Christ Church Grammar School

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MATHEMATICS SPECIALIST Year 12
Section One:
Calculator-free

Your name _____

Teacher's name _____

Time and marks available for this section
Reading time for this section: 3 minutes
Working time for this section: 30 minutes
Marks available: 26 marks

Materials required/recommended for this section
To be provided by the supervisor
This Question/Answer Booklet
Formula Sheet

To be provided by the candidate
Standard items: pens (blue/black preferred), pencils (including coloured), sharpener,
                 correction fluid/tape, eraser, ruler, highlighters

Special items: nil

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

Instructions to candidates

1. The rules of conduct of the CCGS assessments are detailed in the Reporting and Assessment Policy. Sitting this assessment implies that you agree to abide by these rules.

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

3. Answer all questions.

4. 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.

5. 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.

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. 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.

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

Question 1 **(5 marks)**

Find all the values, real and complex, of x for which $H(x) = 0$, if
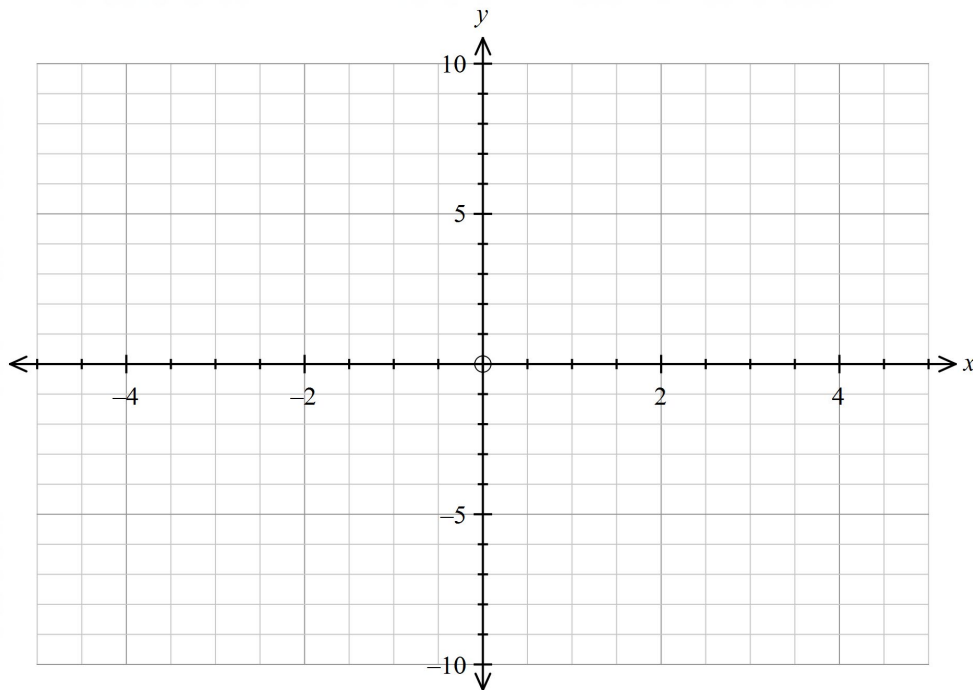
$$H(x) = 10x^3 - 24x^2 + 10x - 4$$

Question 2 **(8 marks)**

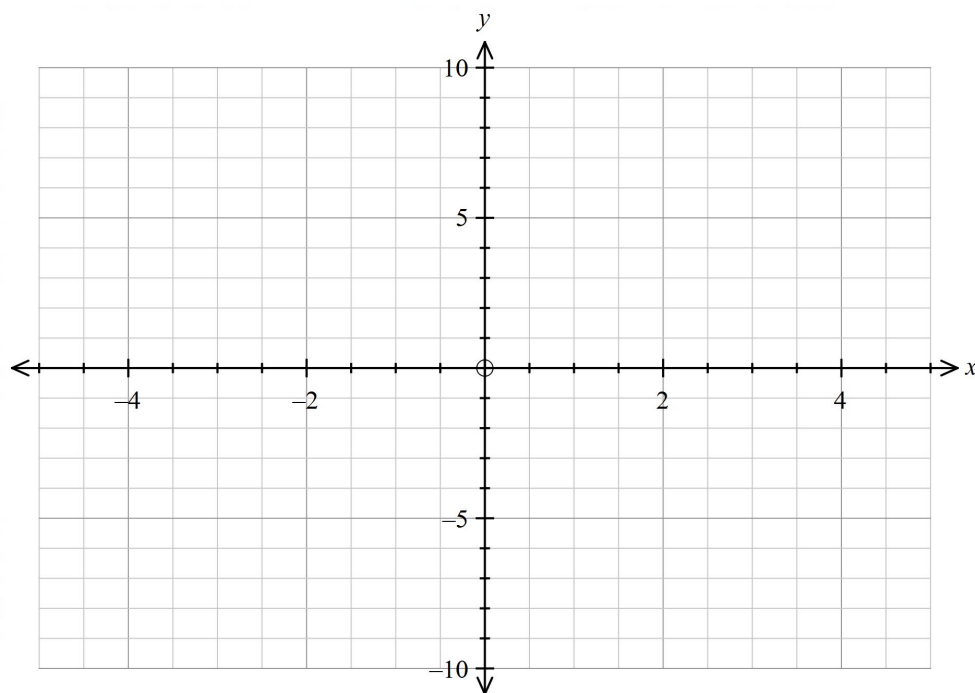Consider the function $f(x) = x(x + 2)$.
Draw

(a) $y = -|f(x)|$. (3 marks)

(b) $y = f(|x|)$. (2 marks)

See next page

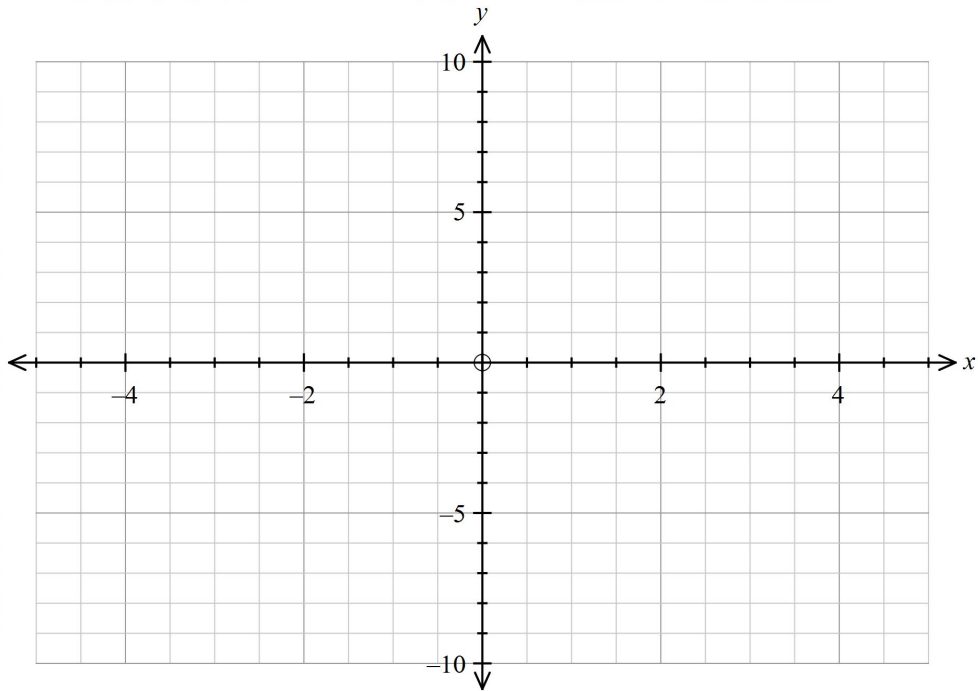**Question 2 continued**

(c) $y = \dfrac{1}{f(x)}$.   (3 marks)

Question 3 **(8 marks)**

If $f(x) = x^4 + 1$ and $g(x) = 5x - 4$, determine

(a) $g \circ f(x)$ (1 mark)

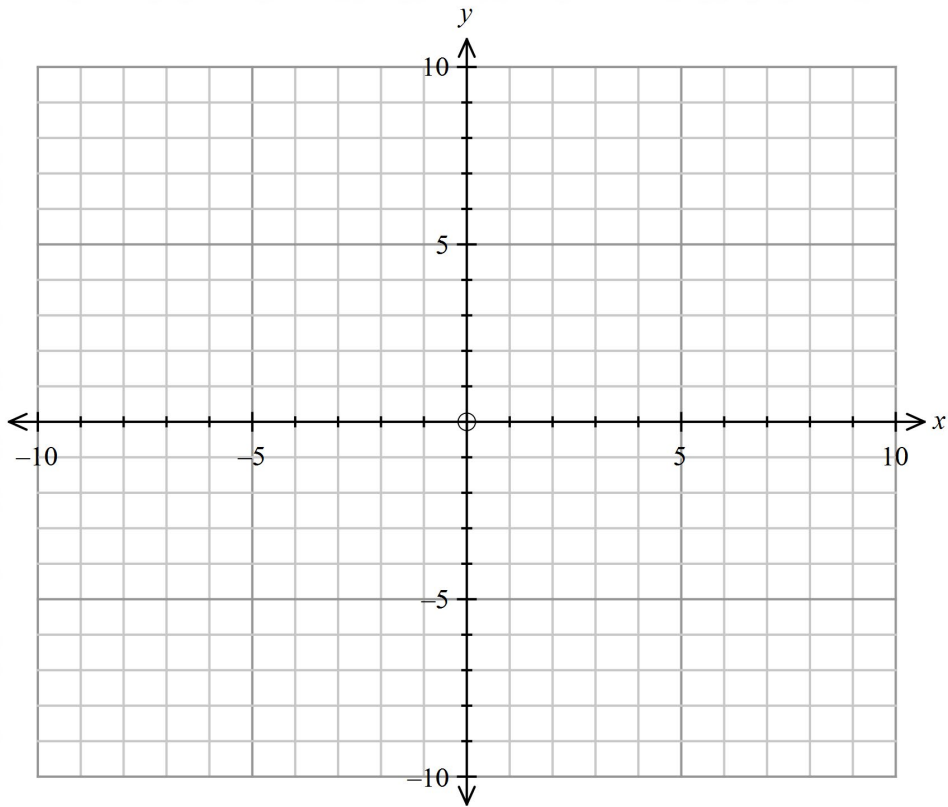(b) the domain and range for $g \circ f(x)$. (2 marks)

(c) $f^{-1}(x)$, stating a suitable restriction to the domain of $f(x)$, so $f^{-1}(x)$ exists as a function. (3 marks)

(d) the domain and range for $f^{-1}(x)$, such that $f^{-1}(x)$ is a function. (2 marks)

See next page

Question 4   **(5 marks)**

Draw the function $y = \frac{2x-1}{3-x^2}$.

End of questions

MATHEMATICS SPECIALIST Year 12
Section Two:
Calculator-assumed

Your name _____

Teacher's name _____

Time and marks available for this section
Reading time for this section: 2 minutes
Working time for this section: 15 minutes
Marks available: 15 marks

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 and up to three calculators approved
                              for use in the WACE examinations

Important note to candidates
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Instructions to candidates

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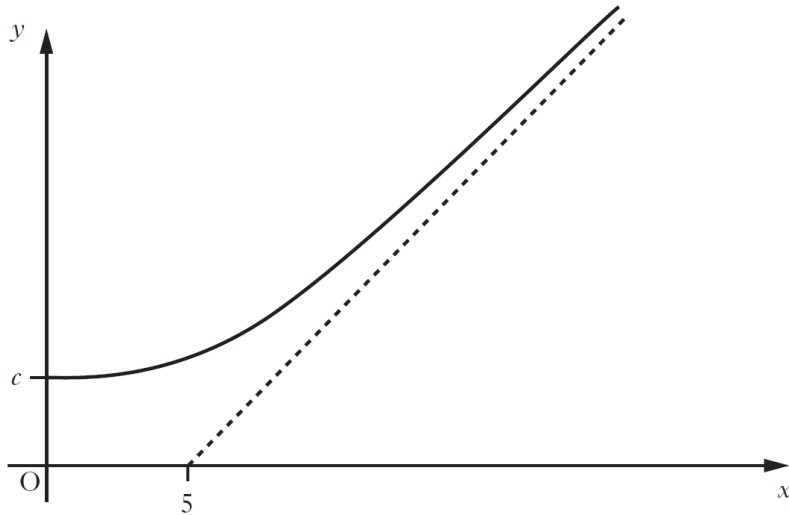7. It is recommended that **you do not use pencil**, except in diagrams.

Question 5 **(6 marks)**

The function $f(x)$ is defined for all $x \geq 0$.
The graph of $y = f(x)$ intersects the $y - axis$ at $(0, c)$, where $0 < c < 5$.
The graph of the function and its asymptote, $y = x - 5$, are shown below.

(a) On the diagram above, draw $f^{-1}(x)$. Clearly label any points of intersection and any asymptotes. **(4 marks)**

(b) What is the equation of the asymptote of the graph of $y = f(x + 2)$? **(1 mark)**

(c) Why does your diagram show that the equation of $x = f^{-1}(f(x))$ has at least one solution? **(1 mark)**

Question 6 **(5 marks)**

Let the function $f(x)$ be given by
$$f(x) = \frac{2x^3 - 7x^2 + 4x + 5}{(x-2)^2}, x \neq 2.$$

(a) The graph of $y = f(x)$ crosses the $y - axis$ at $(0, a)$. State the value of a.

(1 mark)

For the graph of $y = f(x)$,

(b) (i) write down the value of the vertical asymptote. (1 mark)

(ii) show algebraically that there is a non-vertical asymptote and states its equation. (3 marks)

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