Government of **Western Australia**
Curriculum Council

WACE
Western Australian Certificate of Education

Western Australian Certificate of Education
Examination, 2010

Question/Answer Booklet

MATHEMATICS 2C/2D

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.

2010/30990

Ref: 10-131

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

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

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

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 $a = 1387 \times 10^4$ 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)

See next page

Question 10 **(6 marks)**

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

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

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

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

See next page

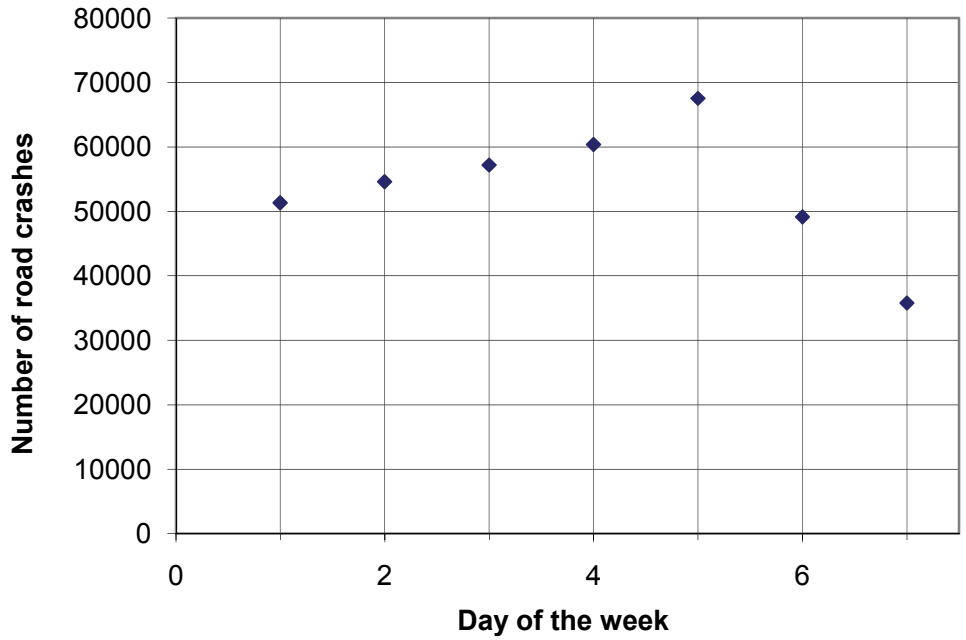
Question 11 **(10 marks)**

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)

See next page

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

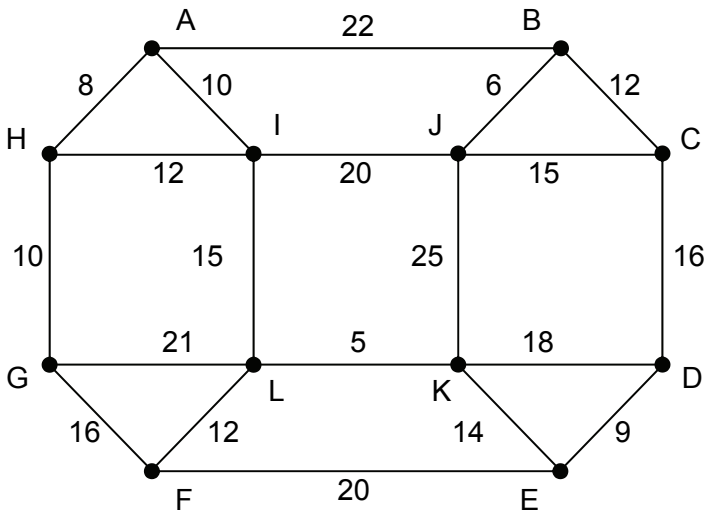
(c) If a road crash is selected at random from the data for investigation, what is the probability that it occurred on a Saturday or Sunday? (2 marks)

(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)

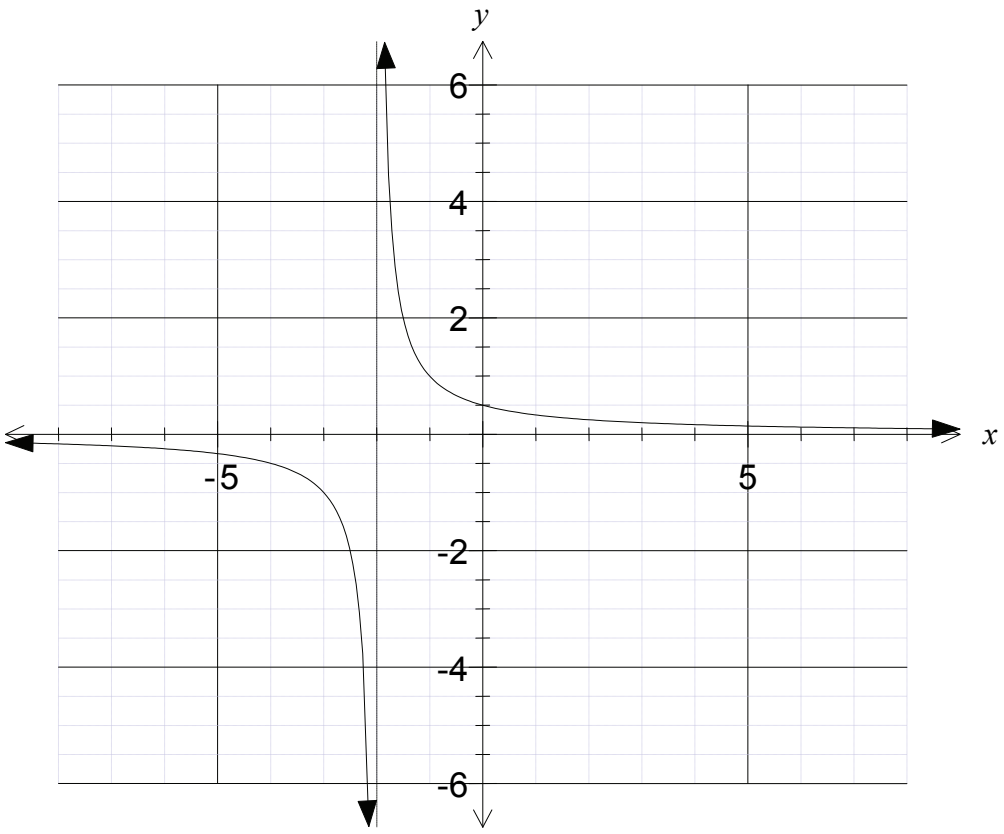
(b) Determine the minimum cost of constructing the communication network. (1 mark)

(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)

See next page

Question 13 **(7 marks)**

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



(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 $2^{(x+2)} = \dfrac{1}{(x+2)}$. (1 mark)

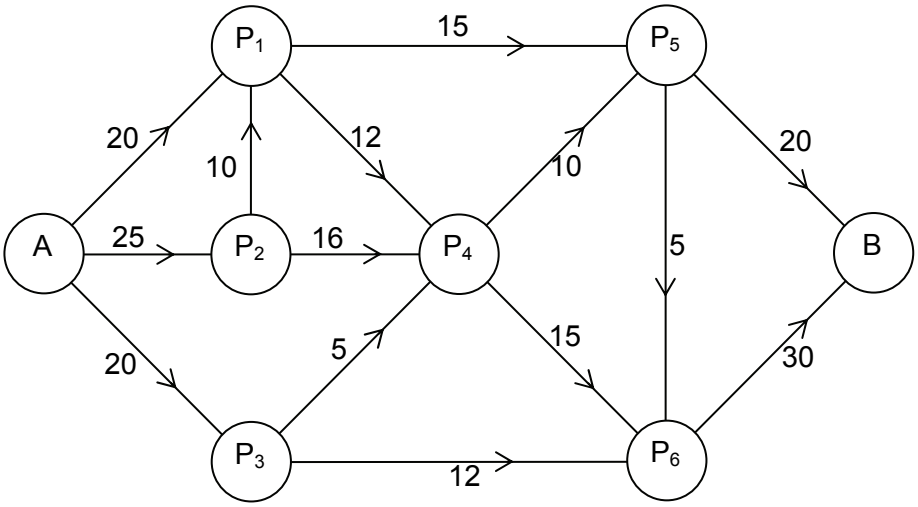
(ii) Show on the graph where the answer to (b)(i) can be found. (1 mark)

(c) Indicate on the graph the equation $\dfrac{1}{(x+2)} = -2$ 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)

(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_6 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 (°C) in October 2008 for the town are summarised in Table 2.

Table 1: Maximum daily temperatures (°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 (°C), October 2008

Temperature T (°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)

See next page

(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)

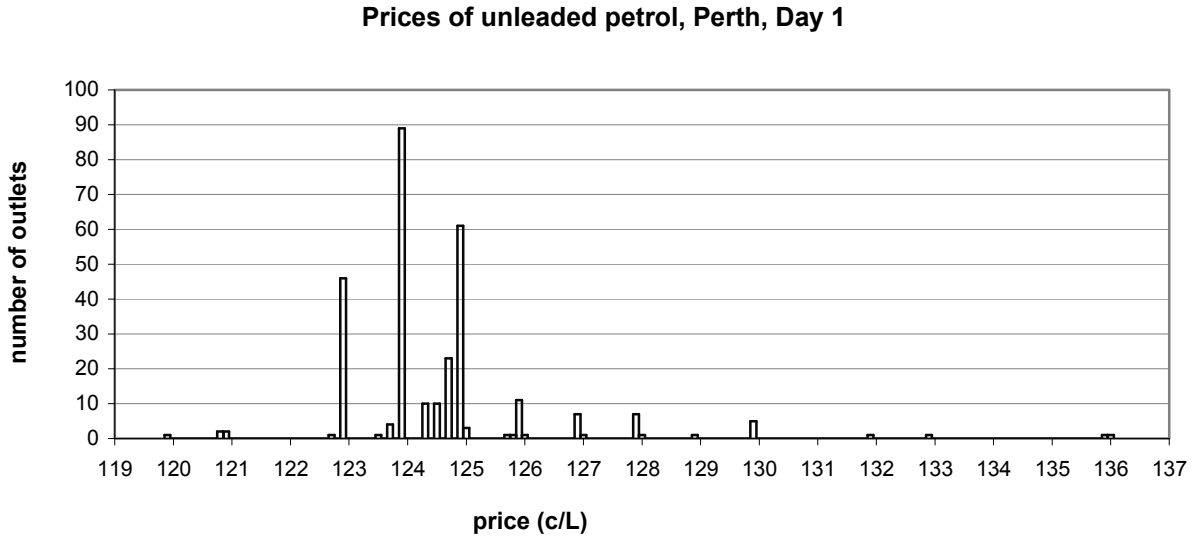
Question 16 **(12 marks)**

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

See next page

The graph below displays the price data from the table.



(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)

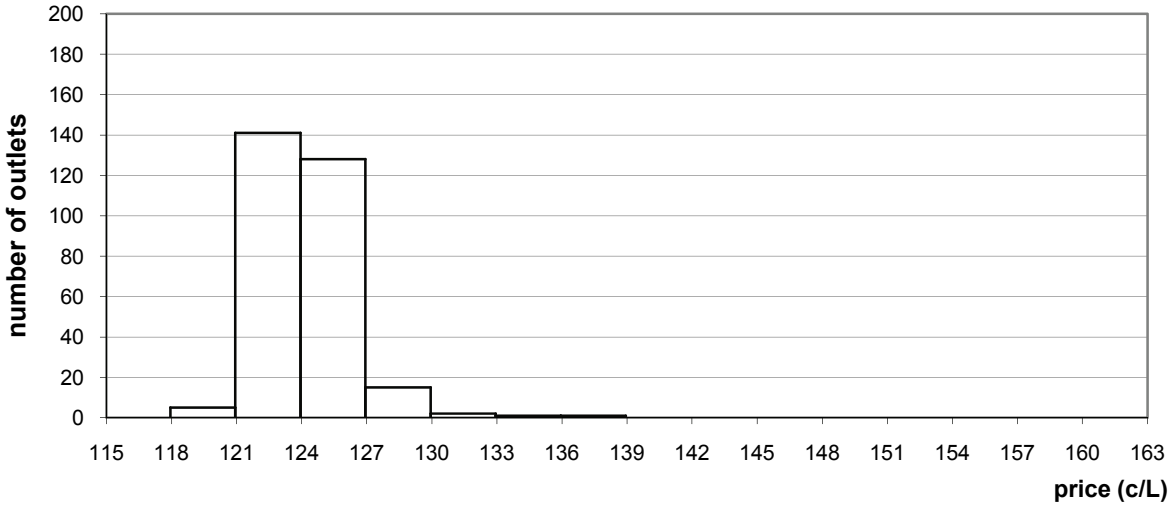
Unleaded petrol prices, Perth, Day 1

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

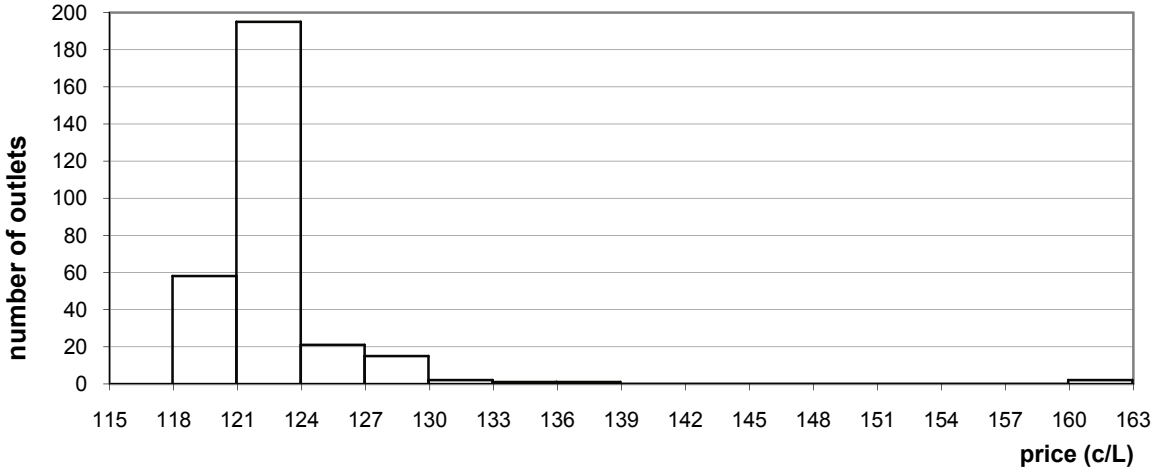
The frequency histogram for the grouped data for Perth on Day 1 is shown below.

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)

See next page

(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

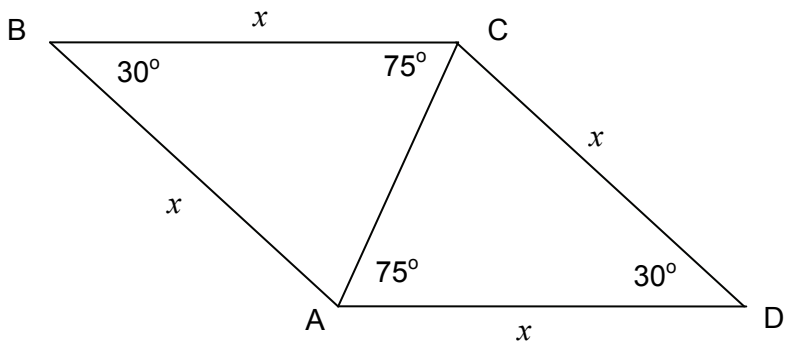
(i) mean price value. (1 mark)

(ii) standard deviation value. (1 mark)

See next page

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)

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

See next page

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)

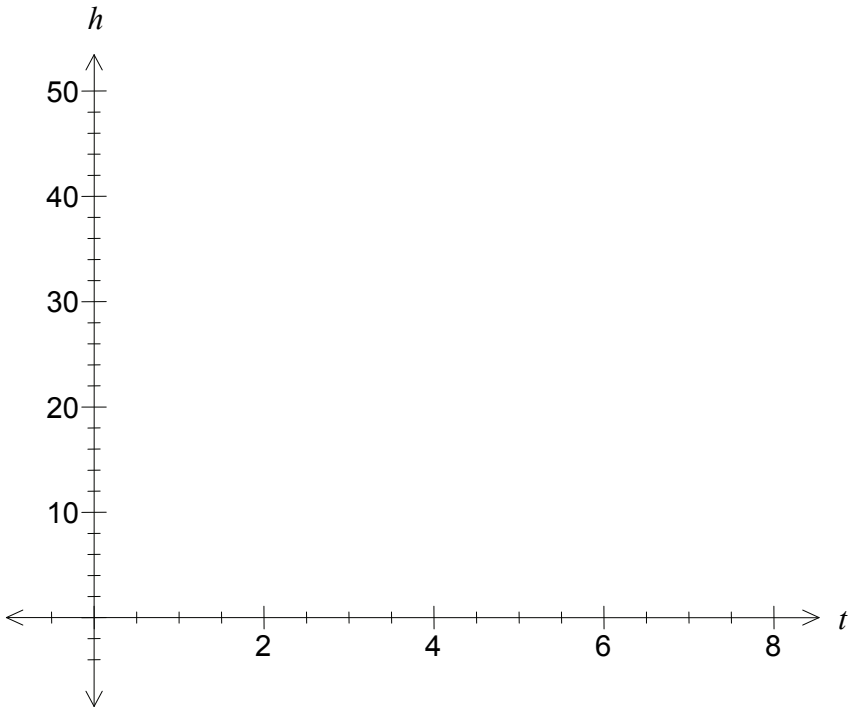
(c) Comment on the link between the gradient of your linear rule in (b) and the recursive rule that defines the T_n values in the table below. (1 mark)

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

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)

Additional working space

Question number: _____

Additional working space

Question number: _____

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Question number: _____

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.

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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