Christ Church Grammar School

2019
TEST 5

MATHEMATICS METHODS Year 11

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:	30 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.

See next page

Question 9 continued

(b) By using Calculus methods, determine the height of the rectangular prism (correct to the nearest 0.1 cm) which maximises the volume. (4 marks)

End of Questions

Question 9 **(6 marks)**

An 80 cm long wire frame is used to make the 12 edges of a rectangular prism. This prism is to have the length of the base equal to four times the width of the base.

Let $x =$ the width of the base of the rectangular (cm)
$h =$ the height of the rectangular prism (cm)

(a) Show that the volume of the prism formed is given by $V = 80x^2 - 20x^3$. (2 marks)

Question 1 **(5 marks)**

(a) Evaluate $32^{-0.6}$ giving your answer as a fraction. (2 marks)

(b) Given that $\dfrac{\sqrt{a^3} \times b^{-2}}{\sqrt[3]{ab^9}} = \dfrac{a^m}{b^n}$ determine the values for m and n. (3 marks)

Question 2 **(3 marks)**

The mass of the sun is approximately 2×10^{30} kg whilst the mass of the earth is approximately 6×10^{24} kg.

Determine the ratio of the mass of the sun to the mass of the earth, in the form $n:1$, where n is written in scientific notation correct to 3 significant figures.

Question 8 **(4 marks)**

Data is collected on the growth of bacteria in an organism is tabulated below.

Time t minutes	10	20	30	40
Bacteria $B(t)$	41	66	108	176

It was suggested that an exponential model of the form $B(t)=c(k)^t$ be used to model this growth.

(a) Determine the values for the constants c and k, each correct to 0.01. (2 marks)

(b) Using this model, make a prediction for the rate of growth in the bacteria at $t=50$ minutes. (2 marks)

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 3 **(5 marks)**

Consider the graphs of $f(x)=2^x$ and $g(x)=4\left(2^{-x}\right)$.

(a) Transformations to the graph of $f(x)=2^x$ are required to obtain the graph of $g(x)=4\left(2^{-x}\right)$. Suppose that the following transformations to $f(x)=2^x$ were considered:

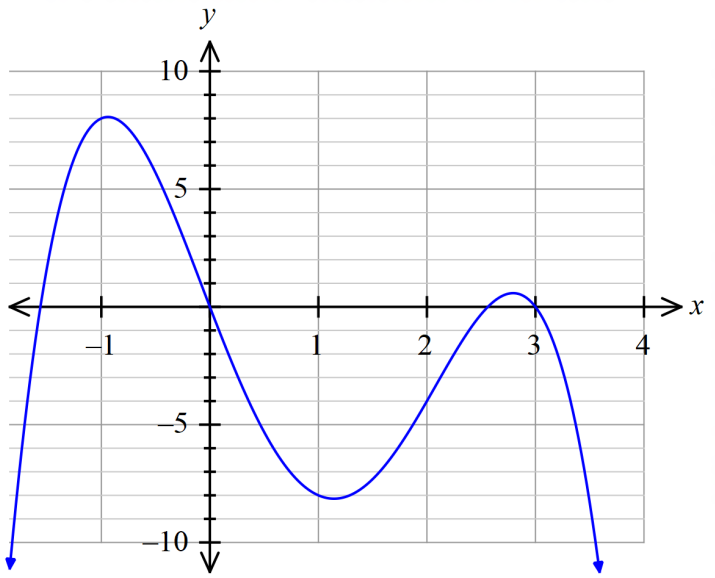
Transformation A	Reflect about $y=0$
Transformation B	Reflect about $x=0$
Transformation C	Translate 2 units LEFT
Transformation D	Translate 2 units RIGHT.

Using ONLY transformations A, B, C, D, which transformations (and in the correct order) must be applied to $f(x)$ in order to obtain the graph of $g(x)$? (3 marks)

(b) Determine the exact solution to the equation $g(x)=\sqrt{8}$. (2 marks)

Question 4 **(6 marks)**

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



By drawing appropriate lines and labelling on the above graph, explain how the:

(a) average rate of change of $y = f(x)$ from $x = 1$ to $x = 2$ is measured. (2 marks)

Christ Church Grammar School

2019
TEST 5

MATHEMATICS METHODS Year 11

Section Two:
Calculator-assumed

Your name _____

Teacher's name _____

Time and marks available for this section

Working time for this section: 10 minutes
Marks available: 10 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

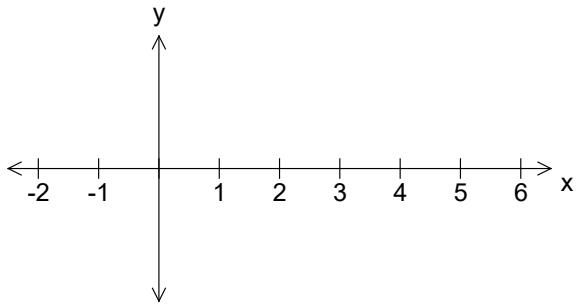
Important note to candidates

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.

Question 7 **(3 marks)**

On the axes provided below, sketch a possible graph $y = f(x)$ satisfying the following requirements:

- The curve only cuts the *x*-axis at the origin
- $\frac{dy}{dx} = 0$ at $x = 1$ and $x = 4$
- $\frac{dy}{dx} < 0$ only for $1 < x < 4$



End of Questions

Question 4 continued

(b) instantaneous rate of change of $y = f(x)$ at $x = 3$ is measured. (2 marks)

(c) Use the graph to determine the value for $f'(1)$. (1 mark)

(d) Use the graph to solve the inequality $f'(x) < 0$ for the domain $x < 2$. (1 mark)

See next page

Question 5 **(4 marks)**

Consider the function $g(x) = 2\sqrt{x} - x^3$.

Determine the equation of the tangent to the curve at $x = 1$.

See next page

Question 6 **(4 marks)**

Consider the function $f(x) = \frac{1}{1+x}$.

Using the definition that $f'(2) = \lim_{h \to 0} \frac{f(2+h) - f(2)}{h}$, determine from first principles the value for $f'(2)$.

See next page