ , where  $t$  is the time in seconds after projection.

(a) Draw the path of the ball on the axes below, labelling all key features. (4 marks)



(b) Determine the length of time that the ball is at least 14 metres above the ground. (2 marks)

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Question 10

(6 marks)

(a) Find the next two terms for each of the sequences defined below.

(i)  $T_{n+1} = 0.5T_n$   $T_1 = 40$  (2 marks)

(ii)  $T_{n+1} = T_{n+2} - T_n$   $T_1 = 1, T_2 = 1$  (2 marks)

(b) Write a recursive rule for the sequence of numbers 8, 12, 18, 27, ..... (2 marks)

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Question 11

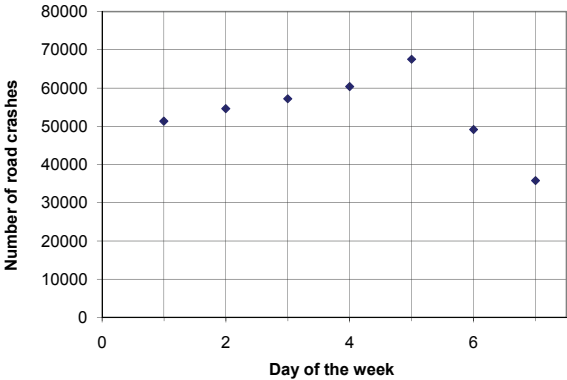
(10 marks)

The table and graph show data on the number of road crashes in Western Australia in the period from 1995 to 2004, by days of the week.

Number of road crashes in Western Australia 1995–2004,  
by days of the week

	Day	Number of crashes (nearest thousand)	
	Monday	1	51 000
	Tuesday	2	55 000
	Wednesday	3	57 000
	Thursday	4	60 000
	Friday	5	68 000
	Saturday	6	49 000
	Sunday	7	36 000

Number of road crashes in Western Australia 1995–2004,  
by days of the week



- (a)
- Based on the above data, which is the safest day of the week on the roads in Western Australia?
- (1 mark)

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Question 18

(5 marks)

The table below shows three points of a linear function.

$x$	1	2	3
$y$	$3n$	$4n$	$2n + 18$

- (a)
- Determine the value of  $n$ .
- (2 marks)
- (b)
- Hence determine the equation of the linear rule for this function.
- (2 marks)
- (c)
- Comment on the link between the gradient of your linear rule in (b) and the recursive rule that defines the  $T_n$  values in the table below.
- (1 mark)

$n$	1	2	3
$T_n$	$3n$	$4n$	$2n + 18$

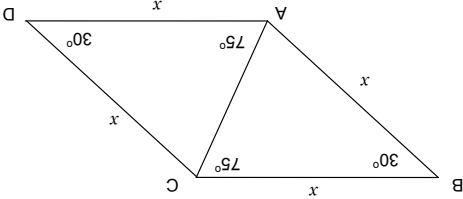
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Question 17

(8 marks)

The diagram below shows a plan for an indoor sports centre ABCD that is to be built in the shape of a rhombus with side length  $x$  metres. A walkway is planned from A to C.



(a) Write an expression for the distance between A and C. (2 marks)

(b) Write a simplified expression for the total floor area of the sports centre. (3 marks)

A decision has been made to increase all sides of the rhombus by 20%.  
(c) (i) Give an expression for the total floor area of the sports centre in the form  $ax^2 + bx + c$ . (2 marks)

(iii) How will increasing the sides of the rhombus effect the total floor area of the sports centre? Show your working. (1 mark)

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(b) Describe any trends in terms of the variables. (3 marks)

(c) If a road crash is selected at random from the data for investigation, what is the probability that it occurred on a Saturday or Sunday? (2 marks)

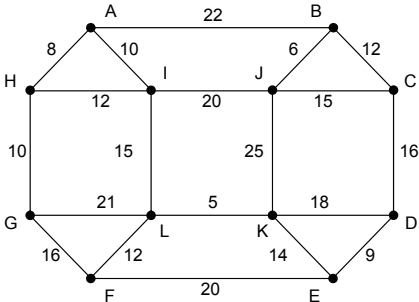
(d) Suppose 1000 of the road crashes are selected at random from the data, and it is found that 223 of them occurred on either a Saturday or a Sunday. Is the result of 223 within the range of values that you would expect? Justify your answer. (4 marks)

See next page

Question 12

(6 marks)

A communication network linking 12 centres A, B, C, ..., K, L is to be constructed. The possible connections are given in the following network. The number on each arc represents the cost, in thousands of dollars, of establishing the connection.



To minimise the cost, the network management decides to use a minimal spanning tree solution.

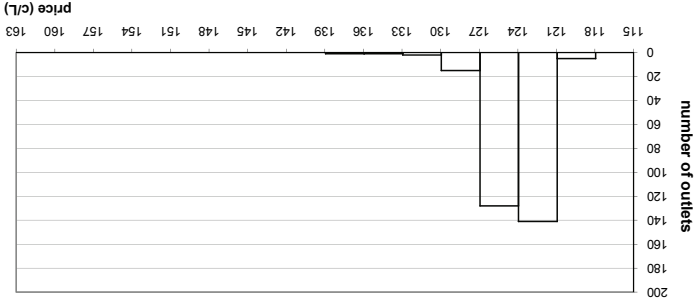
- (a) Indicate clearly the minimal spanning tree solution on the network above. (3 marks)
- (b) Determine the minimum cost of constructing the communication network. (1 mark)
- (c) The cost of connecting I and J has been overestimated by \$6 000. How does this information change the minimum cost of constructing the network? (2 marks)

- (d) The data for Day 2 includes a price of 161.2 c/L. If this value is removed from the data set, describe the effect on the
- (i) mean price value. (1 mark)
- (ii) standard deviation value. (1 mark)



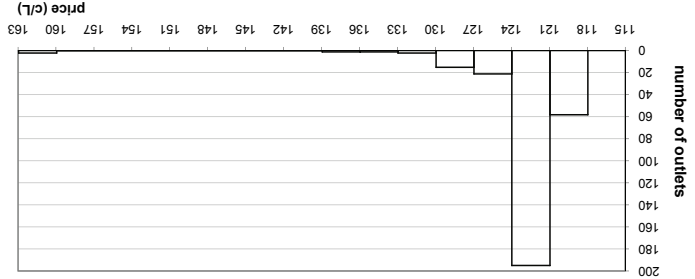
The frequency histogram for the grouped data for Perth on Day 1 is shown below.

Unleaded petrol prices, Perth, Day 1, grouped data



Unleaded petrol prices from the same outlets were also recorded for the following day (Day 2). The frequency histogram for Day 2 is given below.

Unleaded petrol prices, Perth, Day 2, grouped data



- (c) Did prices for Day 2 tend to be higher or lower than prices for Day 1? Justify your answer. (4 marks)

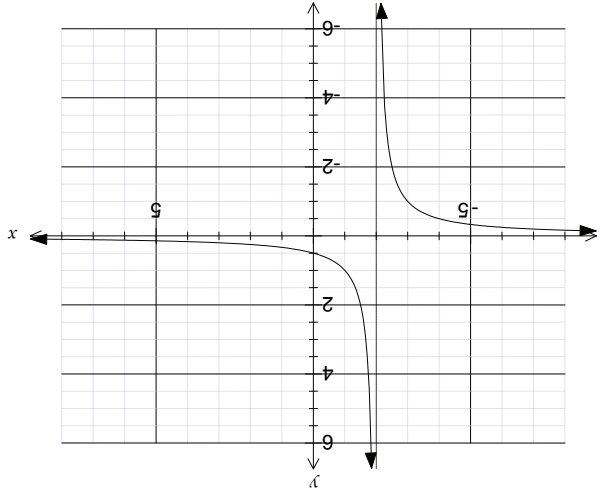
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The function  $y = \frac{1}{(x+2)}$  is drawn below.

Question 13

(7 marks)



- (a) On the same axes above, plot the graph of the function  $y = 2^{(x+2)}$ . (3 marks)

- (b) (i) Using your calculator, solve the equation  $2^{(x+2)} = \frac{1}{(x+2)}$ . (1 mark)

- (ii) Show on the graph where the answer to (b)(i) can be found. (1 mark)

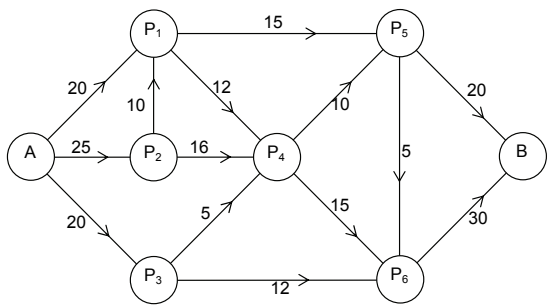
- (c) Indicate on the graph the equation  $\frac{1}{(x+2)} = -2$  and state the solution. (2 marks)

See next page

Question 14

(5 marks)

In a waste treatment system, liquid waste is moved from treatment plant A to treatment plant B through a pipeline network containing six pumping stations  $P_1$ ,  $P_2$ ,  $P_3$ ,  $P_4$ ,  $P_5$  and  $P_6$ . The network is displayed below. The number on each arc represents the maximum amount of waste, in tonnes per hour, that can be moved along that pipe segment.



- (a)
- What is the maximum hourly amount of liquid waste that can be moved from treatment plant A to treatment plant B? Show systematic working to allow your solution to be checked.
- (3 marks)

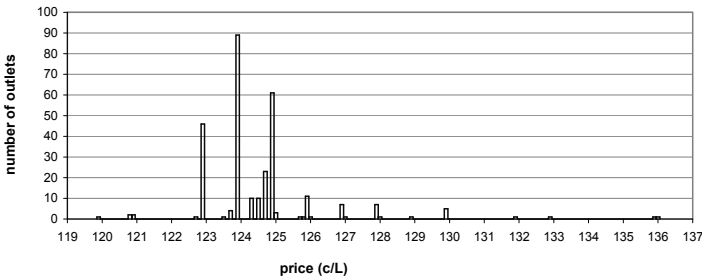
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The graph below displays the price data from the table.

Prices of unleaded petrol, Perth, Day 1



- (a)
- Describe the centredness and spread of the prices. Use information in the table and graph. Do not calculate any statistics.
- (4 marks)

- (b)
- The table below shows the price data grouped in the equal-sized intervals. Complete the table.
- (2 marks)

Unleaded petrol prices, Perth, Day 1

Price (c/L)	Frequency (number of outlets)
118–120.9	
121–123.9	141
124–126.9	128
127–129.9	
130–132.9	2
133–135.9	1
136–138.9	1

See next page

(12 marks)

Question 16

The table shows prices (c/L) of standard unleaded petrol from 293 outlets in Perth on one day in early 2010 (Day 1). All prices published for the day on the Western Australian Government's 'FuelWatch' website are included.

Price (c/L)	Frequency
119.9	1
120.8	2
120.9	2
122.7	1
122.9	46
123.5	1
123.7	4
123.9	89
124.3	10
124.5	10
124.7	23
124.9	61
125.0	3
125.7	1
125.7	1
125.9	11
126.0	1
126.9	7
127.0	1
127.9	7
128.0	1
128.9	1
129.9	5
131.9	1
132.9	1
135.9	1
136.0	1

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(b) What effect, if any, would there be on the maximum flow of liquid waste from A to B if the capacity of the link between P<sub>6</sub> and B was increased by 5 tonnes per hour. Justify your answer. (2 marks)

See next page

**Question 15** (7 marks)

Table 1 shows some summary statistics for maximum daily temperatures in October 2008 and October 2009 for a Western Australian town. The maximum daily temperatures ( $^{\circ}\text{C}$ ) in October 2008 for the town are summarised in Table 2.

**Table 1: Maximum daily temperatures ( $^{\circ}\text{C}$ ), October 2008–2009**

	October 2008	October 2009
Mean		21.8
Median	20.0	20.7
Standard deviation		4.9
Range	17.0	21.8

**Table 2: Maximum daily temperatures ( $^{\circ}\text{C}$ ), October 2008**

Temperature $T$ ( $^{\circ}\text{C}$ )	Frequency
$14 \leq T < 18$	9
$18 \leq T < 22$	12
$22 \leq T < 26$	5
$26 \leq T < 30$	4
$30 \leq T < 34$	1

(a) Use the data in Table 2 to:

- (i) calculate the mean and standard deviation of the temperatures for October 2008 and enter the results in Table 1. (2 marks)

- (ii) determine the modal class. (1 mark)

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- (b) In which of the two years were the October temperatures in the town less variable? Justify your answer. (2 marks)

- (c) (i) Tick the box next to the statement that is supported by the data for this Western Australian town. (1 mark)

- ☐ The year 2008 tended to be cooler than the year 2009.  
☐ The year 2008 tended to be hotter than the year 2009.  
☐ It is not possible to tell whether the year 2008 tended to be cooler or hotter than the year 2009.

- (ii) Justify your choice. (1 mark)

See next page