Hale School

Year 11 Semester 1 Examination, 2015

Write your name below:

MARKING KEY

Mathematics Methods

Teacher:_____

Section Two: Calculator-assumed

Booklet 2 of 3

TIME ALLOWED FOR THIS SECTION

Reading time before commencing:	Ten minutes
Working time for paper:	One hundred minutes

MATERIAL REQUIRED/RECOMMENDED FOR THIS PAPER

TO BE PROVIDED BY THE SUPERVISOR
TWO Question/Answer booklets for Section Two – complete BOTH.
Formula Sheet (retained from Section One).

TO BE PROVIDED BY THE CANDIDATE

Standard Items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special Items: drawing instruments, templates, notes on one unfolded sheet of A4 paper, and calculators approved for use.

IMPORTANT NOTE TO CANDIDATES

No other items may be taken into the examination room. 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. Please check carefully, and 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	Percentage of exam
Section One: Calculator-free	9	9	50	50	37
Section Two: Calculator-assumed	15	15	100	85	63
				Total	100

INSTRUCTIONS TO CANDIDATES

1. Write your answers in this Question/Answer Booklet.

2. You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.

3. 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.

4. Fill in the number of the question that you are continuing to answer at the top of the page.

5. 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.

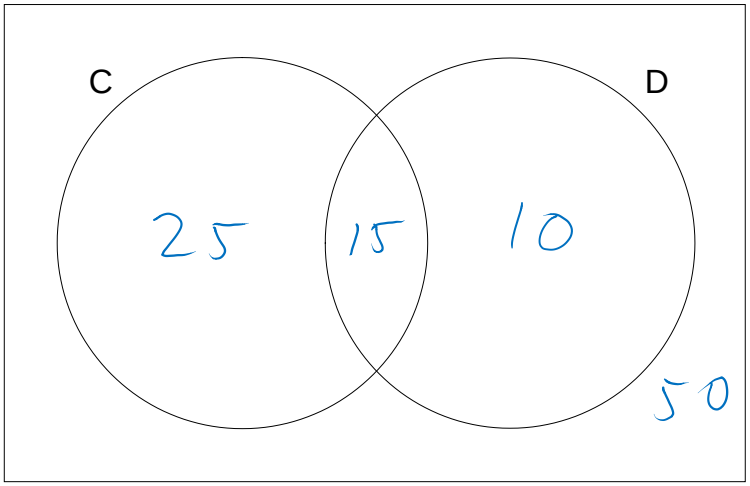
6. It is recommended that you do not use pencil, except in diagrams.

Section Two: Calculator Assumed 85 marks (63%)
This section has 15 questions. Answer all questions. Write your answers in the spaces provided.
Working time: 100 minutes

Question 10 **7 marks**

In a group of 100 people, 40 own a cat, 25 own a dog and 15 own a cat and a dog.

a. Use the information above to complete the Venn diagram (2 marks)



✓ Subtracts intersection to find C and D only

✓ Completes the Venn diagram

b. Find the probability that a person chosen at random: (3 marks)

i. Owns a dog or a cat but not both

$\frac{35}{100} = \frac{7}{20}$

✓States correct probability (NO penalty for simplifying in this question)

ii. Owns a dog given that he owns a cat

$\frac{15}{40} = \frac{3}{8}$

✓States correct probability

iii. Does not own a cat given that he does own a dog.

$\frac{10}{25} = \frac{2}{5}$

✓States correct probability

c. Are the events owning a cat and owning a dog mutually exclusive? Explain. (2 marks)

✓States NOT mutually exclusive

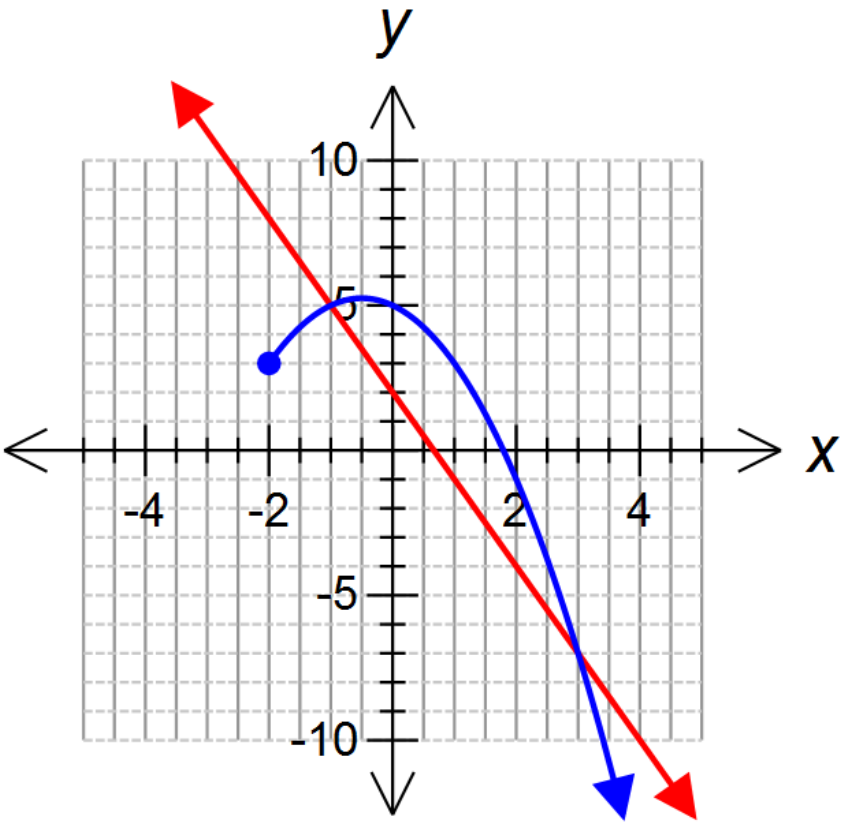
✓Explanation shows understanding of mutual exclusivity

No, possible to own both.

$P(C \cap D) \neq 0$

Question 11 **5 marks**

The graph below shows the functions $f(x)$ and $g(x)$.
The equation of $g(x)$ is unknown, $f(x) = 2 - 3x$.
The maximum of $g(x)$ is located at $(-0.5\,, 5.25)$.



a. Calculate $f(10)$ (1 mark)

-28

✓Calculates correctly

b. Determine k, if $f(k) = g(k)$ (2 marks)

✓ States one correct solution
✓States both correct solutions

$k = -1$, $k = 3$

c. State the domain and range of $g(x)$ (2 marks)

✓States domain correctly
✓States range correctly

Domain $= \{x \in \mathbb{R} : x \geq -2\}$

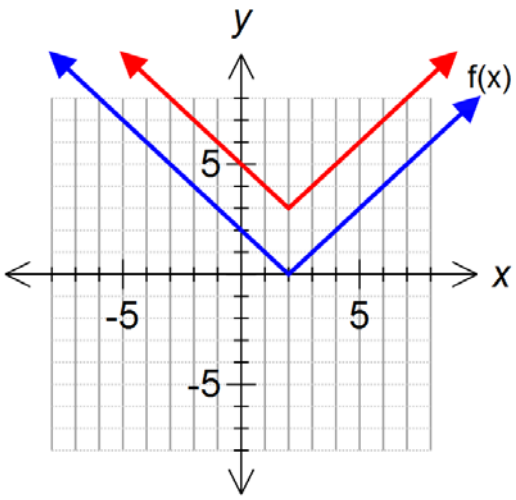
Range $= \{y \in \mathbb{R} : y \leq 5.25\}$

Question 12 **8 marks**

a. The graph of $y = f(x)$ is shown on each graph below. Neatly sketch and label the following functions on each graph. (4 marks)

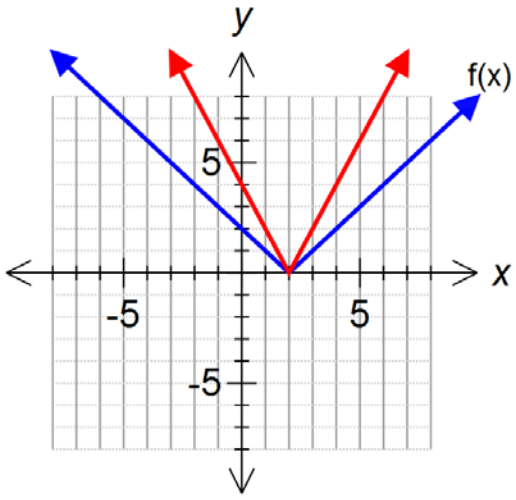
i. $f(x) + 3$

✓ Correctly translates graph

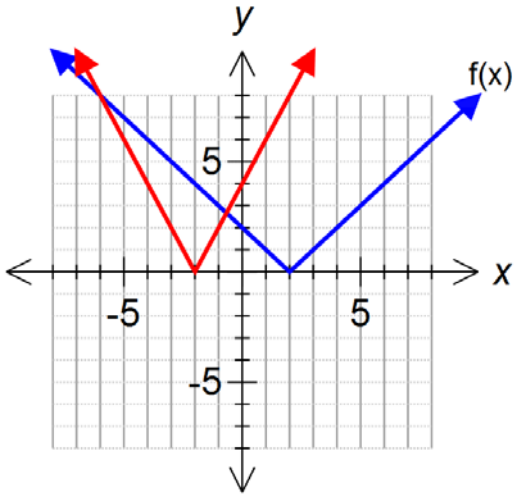


ii. $f(2x)$

✓ Correctly dilates graph



iii. $2f(x + 4)$



✓ Correctly dilates graph

✓ Correctly translates graph

b. Describe in order the transformations required to change the graph of $y = \frac{1}{x}$ into the graph of $y = \frac{2}{-x+3}$. (4 marks)

✓✓✓ One mark per correct transformation

✓ Identifies order of transformations

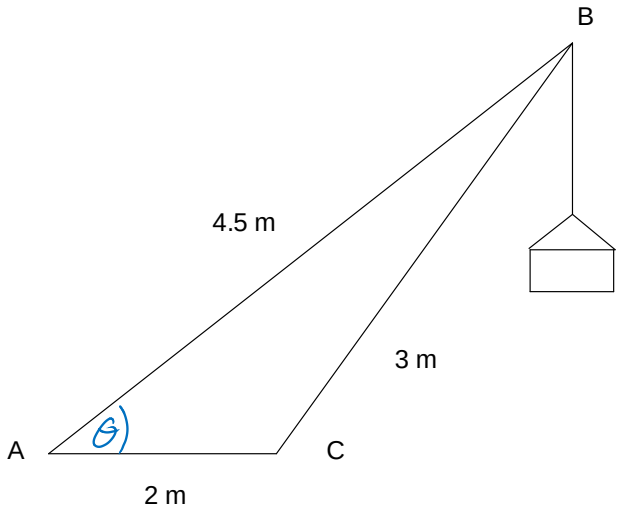
(1) Translate left 3 units
(2) Reflect in y-axis
Dilate vertically, s.f. 2 (order n/a)

OR

(1) Reflect in y-axis
(2) Translate right 3 units

Question 13 **3 marks**

The following diagram represents the main structure of a crane. AC is horizontal.
Calculate the angle of elevation of the point B from A.



$\cos\theta = \frac{2^2 + 4.5^2 - 3^2}{2(2)(4.5)}$

$\cos\theta = \frac{61}{72}$

$\theta = 32.09^\circ$

✓ Identifies the angle of elevation

✓ Correctly applies the cosine rule

✓ Calculates the angle correctly

Question 14 **2 marks**

Show algebraically that $\sin(2\theta) = 2\sin\theta\cos\theta$.

$\sin(\theta+\theta) = \sin\theta\cos\theta + \cos\theta\sin\theta$

$= 2\sin\theta\cos\theta$

✓ Expands using angle sum formula

✓ Simplifies to show equality

Question 15 **7 marks**

a. Aaron Sandilands likes to wear odd socks at training and has 4 different colours to choose from: red, green, purple and white. List the different colour combination pairs he can make from the colours listed. (2 marks)

RG

RP GP

RW GW PW

✓ Lists pairs of colours showing combinations only

✓ Lists all pairs correctly

b. The Fremantle Dockers have 46 players at their club and need to select 3 emergency players for each game. How many different groups of 3 could be selected as emergencies? (1 mark)

$C_3 = 15180$

✓ Calculates correctly

c. There are 16 experienced players and 12 younger players fit for selection at the Dockers this week. How many ways can the team be selected if 12 experienced players and 10 younger players need to be chosen? (2 marks)

$^{16}C_{12} \times {}^{12}C_{10}$

$= 1820 \times 66$

$= 120,120$

✓ Calculates combinations correctly

✓Applies the multiplication principle

d. The leadership group at the Dockers consists of 4 players. The club has been asked to send some of the leadership group to a media conference tonight and needs to decide whether to send some, all or none of the players. How many combinations of players from the leadership group are possible? (2 marks)

$^4C_0 + {}^4C_1 + {}^4C_2 + {}^4C_3 + {}^4C_4$

$= 2^4$

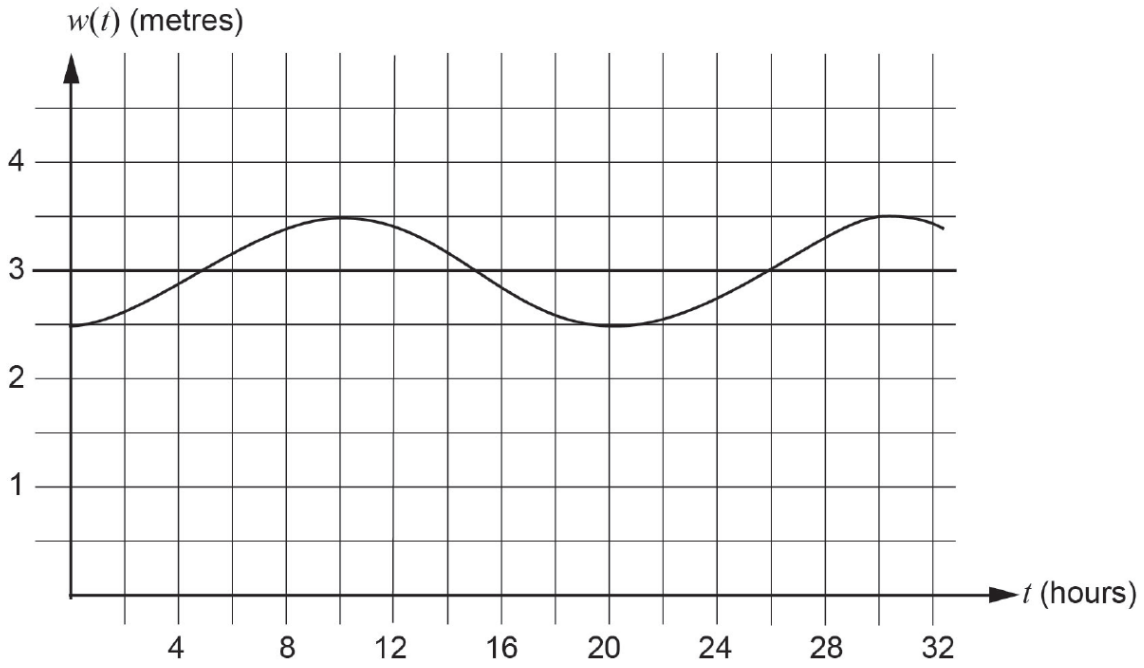
$= \underline{16}$

✓Identifies that any number may be chosen

✓Correctly calculates number of combinations

Question 16 **4 marks**

Data was gathered at Betty's Jetty on the variation of the height of the water level, $w(t)$, t hours after midnight and measured in metres. The graph of this variation is shown below:



The graph shows initially that the water level was at low tide. The trigonometric function $w(t) = -a\cos(bt) + c$ is used to model the variation in the water level.

a. Explain, with reasoning, why a = 0.5, b = $\frac{\pi}{10}$ and c = 3. (3 marks)

a = Amplitude

Period = $20 = \frac{2\pi}{b}$ $\Rightarrow b = \frac{\pi}{10}$

c = Equilibrium value.

✓Identifies amplitude is 0.5 or describes dilation

✓Explains link between period and 'b' or describes dilation

✓Identifies equilibrium value is 3 or describes translation

b. How many hours after midnight is the water level first at high tide? (1 mark)

10 hours (10 am)

✓States time

Question 17 **7 marks**

The table below displays some data on road crashes in Western Australia for the ten years 1995 to 2004. The road crashes are classified as:

- single-vehicle crashes, e.g. a car hits a tree, or multiple-vehicle crashes (two or more vehicles)
- being in Perth or outside Perth.

Number of road crashes in Western Australia (nearest thousand), 1995–2004

	in Perth	outside Perth	Total
Single-vehicle	35 000	29 000	64 000
Multiple-vehicle	274 000	38 000	312 000
Total	309 000	67 000	376 000

a. Complete all sections of the table above. (2 marks)

b. What is the probability that a road crash chosen at random from the data involved: (3 marks)

i. multiple vehicles?

$\frac{312}{376} = \frac{39}{47} = 0.829$

✓Calculates correct probability
(NO penalty for simplifying in this question)

ii. multiple vehicles and was in Perth?

$\frac{274}{376} = \frac{137}{188} = 0.729$

✓Calculates correct probability

iii. multiple vehicles given that it was in Perth?

$\frac{274}{309} = 0.887$

✓Calculates correct probability

c. Does the data collected suggest that multiple vehicle crashes and crashes in Perth are independent events? Justify your answer. (2 marks)

$P(M) \approx 0.83$
$P(M|P) \approx 0.89$
$P(M) \neq P(M|P)$
∴ Not independent

✓Correctly applies test for independence
✓Concludes correctly based on test result

END OF BOOKLET 2