

MATHEMATICS 3AMAT
Semester One Examination 2009

PERTH MODERN SCHOOL
Exceptional schooling. Exceptional students.



PART A
RESOURCE-FREE

Name

Teacher

Time allowed for this paper
Reading time before commencing work:
Five minutes
Working time for paper:
Forty minutes

Material required/recommended for this paper
To be provided by the supervisor
This Question/Answer Booklet

To be provided by the candidate
Standard items: Pens, pencils, eraser or correction fluid, highlighter

Important note to candidates
The standard items listed above and the Resource-free examination paper are the only items permitted on your table during the Resource-free examination. When directed, you will place all other items and the Resource-rich examination paper under your chair.

This paper is for students who have completed Units 3AMAT in Semester One 2009

Structure of this paper

Working time	Number of questions available	Number of questions to be attempted	Marks
40 minutes	5	5	40
[Total marks]			40

This paper has **FIVE (5)** questions. Attempt **ALL** questions.

Question	Marks
1	4
2	4
3	3
4	11
5	18
Total marks	40

Instructions to candidates

1. The rules for the conduct of Curriculum Council examinations are detailed in the *Student Information Handbook*. 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 may be found at the end of the booklet. If you need to use them, indicate in the original answer space where the answer is continued (i.e. give the page number).
3. A blue or black ballpoint or ink pen should be used.
4. It is recommended that you **do not use pencil** except in diagrams.
6. **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. Correct answers given without supporting reasoning may not be allocated full marks. Incorrect answers given without supporting reasoning cannot be allocated any marks. If you repeat an answer to any question, ensure that you cancel the answer you do not wish to have marked.

RESOURCE-FREE

This paper has FIVE (5) questions. Attempt ALL questions.

Question 1 [4 marks]

Using calculus and algebra, determine the coordinates of any points on the curve $y = x^3 - 3x^2 + 3x - 4$ where the gradient is zero.

[4 marks]

Question 2 [4 marks]

Determine the equation of the line tangential to the curve $y = 5x^4 - 3x^2 + 7$ at the point where $x = 1$.

[4 marks]

Question 3 [3 marks]

Given $\frac{dy}{dx} = 4x^3 - 2x + 7$ and $y = 5$ when $x = -1$, determine y as a function of x .

[3 marks]

SEE NEXT PAGE

Question 4 [11 marks]

The pitch of a pipe in a musical organ (in cycles per second) is modelled by the equation:

$$P = \frac{216}{l}$$
 where l is the length of the pipe (in metres).

(a) Describe in words how P varies with l .

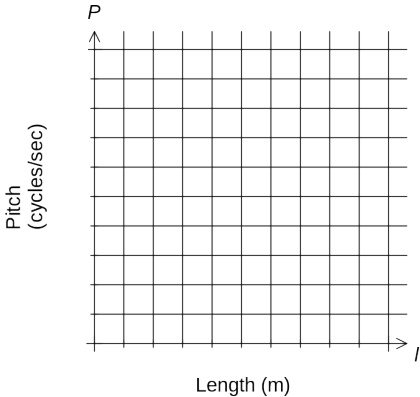
[2 marks]

(b) What would be a suitable domain for l ? Justify your choice.

[2 marks]

(c) Graph the function P , using the axes below:

[3 marks]



(d) What is the pitch of a pipe with a length of 3 metres?

[2 marks]

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

(e) (i) Is P increasing or decreasing as l increases $l = 3$?

[1 mark]

(e) (ii) What units would the rate of change of P be measured in for the $P = \frac{l}{216}$ relationship?

[1 mark]

(f) An extra rating of 'Very Poor' is introduced for a fitness index of below 50. Explain why $S = R$ is the line forming the boundary between 'Poor' and 'Very Poor' and add this line to the graph above.

[3 marks]

(g) Shade the region on the graph above that represents a 'Very Poor' rating.

[1 mark]

THIS SPACE HAS BEEN LEFT BLANK INTENTIONALLY

SEE NEXT PAGE

END OF PAPER

Question 5 [18 marks]

To test fitness in a step aerobics class, a student climbs up and down a 0.5 metre step for up to 5 minutes. When the student stops, the pulse rate (r) is taken 3 times after 1, 2 and 3 minutes respectively and a fitness index is calculated using the formula:

$$F = \frac{50S}{R},$$

where S is the time (in seconds) for the exercise and R is the total combined pulse rate from the three readings, (i.e. $R = r_1 + r_2 + r_3$).

Fitness ratings are given in the following table:

Fitness Index (F)	Rating
$F < 60$	Poor
$60 \leq F < 70$	Satisfactory
$70 \leq F < 80$	Good
$F \geq 80$	Excellent

(a) What restrictions are there on S ?

[2 marks]

(b) Karl exercises for 4 minutes with the resulting pulse rates, r_1, r_2, r_3 of 100, 80, 70 respectively.

(i) What is his fitness index?

[2 marks]

(ii) What fitness rating would he get?

[1 mark]

(c) Pulse rates (r) are found to be between 50 and 140.

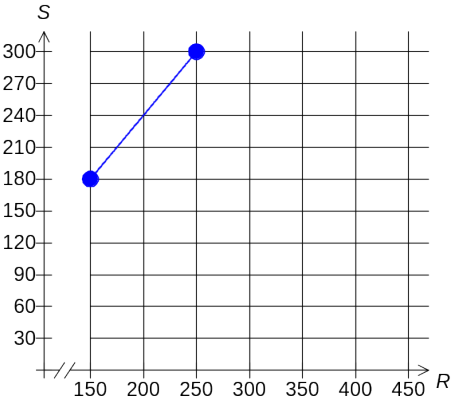
(i) Express this as a restriction on R .

[1 mark]

(ii) Give an example of 3 measured pulse rates after 4 minutes of exercise that would result in a 'Good' rating and verify this by calculation.

[2 marks]

The relationship between S and R , when a person is at the boundary of 'Poor' and 'Satisfactory' ratings are given by the formula: $60 = \frac{50S}{R}$ (i.e. $S = 1.2R$), and this is shown on the graph below:



(d) Determine the equation of the line forming the boundary between the categories 'Excellent' and 'Good.'

[3 marks]

(e) Shade the region that represents an 'Excellent' rating, on the graph above.

[3 marks]