**Semester One Examination, 2018**

**Question/Answer booklet**

HALE SCHOOL

# Year 11
# MATHEMATICS METHODS
# UNIT 1
## Section Two:
## Calculator Allowed

## Booklet 2 of 3

Student name Marking Key

**Circle your teacher's Initials:** **IFB** **DD** **VMU** **SWA** **MS** **AGC**

## Time allowed for this section
Reading time before commencing work: ten minutes
Working time: one hundred minutes

## Materials required/recommended for this section
***To be provided by the supervisor***
This Question/Answer booklet
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 two unfolded sheets of A4 paper, and up to three calculators approved for use in this examination

## 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 material. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.



**End of questions**

## 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 | 9 | 9 | 50 | ~~66~~ 67 | 35 |
| Section Two: Calculator-assumed | 13 | 13 | 100 | 78 | 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.

3. You must be careful to confine your response to the specific question asked and to follow any instructions that are specified to a particular question.

4. Supplementary pages for the use of planning/continuing your answer to a question have been 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.

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.

7. The Formula sheet is not to be handed in with your Question/Answer booklet.

**Section Two: Calculator-assumed** **65% (84 Marks)**

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

Working time: 100 minutes.

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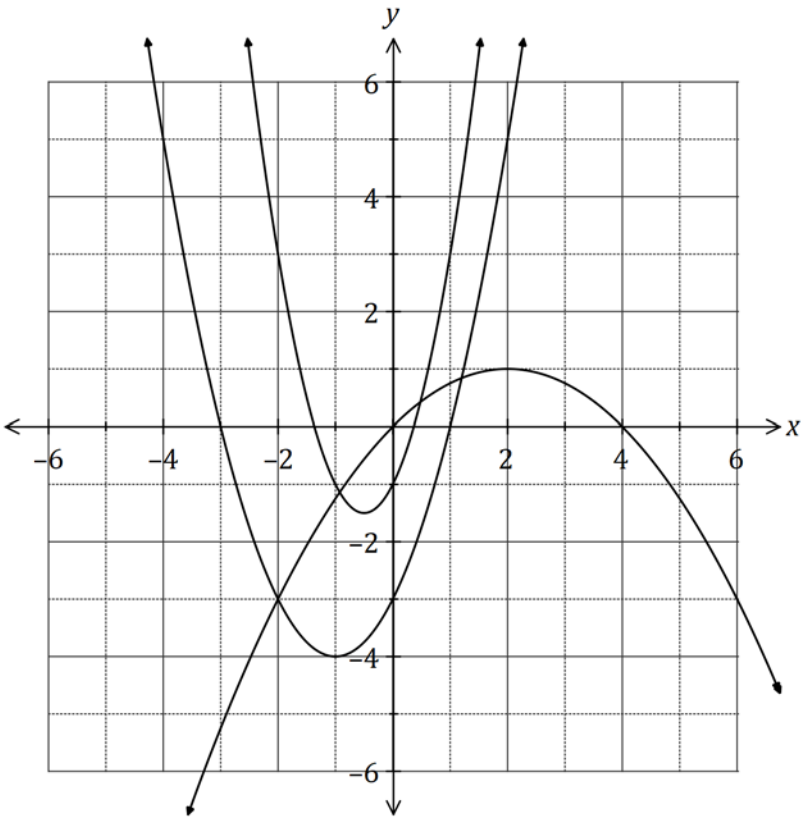
**Question 10** **(3 marks)**

The graphs of $y = 2x^2 + 2x + c$ , $y = a(x-2)^2 + 1$ and $y = (x+b)(x+3)$ are shown below.




Determine the values of the constants $a, b$ and $c$.

$a = -\frac{1}{4}$ ✓

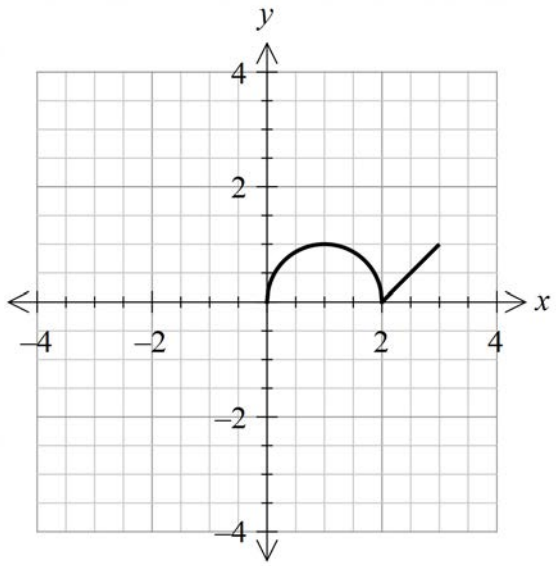
$b = -1$ ✓

$c = -1$ ✓

1 each right/wrong

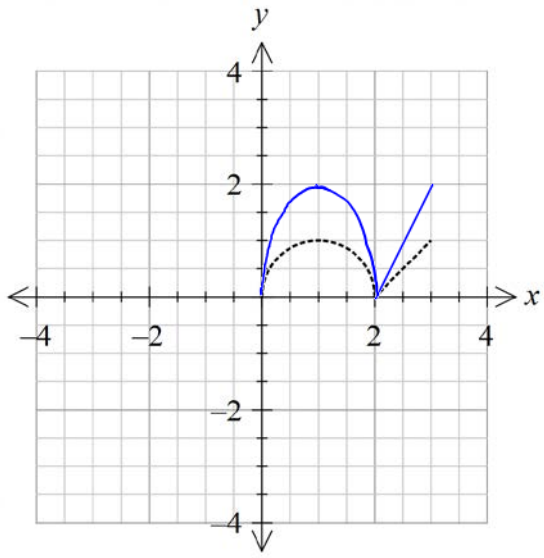
**Question 11** **(8 marks)**

Given the graph below is $y = f(x)$.



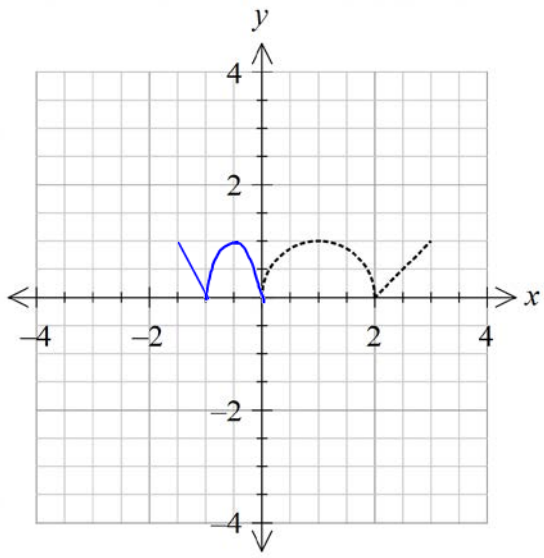

On each of the axes below sketch the required function. (1 mark)

(a) $y = 2f(x)$




✓ right/wrong.

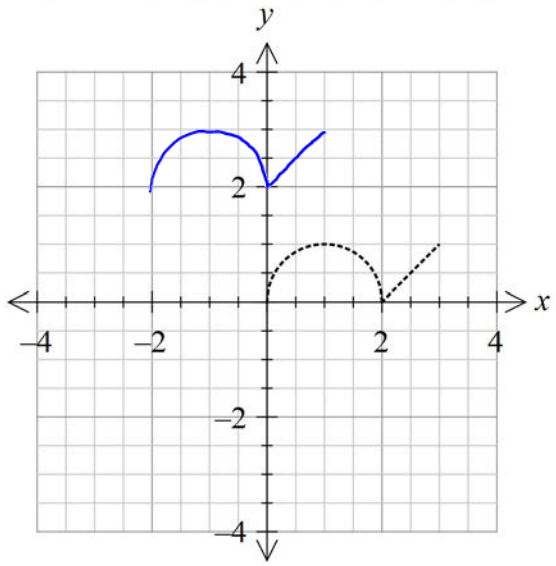
(b) $y = f(-2x)$ (2 marks)




✓ Reflection in y-axis

✓ horizontal dilation, sf $\frac{1}{2}$

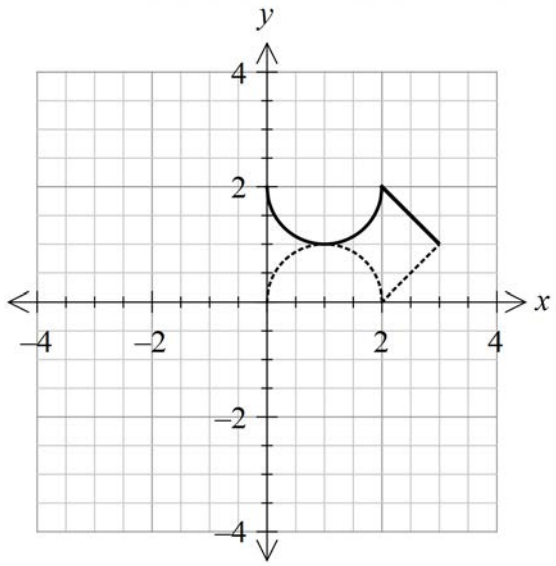
(c) $y = f\left(x+2\right)+2$ (2 marks)




✓ Horizontal Translation (2 units left).

✓ Vertical translation. (2 units up)

(d) Write the function for this transformation of $y = f\left(x\right)$ (3 marks)




Function: $y = -f(x) + 2$

✓ reflection in x-axis

✓ Vertical translation 2 units up.

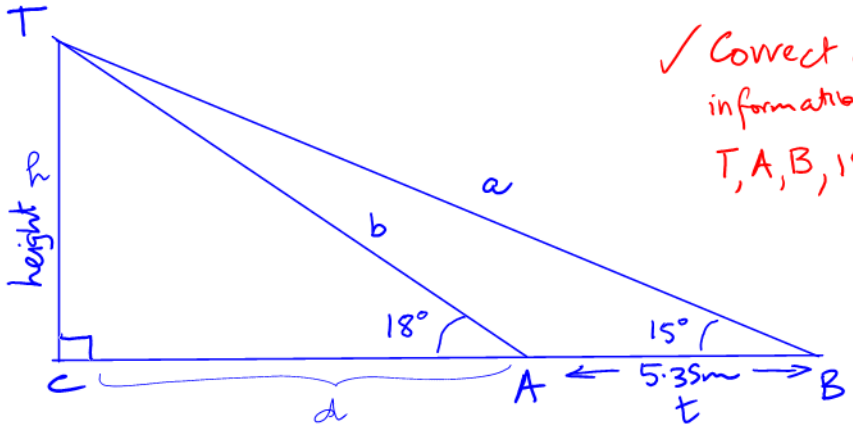
✓ Notation needs to be of the form $y = \_\_ f(x) \pm \_\_$

**Question 12** **(6 marks)**

A goal post stands vertically on the playing surface of Craig Oval. From point $A$ on Craig Oval, the angle of elevation to the top of the goal post, $T$, is 18º.

From point $B$, also on Craig Oval, but 5.35 metres further from the foot of the goal post than $A$, the angle of elevation to the top of the goal post is 15º.

(a) Draw a diagram to represent this information. (1 mark)




✓ Correct diagram containing information from question
T, A, B, 18°, 15°, 5·35m.

(b) Calculate the height of the ~~pole~~ goal post. (5 marks)

In $\triangle ATB$

$\angle TAB = 162°$ ✓ Calculates Angles in $\triangle TAB$

$\therefore \angle ATB = 3°$

$\therefore \frac{TA}{\sin 15°} = \frac{5.35}{\sin 3°}$ ✓ Evidence of Correct use of sine rule

$\therefore TA = 26.46m$ (2dp) ✓ solves for TA

$\therefore \sin 18° = \frac{TC}{26.46}$ ✓ solves for TC

$TC = 8.18m$ (2dp)

$\therefore$ Height of goal post is 8.18m (2dp) ✓ Answer to the question.

Alternative:
✓ sub into one relevant eqn
✓ sub into 2nd relevant eqn
✓ Attempt valid method to solve sim. equation.
✓ solves sim eqns.
✓ determine height with units.

Alternative

$\tan 18° = \frac{h}{d}$ ✓

$h = d \times \tan 18°$

$\tan 15° = \frac{h}{(d + 5.35)}$ ✓ h in terms of d for right $\Delta$s.

$h = (d + 5.35) \times \tan 15°$

Solve $d \times \tan 18° = (d + 5.35) \times \tan 15°$ ✓ derives equation to solve

$d = 25.1626m$ (4dp) ✓ solves for d

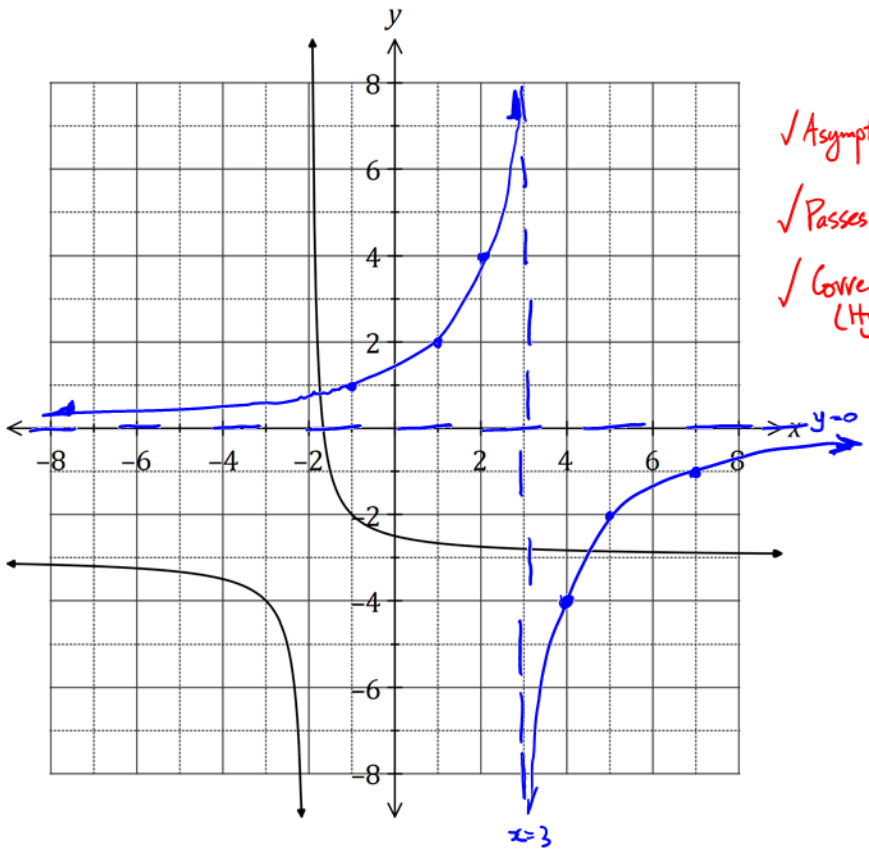
$\therefore h = 25.1626 \times \tan 18°$

$= 8.18m$ (2dp). ✓ Answers the question

**Question 13** **(8 marks)**

Let $f(x) = \frac{4}{3-x}$ and $g(x) = \frac{1}{x+p} + q$, where $p$ and $q$ are constants.

The graph of $y = g(x)$ is shown below.




✓ Asymptotes at $x=3$, $y=0$
✓ Passes through key points
✓ Correct shape (Hyperbola).

(a) Sketch the graph of $y = f(x)$ on the axes above, labelling all key features. (3 marks)

(b) Determine the values of $p$ and $q$. (2 marks)

$p = 2$ ✓

$q = -3$ ✓

right/wrong.

(c) Solve the equation $f(x) = g(x)$, giving your solution(s) to two decimal places. (3 marks)

Solve $\frac{4}{3-x} = \frac{1}{x+2} - 3$

$\therefore x = -1.74$ (2dp) ✓

and $x = 4.41$ (2dp) ✓

1 for each correct answer.

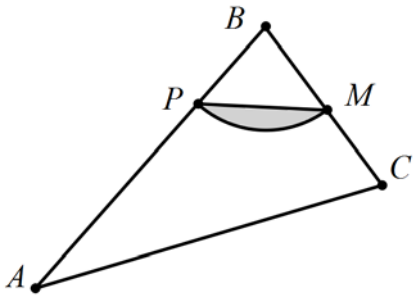
✓ Rounded correctly.

Needs to be just $x = \ldots$

NOT a co-ordinate.

**Question 14** **(12 marks)**

A logo with triangular outline $ABC$ contains a shaded segment bounded by the straight line $PM$ and the circular arc $PM$ with centre $B$ and radius $BM = 18$ cm, as shown below.




Given that $\angle ABC = \frac{5\pi}{12}$, $\angle BCA = 2\angle BAC$ and $M$ is the midpoint of $BC$, determine

(a) the size of $\angle ABC$ in degrees. (1 mark)

$\angle ABC = 75°$ ✓ right/wrong.

(b) the area of the shaded segment. (2 marks)

$A(\text{Segment}) = \frac{r^2}{2}(\theta - \sin\theta)$

$= \frac{18^2}{2}\left(\frac{5\pi}{12} - \sin\frac{5\pi}{12}\right)$ ✓ correct values substituted into the rule.

$= 55.58\text{ cm}^2$ (2dp). ✓ correct answer.

(c) the perimeter of the shaded segment. (4 marks)

$P = a + \text{Chord } PM$

$a = 18 \times \frac{5\pi}{12}$ ✓ correct arc length

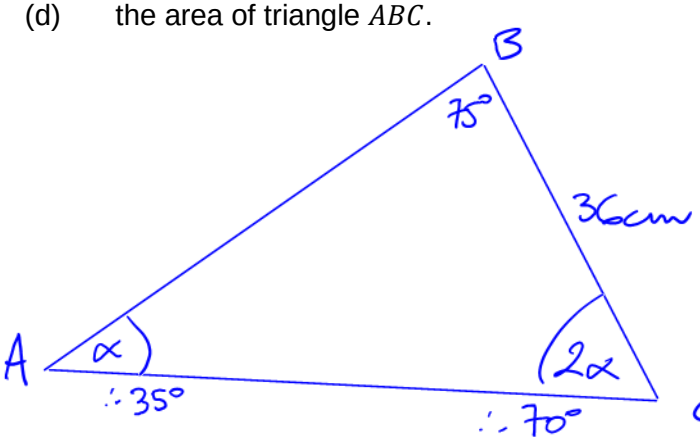
$= 23.56\text{cm}$ (2dp)

$PM^2 = 18^2 + 18^2 - 2(18)(18)\cos\left(\frac{5\pi}{12}\right)$ ✓ uses correct info in cosine rule.

$\therefore PM = 21.92\text{cm}$ (2dp) ✓ correct chord length

$\therefore P = 45.48\text{cm}$ (2dp) ✓ Calculate perimeter correctly for their calculations.

(d) the area of triangle $ABC$. (5 marks)




$\alpha + 2\alpha + 75° = 180°$

$3\alpha + 75° = 180°$

$3\alpha = 105°$

$\alpha = 35°$

✓ solves for $\angle BAC$

$\frac{36}{\sin 35°} = \frac{AC}{\sin 75°}$ ✓ correct use of sine rule.

$AC = 60.63\text{cm}$ (2dp) ✓ correct value of second side

$\therefore A(\Delta ABC) = \frac{1}{2}(36\text{cm})(60.63\text{cm}).\sin 70°$ ✓ correct use of area formula for their calculations.

$= 1025.45\text{cm}^2$ (2dp) ✓ correct answer.

**Question 15** **(5 marks)**

(a) Determine the equation of the axis of symmetry for the graph of $y = 3x^2 + 12x + 40$. (2 marks)

$x = \frac{-12}{2(3)}$

$\therefore x = -2$ ✓ value of $-2$

✓ needs to be an equation.

(b) The graph of $y = ax^2 + bx + 13$ passes through the points $(-3, -23)$ and $(4, 5)$. Determine the values of the constants $a$ and $b$. (3 marks)

for $(-3, -23)$

$-23 = a(-3)^2 + b(-3) + 13$

$\therefore -36 = 9a - 3b$

$-12 = 3a - b$ ✓ relationship for $(-3, -23)$

for $(4, 5)$

$5 = a(4)^2 + b(4) + 13$

$-8 = 16a + 4b$

$-2 = 4a + b$ ✓ relationship for $(4, 5)$

Solving these simultaneous equation on ClassPad ...

$a = -2$

$b = 6$ ✓ correct solution for $a$ & $b$ from their equations.

By regression: Alternative.

✓ recognises x-intercept is $(0, 13)$

✓ determines equation using regression – Equation MUST be stated.

✓ states values for $a$ & $b$.

Supplementary page

Question number: _____



**End of questions**

Supplementary page

Question number: _____

Supplementary page

Question number: _____

Supplementary page

Question number: _____

Supplementary page

Question number: _____