

## Mathematics 3A

### Examination

Calculator-assumed  
Section Two:

Time allowed for this section:      Reading time before commencing work:      10 minutes  
Working time for this section:      100 minutes

Material required/recommended for this section  
*To be provided by the supervisor*  
This Question/Answer booklet  
Formula sheet (referred from Section One)

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

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

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.

### 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	8	8	100	80
				120

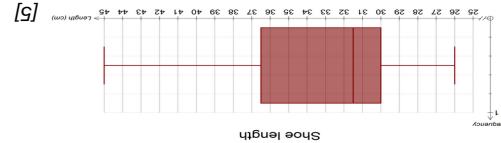
### Instructions to candidates

1. The rules of conduct of school exams should be known to you. Sitting this exam implies 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 spare pages for planning, indicate this clearly at the top of the page
  - Continuing an answer: If you need 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 sufficient 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.

(2 marks)

Outliers are identified as being more than  $1.5 \times \text{IQR}$  beyond the quartiles.  
i.e. above  $36.5 + 9.75 = 46.25$ , or below  $30 - 9.75 = 20.25$ .  
This means no values would be considered outliers. [2]

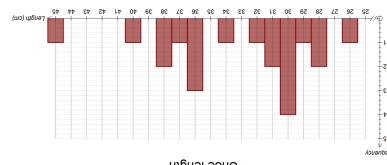
(c) Comment on any outliers in this data explaining your comments.



(5 marks)

(b) Draw a box and whisker plot to represent this set of data.

Mean = 33.25, median = 31.5, mode = 30 and sd = 4.84 [1 mark each]



(4 marks)

(a) Calculate the mean, median, mode and standard deviation for the data represented in this graph:

(11 marks)

## Question 8

Suggested working time for this section is 100 minutes.

- of the question(s) that you are continuing to answer at the top of the page.  
answer space where the answer is continued, i.e. give the page number. Fill in the number  
• Continuing an answer if you need the space to continue an answer, indicate this clearly at the top of the page  
• Planning: if you use spare pages for planning, indicate this clearly at the top of the page  
and/or additional space if required to continue an answer.

Spare pages are included at the end of this booklet. They can be used for planning your responses

This section has **eight (8)** questions. Answer all questions. Write your answers in the space provided.

### Section Two: Calculator-assumed

**Question 9**

(a) Calculate the missing values, (i) to (vii), in the following spreadsheet:

**(9 marks)**

(7 marks)

Month	Amount owing	Interest	Repayment	Balance
1	(i)	\$191.67	\$1,000.00	\$19,191.67
2	\$19,191.67	\$183.92	\$1,000.00	\$18,375.59
3	\$18,375.59	\$176.10	\$1,000.00	\$17,551.69
4	\$17,551.69	(ii)	\$1,000.00	(iii)
5	(iv)	(v)	\$1,000.00	\$15,880.12
6	\$15,880.12	\$152.18	\$1,000.00	\$15,032.31
7	\$15,032.31	\$144.06	\$1,000.00	\$14,176.37
8	\$14,176.37	\$135.86	\$1,000.00	\$13,312.22
9	\$13,312.22	\$127.58	\$1,000.00	\$12,439.80
10	\$12,439.80	\$119.21	\$1,000.00	\$11,559.01
11	\$11,559.01	\$110.77	\$1,000.00	\$10,669.79
12	\$10,669.79	\$102.25	\$1,000.00	\$9,772.04
13	\$9,772.04	\$93.65	\$1,000.00	\$8,865.69
14	\$8,865.69	\$84.96	\$1,000.00	\$7,950.65
15	\$7,950.65	\$76.19	\$1,000.00	\$7,026.84
16	\$7,026.84	\$67.34	\$1,000.00	\$6,094.19
17	\$6,094.19	\$58.40	\$1,000.00	\$5,152.59
18	\$5,152.59	\$49.38	\$1,000.00	\$4,201.97
19	\$4,201.97	\$40.27	\$1,000.00	\$3,242.24
20	\$3,242.24	\$31.07	\$1,000.00	\$2,273.31
21	\$2,273.31	\$21.79	\$1,000.00	\$1,295.09
22	\$1,295.09	\$12.41	\$1,000.00	\$307.50
23	\$307.50	\$2.95	(vi)	(vii)

- (i) \$20,000.00      (ii) \$168.20      (iii) \$16,719.89      (iv) \$16,719.89  
 (v) \$160.23      (vi) \$310.45      (vii) \$0      [1 mark each = 7]

(b) What is the interest rate used in the spreadsheet?

(2 marks)

11.5% p.a. or 0.95835% per month [2]

**Additional working space**

Question number(s): \_\_\_\_\_

$$74/(174 + 162 + 94 + 74) = 74/504 = 0.147 [2]$$

(2 marks)

(f) Was 41 to 50 years if he or she had 2 accidents?

$$247/(247 + 133 + 94 + 16) = 247/490 = 0.504 [2]$$

(2 marks)

(e) Had no accidents if she or he was 31 to 40 years of age?

$$(125 + 138 + 247 + 450)/2360 = 960/2360 = 0.407 [1]$$

(1 mark)

(d) Had no accidents?

$$218/2360 = 0.092 [1]$$

(1 mark)

(c) Is 20 years or less and had only one accident?

$$(138 + 223 + 162 + 87)/2360 = 610/2360 = 0.258 [1]$$

(1 mark)

(b) Is 21 to 30 years of age?

$$(93 + 87 + 16 + 10)/2360 = 206/2360 = 0.087 [1]$$

(1 mark)

(a) Had more than 2 accidents?

What is the probability that a driver chosen at random:

Age of driver	≤20 years	21 – 30 years	31 – 40 years	41 – 50 years	Total:
0	125	138	247	450	93
1	218	223	133	116	162
2	174	162	94	74	94
>2	87	16	10		116

groups claims for road accidents in a year:

An insurance company produced the following table from 2360 clients to investigate different age

(8 marks)

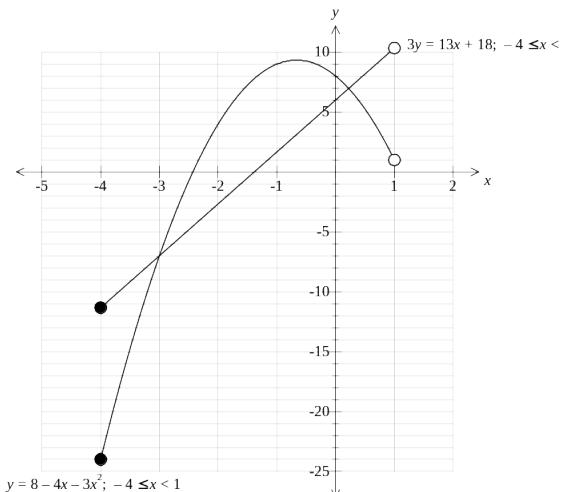
Question 10

**Question 11****(14 marks)**

- (a) Draw a graph here showing the following two functions over the domain:  $-4 \leq x < 1$ .

$$3y = 13x + 18 \text{ and } y = 8 - 4x - 3x^2$$

(6 marks)



[Each graph 2 marks and domain 2 marks = 6 marks]

- (b) From the graph find an exact solution to  $3y = 13x + 18$  and  $y = 8 - 4x - 3x^2$ . (2 marks)

(-3,-7) [2]

- (c) Show verification that your solution is an exact solution. (2 marks)

One way is  $3(-7) = (-21) = 13(-3) + 18$  and  $(-7) = 8 - 4(-3) - 3(-3)^2$  [2]

- (d) Estimate another solution to the simultaneous equation from your graph. (2 marks)

About (0.2,6.9) [2]

- (e) Refine this other solution accurate to three decimal places. (2 marks)

(0.22,6.963) [2]

**Additional working space**

Question number(s): \_\_\_\_\_

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$2x^3 - 8x^2 + 4x = (-5)$  is equivalent to  $2x^3 - 8x^2 + 4x + 5 = 0$  hence the solutions are the same. [2]

(d) Explain how to derive solutions to the equation  $2x^3 - 8x^2 + 4x = (-5)$  from the graph above.

$x = -0.55, 1.46, 3.09$  [1 mark each]

(c) Use your values to solve the equation  $2x^3 - 8x^2 + 4x + 5 = 0$ .

(3 marks)

[4 marks with a mark off for each omission or error as per above]

(b) Use your calculator to give values for all of these labeled points accurate to two decimal places or exactly if possible.

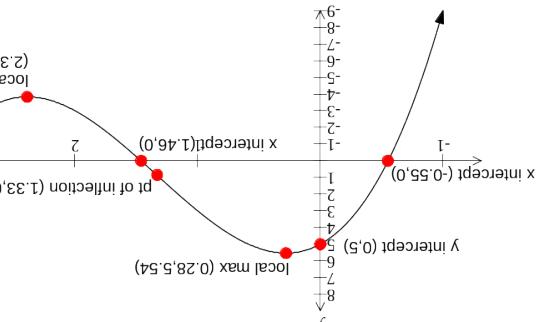
(iii) points of inflection [1 mark for all four labeled as per above]

(ii) turning points [1 mark for all four labeled as per above]

(i) intercepts [1 mark for all four labeled as per above]

(a) Label the following:

(3 marks)

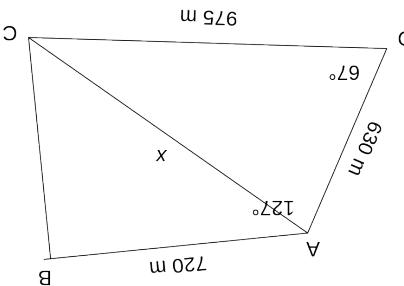


Given the graph below of the function  $y = 2x^3 - 8x^2 + 4x + 5$ :

(12 marks)

Question 12

The diagram below shows a piece of land with some known measurements.



(9 marks)

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(12 marks)

Question 15

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Question 12

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(9 marks)

**Question 13****(9 marks)**

A machine is set to fill packets of potato chips with 200 g of chips. However, due to the inaccuracy of this type of machine the actual weights in packets are normally distributed with a mean of 201 g and a standard deviation of 4.5 g. A quality control measure used by the factory is to weigh each packet after filling and recycle any packet with less than 195 g.

- (a) What percentage of packets will be recycled?

(4 marks)

$$N(201, 4.5^2) \quad P(X < 195) = P(Z < -1.33) = 9.12\% \quad [4]$$

- (b) If the factory produces 12000 packets per day how many will be recycled in one day?  
(2 marks)

$$12,000 \times 0.091211 = 1095 \quad [2]$$

- (c) If a packet is selected from those destined for recycling what is the probability that its weight is less than 190g?  
(3 marks)

$$P(X < 190 | X < 195) = P(Z < -2.44 | Z < -1.33) = 0.007254 / 0.091211 = 0.07953 \quad [3]$$

**Question 14****(8 marks)**

- (a) A 100g block of ice melts losing 15% of its mass every hour.

(5 marks)

- (i) Write down its mass initially i.e.  $T_0$ .

$$T_0 = 100 \text{ g} \quad [1]$$

- (ii) Write down its mass after 1 hour i.e.  $T_1$ .

$$T_1 = 100 \times 0.85^1 = 85 \text{ g} \quad [1]$$

- (iii) Write down  $T_5$ .

$$T_5 = 100 \times 0.85^5 = 44.37 \quad [1]$$

- (iv) Write down a recursive formula for  $T_{n+1}$ .

$$T_{n+1} = T_n \times 0.85 \quad [2]$$

- (b) Find  $S_{160}$  of a sequence given  $S_{159} = 1400$ ,  $T_{159} = 63$ , and the recursive rule for the sequence is  $T_{n+1} = T_n - 6$   
(3 marks)

$$\begin{aligned} S_{160} &= T_{160} + S_{159} \\ &= (T_{159} - 6) + S_{159} \\ &= (63 - 6) + 1400 \\ &= 1457 \\ &\quad [3] \end{aligned}$$