



No other items may be used in this section of the examination. It is **your responsibility** to ensure that you do not have any unauthorized notes or other items of a non-personal nature in the examination room. If you have any unauthorized material with you, hand it to the supervisor **before** reading any further.

Important note to candidates

Special items: drawing instruments, templates, notes on two unruled 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 tape if liquid, ruler, highlighting pens.

To be provided by the candidate

Formula sheet (retained from Section One)

This Question/Answer booklet

Material required/recommended for this section

Reading time before commencing work: ten minutes
Working time for paper: one hundred minutes

Please circle your teacher's name: S Eberle T Hosking S Rowden

Your name: _____

Calculator assumed

Section Two:

3C/3D (Year 12)

MATHEMATICS

Question/Answer Booklet

Semester 1 Examination, 2012

STRIVE FOR THE HIGHEST



Structure of this paper

Section	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available
Section One: Calculator-free	8	8	50	50
Section Two: Calculator-assumed	13	13	100	100
				150

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2012*. 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, 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.

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See next page
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(4 marks)

Question 9

Working time for this section is 100 minutes.

- 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.
- Planning: if you use the spare pages for planning, indicate this clearly at the top of the page.
- Responses and/or as additional space if required to continue an answer.

Space 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.

This section has thirteen (13) questions. Answer all questions. Write your answers in the space provided.

Section Two: Calculator-assumed
SEMESTER ONE 2012
SECTION TWO
MATHEMATICS 3/3D
CALCULATOR-ASSUMED
(100 Marks)

Additional working space
Question number(s): _____

SECTION TWO
SEMESTER TWO 2012
CALCULATOR-ASSUMED
MATHEMATICS 3/3D
SECTION TWO
SEMESTER ONE 2012
SECTION TWO
MATHEMATICS 3/3D
CALCULATOR-ASSUMED
(100 Marks)

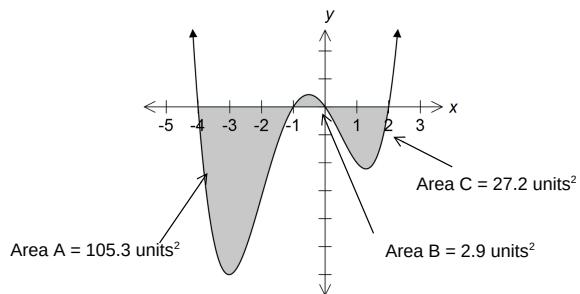
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[1]
Consider the function $f(x) = x^3 + ax^2 + 2x + b$ where a and b are constants.
(a) Find an expression for the gradient of the curve.
(b) Given that the tangents at $A(0, b)$ and $B(2, 5)$ are parallel, find the value of a and b .
[3]

Question 10

(13 marks)

- (a) The function $f(x)$ is shown below with the areas given in square units for the shaded region.



Determine the value of

$$(i) \int_{-4}^{-1} f(x) dx$$

[1]

$$(ii) \int_{-4}^2 f(x) dx$$

[2]

$$(iii) \int_{-1}^0 (2f(x) + 3) dx$$

[3]

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Additional working space

Question number(s): _____





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Given $f(x) = \frac{1}{x}$, $g(x) = 2^x$ and $h(x) = 2x + 1$

(i) 2^x

(a) Use composite function notation to describe:

(ii) x

(iii) $2_{x+1} + 1$

(b) (i) Determine $h \circ f(x)$

(ii) Determine the domain and range of $h \circ f(x)$

[2]

[2]

[2]

[2]

[2]

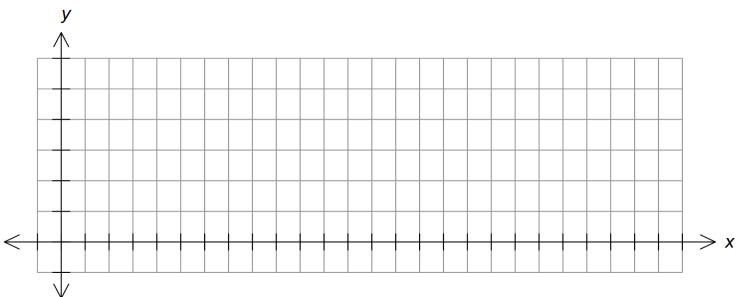
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Question 10 continued

- (b) (i) Sketch $y = \sqrt{x}$ and $4y = x$ on the axes below.

[2]



- (ii) Find the intersection(s) between $y = \sqrt{x}$ and $4y = x$.

[2]

- (iii) $x = c$ divides the region bounded between $y = \sqrt{x}$ and $4y = x$ into two regions of equal area. State an equation involving the use of calculus that represents the given situation.

Hence determine c to 1 decimal place.

[3]

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Question 11

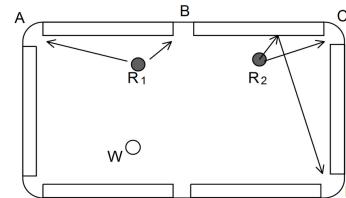
(12 marks)

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Question 20

(7 marks)

In the game of billiards, one of the scoring shots is a "cannon". The player hits the white ball, W, with the cue and it cannons into one of the red balls, R₁ or R₂. The player's objective is to sink a red ball in one of the pockets A, B, C or D.



The player is about to attempt a cannon. She considers only the four pockets A, B, C or D for this shot as indicated on the diagram.

The probability that she will attempt the shots A, B, C or D is in the ratio 7 : 6 : 5 : 2.

- (a) List these probabilities.

[1]

If she attempts one of these shots, the respective probabilities of sinking a red are:

$$\frac{5}{6}, \frac{5}{6}, \frac{3}{5}, \frac{2}{5}$$

Determine the probability that

- (b) she will sink a red in B.

[1]

- (c) she will not sink a red.

[2]

- (d) she attempted shot D given she didn't sink a red.

[3]



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See next page

(a) Use any method to determine the derivative of $\frac{1}{x}$.

$$\frac{f(x+h)-f(x)}{h}$$

[2]

(b) Use the Newton quotient to determine the derivative of x . Simplify your answer.

$$\frac{1}{h}$$

is called the Newton quotient and is used to determine the derivative of a function.

$$\frac{f(x+h)-f(x)}{h}$$

The expression

(c) If h is approaching 0, does your answer in (b) equal your answer in (a)? Explain.

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[3]



(b) Complete the graph below using your inequalities and shade the feasible region.

[3]

The line relating to the screen printing constraint has been given.

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[3]

(a) Determine four inequalities from the information given.

Let A be the number produced per week of type A jacket and B be the number produced per week of type B jacket.

This equipment can screen print 60 per hour of type A and 20 per hour of type B. Facilities for screen printing the jackets are limited to 30 hours per week and 200 of type B. The factory has a minimum weekly contract for 150 type A jackets B makes a profit of \$45. The factory has a minimum weekly contract for 150 type B jackets available to produce 1000 jackets per week. Jacket type A makes a profit of \$30 while jacket type B makes a profit of \$45. The factory has enough cloth available to produce 12 jackets per week.

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Question 11 continued

- (c) Determine how many of type A and B jackets the factory should produce per week to maximise the profit and state the maximum profit.

[3]

- (d) By what percentage can the profit on jacket A change by before the solution in part (c) is no longer unique.

[3]

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Question 18

(8 marks)

X and Y are two events where $3P(X) = 2P(Y)$ and $P(X \cup Y) = \frac{2}{3}$.

- (a) If $P(Y) = p$ determine the value of p given X and Y are mutually exclusive.

[2]

- (b) If $P(Y) = 0.6$ determine whether the events X and Y are independent.

[4]

- (c) If $P(Y) = p$ determine the value of p given X and Y are independent.

[2]



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Question 13

(6 marks)

In the first five seconds of inflation, the relationship between the radius (r cm) and time (t sec) of a spherical party balloon are related by the formula:

$$r = -t(t - 10)$$

- (a) Show that the relationship between volume (V cm³) and time is given by

$$V = \frac{4\pi(10t - t^2)^3}{3}$$

[1]

- (b) Determine the exact volume of the balloon 3 seconds after first being inflated.

[1]

- (c) Determine the rate the volume is changing when $t = 2$ seconds.

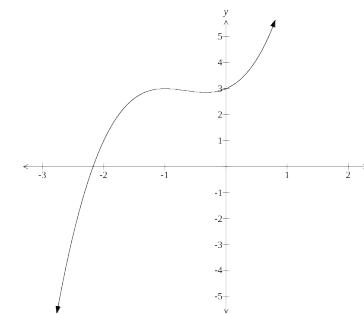
[1]

- (d) Determine the approximate change using the increments formula in volume as t increases from 3 to 3.01 sec.

[3]

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The graph of $y = x^3 + 2x^2 + x + 3$ is shown.



- (a) Use the second derivative to show that a possible point of inflection exists at $x = -\frac{2}{3}$

[2]

- (b) Use a sign test to verify that the point where $x = -\frac{2}{3}$ is, in fact, a point of inflection.

[2]



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A worker in the city finishes work at 5:30 pm and drives home. Depending on the conditions of his journey home with no lights on or the parking lights on or the headlamps on, if fact, for 80% he drives home with no lights on or the parking lights on or the headlamps on. Depending on the conditions either of the lights on overemigift the battery will flat in the morning.

- (a) Draw a probability tree diagram to represent the given information.

[2]

(b) What is the probability that on the next journey home from work he uses his lights and turns them off?

[2]

(c) Because he left his lights on, he had a flat battery on Tuesday morning what is the probability that on Monday night he left his parking lights on?

[3]



Question 14

A particle is moving under rectilinear motion with velocity $V(t) = -2t + 9t^2$ m/s. Answer the following questions for the movement of the particle over the time interval $0 \leq t \leq 6$.

- (a) If the particle was initially 2 m to the right of the origin, what is the displacement from the origin after 2 seconds?

[2]

- (b) How far did the particle travel in the first 2 seconds?

[2]

- (c) What was the average speed during the 5th second?

[2]

- (d) For what subset(s) of the given time interval is the acceleration negative?

[2]

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(8 marks)

Question 14 continued

- (d) The driver decided that, in future, whenever he turned on his lights to drive home it would be his headlights on full. Would this decision reduce the chance of a flat battery? If so, by what factor?

[3]

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Question 15

(6 marks)

Two competing cyclist are riding with constant speed. At 12 midday cyclist X is 40 metres north of a judge and is riding east at 9m/s, while cyclist Y is 70 metres east of the judge and is riding north at 7m/s.

- (a) Show diagrammatically this situation (a scale diagram is not required).

[1]

- (b) If the distance between the cyclist t seconds later is D metres, show that
$$D^2 = 6500 - 1820t + 130t^2$$

[2]

- (c) Determine the time the cyclists are closest together and determine the minimum distance between them.

[3]

Question 16



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(6 marks)

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