

No other items may be used in this section of the examination. 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.

Important note to candidates

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.

Standard items: pens, pencils, pencil sharpener, eraser, correction fluid, ruler, highlighters

To be provided by the candidate

Formula sheet (retained from Section One)
This Question/Answer booklet

To be provided by the supervisor

Material required/recommended for this section

Working time for paper: 100 minutes
Reading time before commencing work: 10 minutes

Time allowed for this section

Your name _____							
In words _____							

Student Number: In figures _____							

MATHEMATICS
3A/3B(2)
Section Two:
Calculator-assumed

If required by your examination administrator, please place your student identification label in this box

Question/Answer Booklet

Trial WACE Examination, 2010

Question number(s): _____

Additional working space

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available
Section One: Calculator-free	7	7	50	40
Section Two: Calculator-assumed	12	12	100	80
				120

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.

Question 19

(4 marks)

- (a) Write down the equation of the tangent to $f(x) = 2x^2 + 5x - 3$ at the point where $f(x)$ cuts the y -axis. (1 mark)

- (b) Find an expression for the equation of the tangent to $g(x) = ax^3 + bx^2 + cx + d$ at the point where $g(x)$ cuts the y -axis in terms of a , b , c and d . (2 mark)

- (c) Write down the equation of the tangent to $h(x) = 13x^4 + 174x^3 - 15x^2 + 9x - 17$ at the point where $h(x)$ cuts the y -axis. (1 mark)

(1 mark)

- (ii) the probability that the total value of the notes is less than \$35 given that the total is greater than \$25.

(1 mark)

- (i) the probability that the \$5 note remains in the bag.
 (ii) if each way has an equal chance of happening, calculate

(2 marks)

- (c) If $x = 17$ cm, find the area of the triangle.

(3 marks)

- (a) Draw a tree diagram to represent all the possible ways in which the notes can be drawn from the bag.

(3 marks)

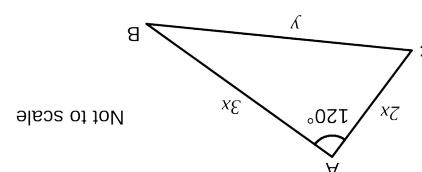
- (b) Find the size of $\angle ABC$.

(5 marks)

- A \$5 note, a \$10 note, another \$10 note and a \$20 note, all of the same size and shape, are placed into an opaque bag. A student puts their hand into the bag and randomly pulls out one of the notes and places it on a table. The student repeats this process, stopping when the value of the notes on the table has a total of at least \$25.

(2 marks)

- (a) Show that $y^2 = 19x^2$.



In the triangle below, $x > 0$, $AC = 2x$, $AB = 3x$, $BC = y$ and $\angle CAB = 120^\circ$.

(80 Marks)

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

Working time for this section is 100 minutes.

(7 marks)

CALCULATOR-ASSUMED

- Section Two: Calculator-assumed

SECTION TWO

(7 marks)

- TRIAL EXAMINATION 2010

SECTION TWO

MATHEMATICS 3A/3B(2)

CALCULATOR-ASSUMED

SECTION TWO

TRIAL EXAMINATION 2010

Question 9

(7 marks)

The heights of a group of children taking part in a survey are shown in the table below.
 The 145 - 149 cm group had the second lowest frequency of all the groups.

Height (cm)	145 - 149	150 - 154	155 - 159	160 - 164	165 - 169	170 - 174
Number of children	x	35	54	48	29	18

- (a) State the modal group for this data. (1 mark)

- (b) Calculate estimates for the mean and standard deviation of the heights of the children who were taller than 149.5 cm. (2 marks)

- (c) Explain why your answers to part (a) are estimates. (1 mark)

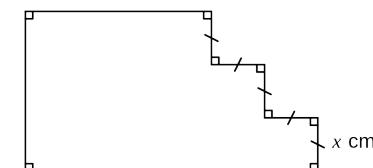
- (d) The children in the 145 - 149 cm group are now included in calculations.

- (i) Explain whether the standard deviation would be the same, smaller or greater than your answer in part (b). (1 mark)

- (ii) Find x , the number of children in this group, if the mean height is 158.8 cm when rounded to one decimal place. (2 marks)

Question 17

The perimeter of the figure shown below is 192cm.



- (a) Show that the area of the figure is given by $(288x - 12x^2)$ cm². (3 marks)

- (b) Use differentiation to find the maximum area of the figure. (3 marks)

(1 mark)

- (e) The student was planning to buy a car for \$8000. How long before they would have saved this amount if the saving scheme continued? (1 mark)

(2 marks)

(1 mark)

- (c) Find B_{12} , the amount in her account after her 12th deposit. (1 mark)

(2 marks)

(1 mark)

- (a) What was the annual percentage interest rate for the savings account? (1 mark)

Month	Starting Balance (B_0)	Interest (B_n)	Deposit	Next Balance (B_{n+1})
3				
2	2798.62	20.99	130.00	2949.61
1	2648.75	19.87	130.00	2798.62
0	2500.00	18.75	130.00	2648.75

A student won \$2500 in a photographic competition and used it all to open a savings account. She then decided to add \$130 every month to this account from her part-time job. She made the deposit on the first of each month and the savings bank paid interest on the last day of each month. The table below shows how her savings progressed each month.

(a) Use your calculator to graph this data and by referring to features of your graph and a suitable statistic, explain why it is appropriate to fit a linear relationship to model the price of these boats against time. (2 marks)

Age (t)	3	13	5	14	34	24	18	29	31	32	12	6	10	5	14	34	24	13	3
Price (P)	41	24	5	13	3	13	5	14	34	24	18	18	29	29	14	34	24	13	3

The following data was collected by a student interested in buying a second-hand sailing boat. It shows the age in years and the sale price, in hundreds of dollars, for 10 boats of the same type. The following data was collected by a student interested in buying a second-hand sailing boat. It shows the age in years and the sale price, in hundreds of dollars, for 10 boats of the same type.

Question 16 (8 marks)

(7 marks)

CALCULATOR-ASSUMED

MATHEMATICS 3A/3B(2)

SECTION TWO

TRIAL EXAMINATION 2010

5

(2 marks)

Calculate the price residual for the 10-year old boat and use your value to argue whether

or not this boat is likely to be in better or worse condition compared to boats of a similar

age.

(2 marks)

(2 marks)

(2 marks)

(1 mark)

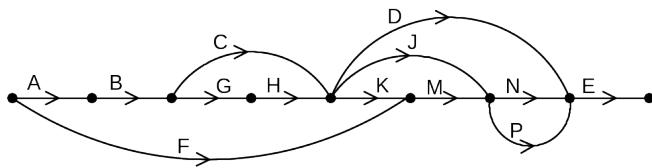
(c) The student saw another boat aged 15 years old advertised in the local paper. Use your line from part (b) to predict its sale price and comment on the reliability of your prediction. (3 marks)

(b) Calculate the least-squares linear regression line of P on t . (1 mark)

(7 marks)

Question 11

A project network for a task involving 13 separate jobs is shown below.



The length of time each job takes in weeks is given in the table below.

Job	A	B	C	D	E	F	G	H	J	K	M	N	P
Time	3	7	11	13	2	12	8	2	9	4	4	4	5

- (a) List all the tasks that must be completed before job K can commence. (1 mark)

- (b) How many immediate predecessors does the final job have? (1 mark)

- (c) What is the minimum number of weeks required to complete the task? You must show working either in the space below or on the diagram above to obtain full marks. (2 marks)

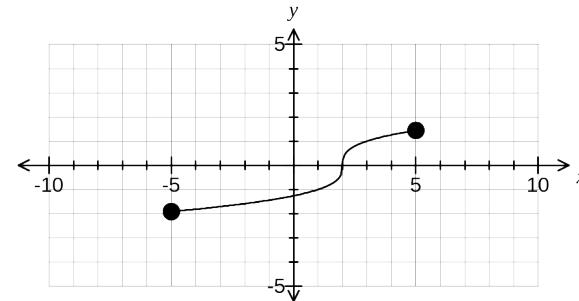
- (d) List the jobs on the critical path. (1 mark)

- (e) If any one of the 13 jobs could be reduced in time by up to 4 weeks, which job should be chosen so that the minimum completion time is reduced by the maximum amount? Explain your answer and state the new minimum completion time. (2 marks)

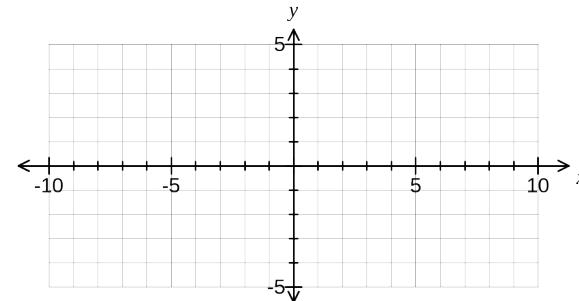
(4 marks)

Question 15

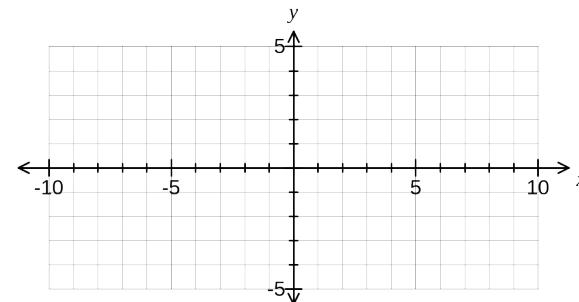
The graph shows the function $y = f(x)$.



- (a) Sketch the graph of $y = 2f(x + 2)$. (2 marks)



- (b) Sketch the graph of $y = f(-x) - 2$. (2 marks)



(1 mark)

- (iii) The values of x for which $f(x)$ is concave upwards.

(1 mark)

- (ii) The coordinates of the point of inflection of $f(x)$.

(1 mark)

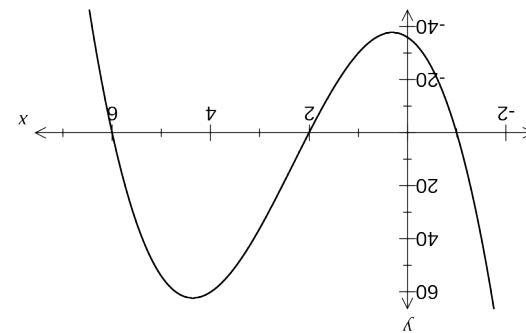
- (i) The maximum value of $f(x)$ for $x \geq 0$.

(b) State the following (no calculations required), rounding to one decimal place where required.

- (c) List the coordinates of the vertices of the feasible region found in part (b). (2 marks)

(2 marks)

- (d) State the coordinates of the point which maximises the objective function $6x + 11y$.



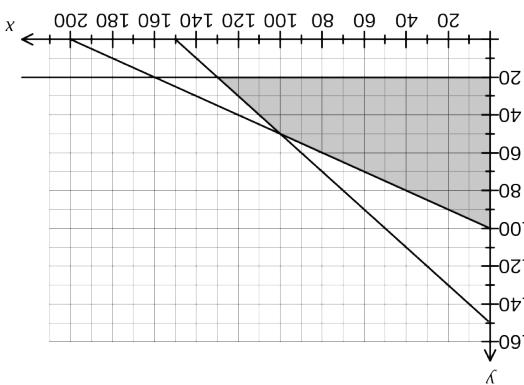
(3 marks)

determine the values of a , b , c and k .

(a)

- Given $f(x) = k(x+a)(x+b)(x+c)$, where a , b , c and k are constants, and $a < b < c$,

- (a) State the three inequalities which define the feasible region shaded on the graph above other than $x \geq 0$. (3 marks)



The graph below shows the feasible region of a linear programming problem.

(9 marks)

(6 marks)

Question 12

(10 marks)

Question 13

A company was concerned about the number of employees turning up late for work and implemented some changes to improve punctuality. Data was then collected on the numbers of employees arriving late for work over a period of 17 consecutive work days (Monday to Friday).

This data is shown in the table below, together with some calculated values based on this data.

(t)	Week	Day of Week	Number Late	5-Day Moving Average (m)	Residual
1	1	Friday	21	-	-
2	2	Monday	25	-	-
3	2	Tuesday	25	22.6	2.4
4	2	Wednesday	21	22.2	-1.2
5	2	Thursday	21	21.8	-0.8
6	2	Friday	19	21.6	-2.6
7	3	Monday	A	21.2	1.8
8	3	Tuesday	24	21.0	3.0
9	3	Wednesday	19	20.4	-1.4
10	3	Thursday	20	20.0	0.0
11	3	Friday	16	B	
12	4	Monday	21	18.8	2.2
13	4	Tuesday	20	18.2	1.8
14	4	Wednesday	17	17.6	-0.6
15	4	Thursday	17	17.2	-0.2
16	4	Friday	C	-	-
17	5	Monday	19	-	-

The equation of the trend line fitted to the 5-day moving average is $m = 24.25 - 0.457t$ where t is the time period in days, shown in the first column of the table. $r_{lm} = -0.99$.

(a) Explain why calculating a 5-day moving average is an appropriate way to smooth this data. (1 mark)

(b) Determine the values of A, B and C in the table above. (3 marks)

(c) What is the average change in the number of employees arriving late in a five-day cycle? (1 mark)

(d) Calculate the seasonal component for Thursday and explain what its value means in the context of this question. (2 marks)

(e) Predict the number of employees who will arrive late on the Thursday of Week 5. (3 marks)