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| <p style="text-align: center;">MATHEMATICS</p> <p>Semester Two Examination, 2021</p> <p>Question/Answer booklet</p> <p>Section Two:</p> <p>METHODS</p> <p>UNITS 1&2</p> <p>Calculator-assumed</p> <p>Section Two:</p> <p>Materials required/recommended for this section</p> <p><i>To be provided by the supervisor</i></p> <p>Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters.</p> <p><i>To be provided by the candidate</i></p> <p>Special items: drawing instruments, templates, notes on two unfolded sheets of A4 paper, Computer Algebra System (CAS) calculators, are permitted in this ATAR course examination.</p> <p>No other items may be taken into the examination room. It is your responsibility to ensure that you do not have any unauthorised material if you have any unauthorised material with you, hand it to the supervisor before reading any further.</p> <p>© 2021 WA Exam Papers. Kennebey Baptist College has a non-exclusive licence to copy and communicate this document for non-commercial, educational use within the school. No other copying, communication or use is permitted without the express written permission of WA Exam Papers. SN245-182-Z.</p> | |
| <input type="checkbox"/> | <p>Your name _____</p> <p>Number of additional answer books used _____</p> <p>Working time: _____ minutes</p> <p>Reading time before commencing work: ten minutes</p> <p>Working time (if applicable): one hundred minutes</p> |



Structure of this paper

| Section | Number of questions available | Number of questions to be answered | Working time (minutes) | Marks available | Percentage of examination |
|------------------------------------|-------------------------------|------------------------------------|------------------------|-----------------|---------------------------|
| Section One: Calculator-free | 8 | 8 | 50 | 52 | 35 |
| Section Two: Calculator-assumed | 13 | 13 | 100 | 98 | 65 |
| Total | | | | | 100 |

Instructions to candidates

1. The rules for the conduct of examinations are detailed in the school handbook. Sitting this examination implies that you agree to abide by these rules.
2. Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens.
3. You must be careful to confine your answers to the specific question asked and to follow any instructions that are specific to a particular question.
4. 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 any question, ensure that you cancel the answer you do not wish to have marked.
5. It is recommended that you do not use pencil, except in diagrams.
6. Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.
7. The Formula sheet is not to be handed in with your Question/Answer booklet.

| Markers use only | | |
|------------------------------|---------|------|
| Question | Maximum | Mark |
| 9 | 5 | |
| 10 | 4 | |
| 11 | 9 | |
| 12 | 8 | |
| 13 | 7 | |
| 14 | 8 | |
| 15 | 7 | |
| 16 | 6 | |
| 17 | 10 | |
| 18 | 8 | |
| 19 | 7 | |
| 20 | 10 | |
| 21 | 9 | |
| S2 Total | 98 | |
| S2 Wt ($\times 0.6633$) | 65% | |

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Supplementary page

Question number: _____

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Working time: 100 minutes.
Calculator-assumed
This section has thirteen questions. Answer all questions. Write your answers in the spaces provided.

Question 9

Sector PQ subtends an angle of 108° in a circle with centre O and radius r .
(5 marks)

(1 mark)

(a) Express 108° as an exact and simplified radian measure.
(2 marks)

(b) Determine the radius of the circle.
The area of sector PQ is 120 m^2 .

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Question 10

(4 marks)

The value V of a block of land, in thousands of dollars, t years after the start of the year 2010, can be modelled by the equation $V=65r^t$, where r is a positive constant.

At the start of 2015, the land was valued at \$92 000.

- (a) Show that the value of r is 1.072, when rounded to 3 decimal places. (2 marks)
- (b) Assuming that the model remains valid into the future, determine the year in which the value of the block will reach \$500 000. (2 marks)

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- (c) Add the line $y=2x+3$ to the graph of the hyperbola and state the number of points of intersection it will have with the hyperbola. (2 marks)
- (d) The line $y=mx+3$ is tangential to the hyperbola, where m is a constant. Use an algebraic method to determine all possible values of m . (3 marks)

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Question 21

A function is defined by $f(x) = x^4 - 8x^3 + 18x^2 - 16x + 21$.

(a)

Complete the following table.

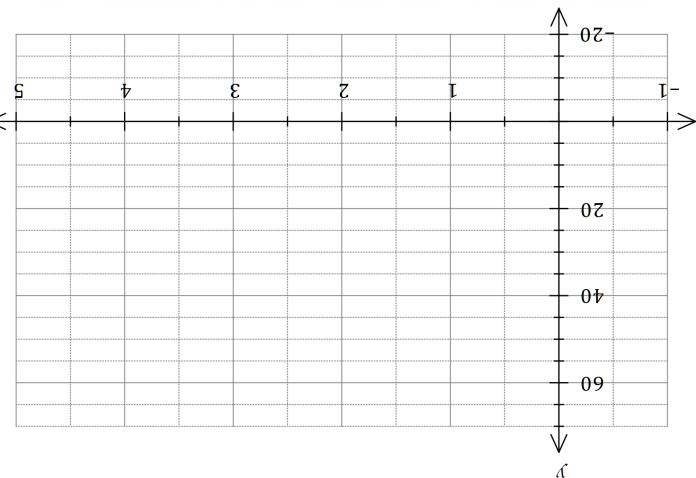
| $f(x)$ | -1 | 0 | 1 | 2 | 3 | 4 | 5 |
|--------|----|---|---|---|---|---|---|
| x | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

(b)

Use calculus to determine the coordinates of all stationary points of the graph $y = f(x)$.

(c)

Sketch the graph of $y = f(x)$ on the axes below for $-1 \leq x \leq 5$. (4 marks)



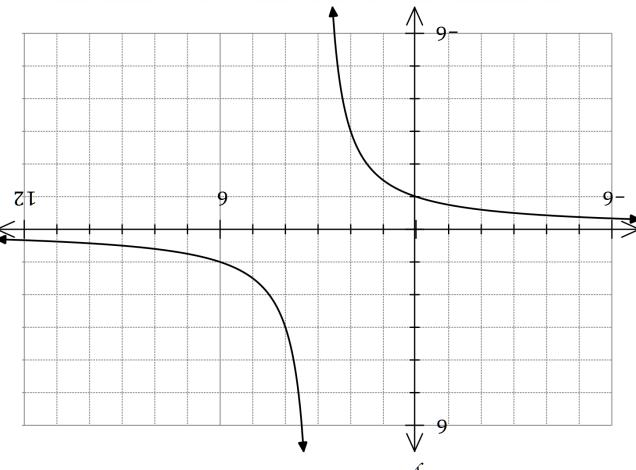
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NS245-182-2

The graph of the hyperbola $y = \frac{a}{x+b}$ is shown below, where a and b are constants.

(9 marks)

Question 22



(a) State the equations of all asymptotes of the hyperbola. (2 marks)

(b) Determine the value of a and the value of b . (2 marks)

Question 12

(8 marks)

Data from repairs to 495 smartphones showed that 340 were Android and the remainder iOS. The type of repair was classified as screen or other, and of the 346 smartphones that required screen repairs, 265 were Android.

- (a) Determine, to 3 decimal places, the probability that a randomly selected smartphone from those repaired

(i) was an iOS smartphone. (2 marks)

(ii) required a screen repair or was an Android smartphone. (2 marks)

(iii) was an iOS smartphone given that it required a screen repair. (2 marks)

- (b) Use two of the above probabilities to explain whether the repair data indicates possible independence of type of smartphone and type of repair. (2 marks)

- (d) Determine the length of time (to 3s.f) during the first 6 seconds for which $h_B > h_C > h_A$. (3 marks)

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Question 13

(7 marks)

- (a) Determine the increase in altitude of the aeroplane during the fourth minute. (2 marks)

reduces by 4%.

An aeroplane takes off from an airport situated at an altitude of 150 metres above sea level and climbs 450 metres during the first minute of flight. In each subsequent minute, its rate of climb

reduces by 4%.

- (a) Determine the increase in altitude of the aeroplane during the fourth minute. (2 marks)

- (b) Deduce a rule in simplified form for the altitude A_n of the aeroplane at the end of the n^{th} minute. (3 marks)

- (d) Determine the maximum altitude the aeroplane can reach. (1 mark)

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(10 marks)

- (a) State which two weights are oscillating with the same amplitude, and state what this common amplitude is. (2 marks)

$$h_A = 15 \sin \left(\frac{3}{2} \pi t \right) + 35, h_B = 14 \cos \left(\frac{3}{2} \pi t \right) + 30, h_C = 15 \sin \left(\frac{3}{2} \pi t \right) + 30.$$

Three small weights, A, B and C, each attached to a spring, are oscillating vertically above level ground. The height, h , cm, above the ground of each weight at time t seconds, ($t \geq 0$), is given by

- (b) State which two weights are oscillating with the same period, and state what this common period is. (2 marks)

- (c) State which of the weights reaches closest to the ground and state the time at which it first reaches this position. (3 marks)

(8 marks)

Question 14

Two events A and B are such that $P(A)=0.35$ and $P(B)=0.48$.

Determine the following probabilities.

- (a) $P(\overline{A} \cup \overline{B})$ when A and B are mutually exclusive.

(2 marks)

- (b) $P(A \cup B)$ when $P(\overline{A} \cap B)=0.25$.

(2 marks)

- (c) $P(A \cap \overline{B})$ when A and B are independent.

(2 marks)

- (d) $P(A \vee B)$ when $P(B|A)=0.2$.

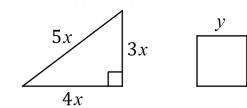
(2 marks)

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(7 marks)

Question 19

A length of wire 72 cm long is cut into two pieces. One piece is bent into a right triangle with sides of length $3x$, $4x$ and $5x$ cm and the other piece is bent into a square of side y cm.



Formulate an expression for the combined area of the triangle and square in terms of x and hence use calculus to determine the minimum value of this total area.

(6 marks)

Question 16

The sum of the first n terms of a sequence is given by $S_n = 3n^2 + 2n$.

- (a) Determine S_5 .

(1 mark)

- (b) Determine T_5 , where T_n is the n^{th} term of the sequence.

(2 marks)

- (c) Explain why the sequence must be arithmetic and hence deduce a rule for the n^{th} term of the sequence.

(3 marks)

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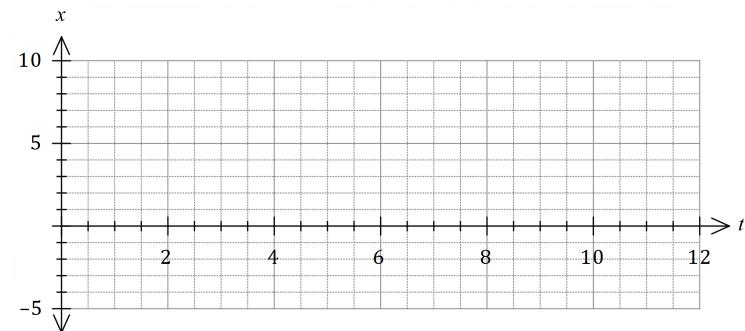
(10 marks)

Question 17

Particle A is moving along the x -axis so that its displacement, in cm, at time t seconds, $t \geq 0$, is given by $x = 5 + 2t - 0.25t^2$.

- (a) Sketch the displacement-time graph of particle A on the axes below.

(3 marks)



- (b) Determine the velocity of particle A at the instant it reaches the origin.

(3 marks)

- (c) Particle B is also moving along the x -axis, but with a constant velocity. When $t = 5$, it has the same displacement and velocity as particle A. Determine when particle B reaches the origin.

(4 marks)