



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: nil

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

To be provided by the candidate

Formula sheet

This Question/Answer booklet

To be provided by the supervisor

Material required/recommended for this section

Reading time before commencing work: five minutes
Working time for paper: fifty minutes

Time allowed for this section

Please circle your teacher's name: Ebert Hosking Rowden

Your name: _____

SOLUTIONS

Calculator-free

Section One:

3C/3D (Year 12)

MATHEMATICS

Question/Answer Booklet

Semester 1 Examination, 2012

STRIVE FOR THE HIGHEST

DENRHOS COLLEGE

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, 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 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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Question 2

(7 marks)

Find the derivative of each of the following: [DO NOT SIMPLIFY YOUR ANSWER]

(a) $7x^3 - \frac{3}{x} + 4\pi$

Solution	[1]
$21x^2 + \frac{3}{x^2}$	
✓ correctly derivative	

(b) $(\sqrt{2x})(1+x)^2$

Solution	[2]
$\sqrt{2} \cdot \frac{1}{2}x^{-\frac{1}{2}}(1+x)^2 + \sqrt{2x} \cdot 2(1+x)$	
✓ applies product rule correctly ✓ differentiates each term correctly	

(c) $\frac{x}{\sqrt{2x-3}}$

Solution	[2]
$\frac{1\sqrt{2x-3} - x \cdot \frac{1}{2}(2x-3)^{-\frac{1}{2}} \cdot 2}{2x-3}$ or $1(2x-3)^{-\frac{1}{2}} + x \cdot \frac{1}{2}(2x-3)^{-\frac{3}{2}} \cdot 2$	
✓ applies quotient (product) rule correctly ✓ differentiates each term correctly	

(d) $\int_1^{2x} (t^3 + t^2) dt$

Solution	[2]
$[(2x)^3 + (2x)^2] \cdot 2$	
✓ recognises the fundamental theorem, substituting t with $2x$ ✓ multiplies by the derivative of $2x$	

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Question 8 continued

(c) Hence determine the Lumen capacity of each of the stage lights Aa, Bb and Cc.

[2]

Solution	[2]
Aa = 800 Bb = 600 Cc = 1000	
Specific behaviours	

- ✓ recognises the relationships between the equations in part (a) and (b)
- ✓ correct Lumen capacity of each of the stage lights

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Question 4

(7 marks)

Given $f(x) = x + 3$ and $g(x) = \frac{2}{x-3} + x$:

$$g \circ f(x) = \frac{x^2 + 3x + 2}{x}$$

(a) show that

Solution
$\begin{aligned} & \frac{2}{(x+3)-3} + x + 3 \\ &= \frac{2}{x} + x + 3 \\ &= \frac{2+x^2+3x}{x} \\ &= \frac{x^2+3x+2}{x} \end{aligned}$
Specific behaviours
<ul style="list-style-type: none"> ✓ substitutes $f(x)$ into $g(x)$ ✓ simplifies and determines LCD x^2+3x+2 ✓ states final simplification is $\frac{x^2+3x+2}{x}$

(b) determine when $g \circ f(x) \geq 0$

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[4]

Solution
$\begin{aligned} & \frac{x^2+3x+2}{x} \geq 0 \\ & \frac{(x+2)(x+1)}{x} \geq 0 \end{aligned}$ <p>Critical values $x = 0, -2$ and -1</p> <p>$-2 \leq x \leq -1$ or $x > 0$</p>
Specific behaviours
<ul style="list-style-type: none"> ✓ factorises numerator ✓ identifies critical values ✓ tests values ✓ correct boundaries (including 'or')

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Question 7 continued

(b) Simplify $\frac{x-2}{x+3} - \frac{4}{5x^2+14x-3} + 1$

[3]

Solution
$\begin{aligned} & \frac{x-2}{x+3} - \frac{4}{5x^2+14x-3} + 1 \\ &= \frac{x-2}{x+3} - \frac{4}{(x+3)(5x-1)} + 1 \\ &= \frac{(x-2)(5x-1) - 4 + (x+3)(5x-1)}{(x+3)(5x-1)} \\ &= \frac{5x^2 - 11x + 2 - 4 + 5x^2 + 14x - 3}{(x+3)(5x-1)} \\ &= \frac{10x^2 + 3x - 5}{(x+3)(5x-1)} \end{aligned}$
Specific behaviours
<ul style="list-style-type: none"> ✓ factorises quadratic ✓ identifies LCD and uses to simplify expression ✓ correct solution

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$$[4]$$

$$\frac{3x+9}{x} - \frac{6}{x^2} = 0$$

$$(x+3)(x-3) - 6 = 0$$

$$x^2 - 9 - 6 = 0$$

$$x^2 - 15 = 0$$

$$x(x-3) = 15$$

$$x = 6 \text{ or } x = -3$$

$$(x-6)(x+3) = 0$$

$$x^2 - 3x - 18 = 0$$

$$x = 6 \text{ or } x = -3$$

$$\therefore x = 6$$

$$\boxed{\text{Specific behaviours}}$$

identifies restrictions and recognises only one solution

identifies quadratic and solves x

simplifies expression

identifies denominator and multiplies throughout by LCD

identifies quadratics and solves x

identifies restrictions only one solution

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Question 6

(8 marks)

- (a) Integrate each of the following with respect to x . DO NOT SIMPLIFY

(i) $3 - 2x$

Solution	
$3x - x^2 + c$	
✓ correctly integrates	

(ii) $\frac{6x - 4}{\sqrt{x}}$

Solution	
$\int 6x^{\frac{1}{2}} - 4x^{-\frac{1}{2}} dx$	
$= 4x^{\frac{3}{2}} + 8x^{\frac{1}{2}} + c$	
✓ simplifies ✓ correctly integrates	

(iii) $-3(5 - x)^{\frac{3}{4}} + \frac{1}{2x^2}$

Solution	
$\int -3(5 - x)^{\frac{3}{4}} + \frac{1}{2x^2} dx$	
$= \frac{12(5 - x)^{\frac{7}{4}}}{7} - \frac{1}{2x} + c$	
✓ correct derivative of the 1 st term ✓ correct derivative of the 2 nd term ✓ includes constant (only penalise in this question)	

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Question 6 continued

(b) $\int \frac{2ax + b}{(ax^2 + bx + c)^2} dx$

where a and b are constants. Simplify the answer.

[2]

Solution	
$\int \frac{2ax + b}{(ax^2 + bx + c)^2} dx$	
$= \int (2ax + b)(ax^2 + bx + c)^{-2} dx$	
$= \frac{-1}{ax^2 + bx + c} + k$	
Specific behaviours	
✓ recognises numerator is the derivative of denominator ✓ hence integrates function correctly	

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