Christ Church Grammar School

MATHEMATICS 3C/3D
Section One:
Calculator-free

Your name _____

Time allowed for this section
Working time for this section: seventeen (17) minutes

Materials required/recommended for this section
To be provided by the supervisor
Nil

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

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Calculator-free   **(17 marks)**

Answer all questions.

Working time: 17 minutes.

Question 1   **(3 marks)**

Match each of the following graphs below with an equation from the given list.

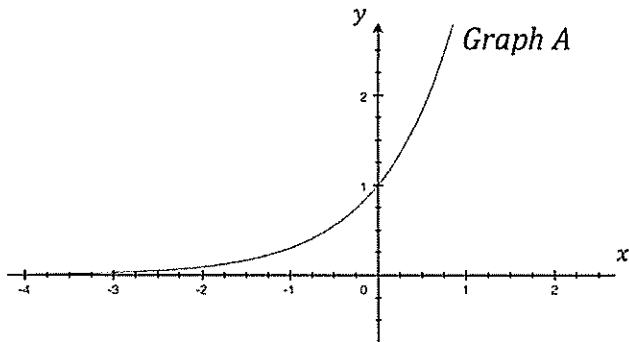Equation 1: $y = x^3$ Equation 2: $y = -3^x$

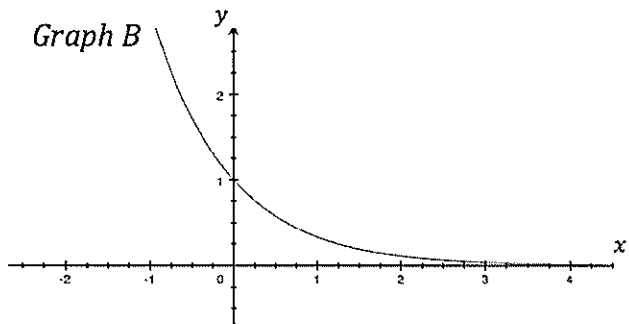Equation 3: $y = 0.3^{-x}$ Equation 4: $y = -0.3^x$
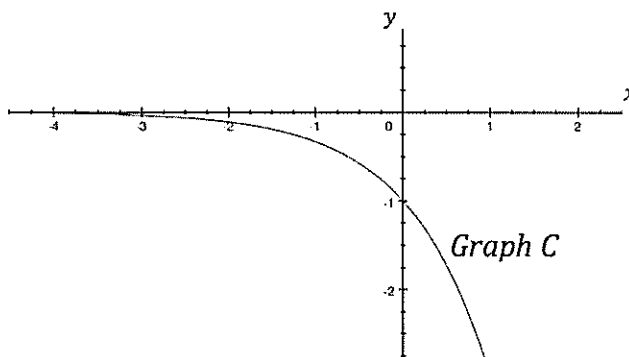
Equation 5: $y = 3^{-x}$ Equation 6: $y = -3^{-x}$

Graph A has Equation _____

Graph B has Equation _____

Graph C has Equation _____

Question 2 (8 marks)

Two functions are defined as $f(x) = e^{-x}$ and $g(x) = \frac{1}{1-x}$.

(a) Evaluate $f(-1)$ and $g(\frac{2}{3})$. (2 marks)

(b) Determine expressions for $f(g(x))$ and of $g(f(x))$. (2 marks)

(c) Evaluate $f(g(0))$ and of $g(f(0))$ if they exist. (2 marks)

(d) Determine the domain and range of $f(g(x))$. (2 marks)

Question 3   **(6 marks)**

Two functions are defined as $f(x) = e^x$ and $g(x) = e^{1-2x}$.

(a)   Describe, in the correct sequence, the transformations which must be applied to the graph
       of $f(x)$ to obtain the graph of $g(x)$.   (3 marks)

(b)   Determine the domain and range of $g(f((x)))$.   (3 marks)

End of questions

Christ Church Grammar School

MATHEMATICS 3C/3D
Section Two:
Calculator-assumed

Your name _____

Time allowed for this section
Working time for this section: twenty-eight (28) minutes

Materials required/recommended for this section
To be provided by the supervisor
Nil

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

Special items: up to three calculators approved for use in the WACE examinations

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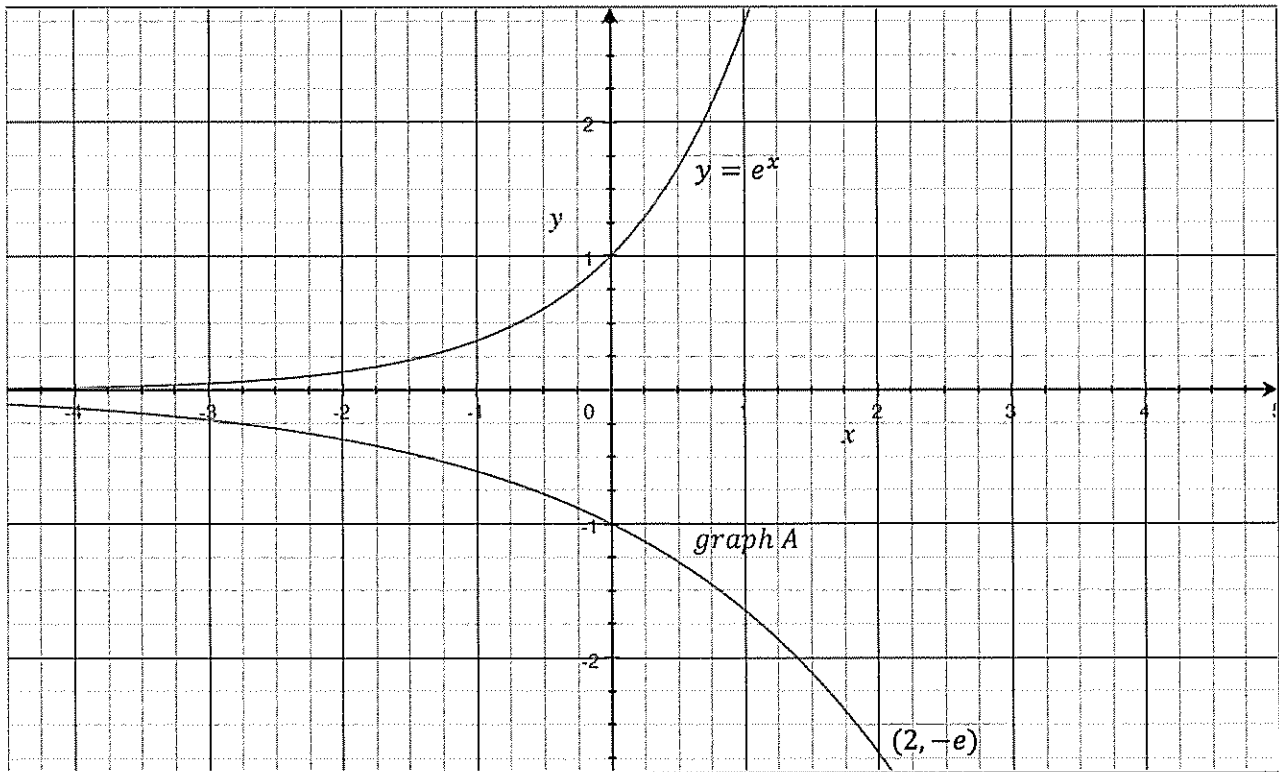**Calculator-assumed**   **(28 marks)**

Answer all questions.

Working time: 28 minutes.

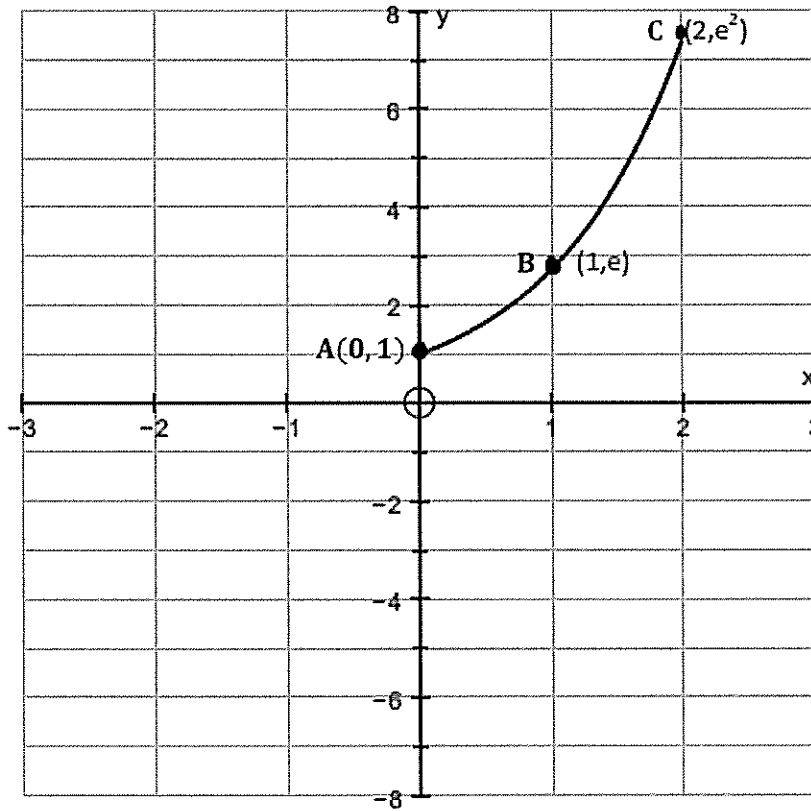**Question 4**   **(2 marks)**

Using the graph of $y = e^x$ as a reference, write the exponential equation for *Graph A* in the form $y = ae^{bx}$, where a and b are constants to be found.

Question 5   **(8 marks)**

The diagram shows the graph of $f(x) = e^x$ for $0 \le x \le 2$.

(a) Describe, in the correct sequence, the transformations which must be applied to the graph of $f(x)$ to obtain the graph of $g(x) = -f(2x + 2)$.   (3 marks)
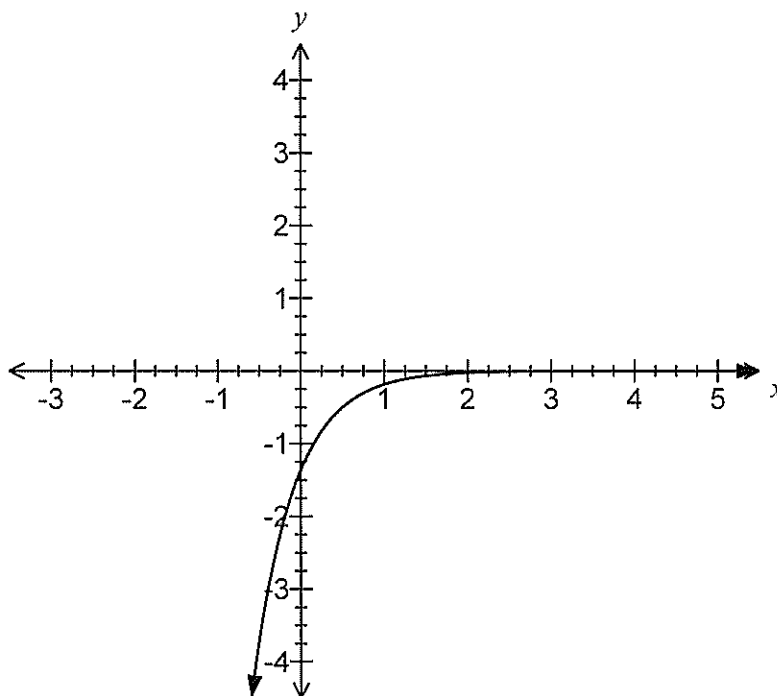
(b) Sketch, on the same diagram above, the graph of $g(x) = -f(2x + 2)$, indicating the *images* of A, B and C as A′ , B′ and C′ .   (2 marks)

(c) Write down the co-ordinates of the images of A, B and C in the above transformations.   (3 marks)

Let $f(x) = ae^{bx+c}$, where a, b and c are constants. The graph of $y = f(x)$ is shown below.

(a)   Write down an asymptote for the graph of $y = f(x)$.   (1 mark)

(b)   Write down the range of $f(x)$.   (1 mark)

(c)   Determine with reason if a is negative or positive.   (2 marks)

(d)   Determine with reason if b is negative or positive.   (2 marks)

Question 7   **(12 marks)**

Two functions are defined as $f(x) = \sqrt{x-1}$ and $g(x) = \frac{1}{x-1}$.

(a)   Find the natural domain and range of $f(x)$ and of $g(x)$.   (4 marks)

(b)   Find in simplified form $g(g(x))$.   (2 marks)

(c)   Evaluate $g\left(f\left(\frac{13}{9}\right)\right)$.   (2 marks)

(d)   Explain why the domain of $f(x)$ has to be restricted if $g(f(x))$ is to be a function.

(2 marks)

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(e)   Determine the domain of $g(f(x))$.

(2 marks)

End of questions