

## Mock-MATH12 T1 MS

### G12 Mathematics Mark Scheme Trimester 1, 2016/2017

#### Question One

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1)

Question No.	A	B	C	D	E	F	G	H	I	J
Answer	d	b	a	a	b	d	d	c	c	c

Student to be awarded 2 marks for each correct answer only.

#### Question Two

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2) In the table below, identify if the functions are **continuous** or **discontinuous** at the given  $x$  value. Identify the *type* of discontinuity if it is of the infinite, jump or removable type.

Function	Continuous or Discontinuous at $x = 1$	Type of discontinuous
$f(x) = \frac{2}{x-1}$	<b>Discontinuous</b>	<b>Infinite</b>
$g(x) = \begin{cases} 2x+1; & x \geq 1 \\ x^2 & ; x < 1 \end{cases}$	<b>Discontinuous</b>	<b>Jump</b>
$h(x) = \sqrt{x+5}$	<b>Continuous</b>	<b>None</b>
$l(x) = \frac{x^2-1}{x-1}$	<b>Discontinuous</b>	<b>Removable</b>

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/12 3) Without **using calculator** find the value of the following: (show your working)

/3 A. If  $\ln 2 = 0.69$  and  $\ln 3 = 1.1$  find the value of  $\ln 1.5$ :

$$\ln \frac{3}{2} = \ln 3 - \ln 2 = 1.1 - 0.69 = 0.41$$

/4 B. Work out the value of  $\log_2 17 + \log_2 5 - \log_2 170$ :

$$\log_2 \frac{17 \times 5}{170} = \log_2 \frac{1}{2} = \log_2 2^{-1} = -1 \log_2 2 = -1$$

/5 C. Solve the equation  $e^{2x} - 4e^x + 3 = 0$

$$(e^x - 3)(e^x - 1) = 0 \rightarrow e^x - 3 = 0 \rightarrow e^x = 3 \rightarrow \ln e^x = \ln 3 \rightarrow x = \ln 3 \rightarrow$$

$$x \approx 1.1$$

$$e^x - 1 = 0 \quad e^x = 1 \quad x = 0$$

/8 4) The number of **fish** in a lake can be represented by the following function:

$$f(x) = -x^3 + 24x^2 - 16x + 384$$

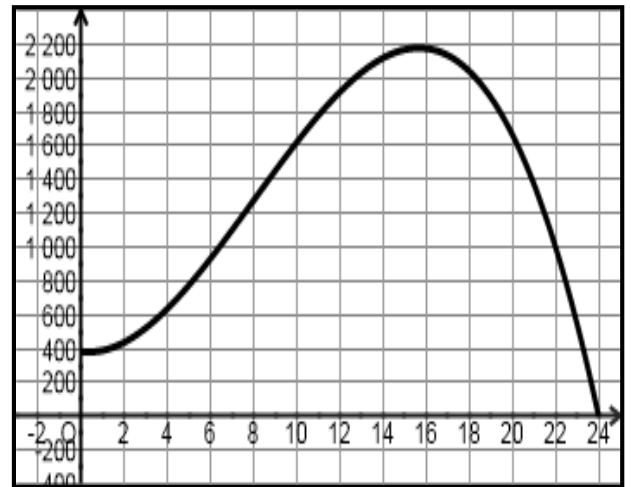
Where  $x$  represents the number of years since 2003.

/2 A. What was the number of fish in the year 2003?

$$f(0) = 384 \text{ fish}$$

/3 B. In which year will the number of fish be the greatest? What would be the number?

From the graph:  $x = 16$  is nearly an absolute maximum value (accept the value as  $x = 15$ ) which represent the value of 2200 fish.



Therefore; in the year 2019 or 2018 the number of fish will be 2200 fish.

/3 C. Identify the year when the fish will extinct from the lake?

$$f(24) = 0 \rightarrow \text{the year } 2027$$

**Question Three:**

/9

5) If  $g(x) = \begin{cases} x^2 - 1 & : x \geq 2 \\ [x] & : x < 2 \end{cases}$  ,  $f(x) = 1 - \sqrt[3]{x}$

/3

- A. Explain the reason for the **discontinuity** of the function  $g(x)$  at  $x = 2$  ?  
What type of discontinuity is this?

$x$	1.9	1.99	1.999	2	2.001	2.01	2.1
$g(x)$	1	1	1	3	3.004	3.04	3.4

From the table, you can see that there is a **jump** type of discontinuity.

/3

B. Find  $[f \circ g](3)$

$$[f \circ g](3) = f[g(3)] = f(8) = 1 - \sqrt[3]{8} = -1$$

/3

C. Find  $f^{-1}(x)$

$$f(x) = 1 - \sqrt[3]{x} \Rightarrow x = 1 - \sqrt[3]{y} \Rightarrow \sqrt[3]{y} = 1 - x \\ \Rightarrow y = (1 - x)^3$$

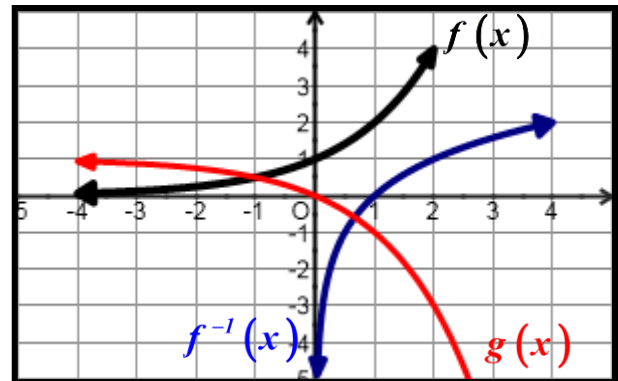
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- 6) Use the graph of  $f(x)$  given to draw the following two functions:

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A.  $g(x) = -2f(x) + 1$

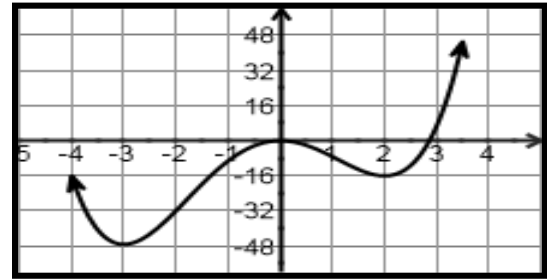


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B.  $f^{-1}(x)$

/14

7) The graph opposite represent the function  $f(x)$ , fill the following to get correct sentences



/1

A. the least power for this function is: ...4.....

/2

B. For the function  $f(x)$  relative minimum values when:  $x = -3$  ,  $x = 2$

/1

C.  $\lim_{x \rightarrow -\infty} f(x)$  is equal to .....  $\infty$  .....

/2

D. The range of the function  $f(x)$  is:  $(-48, \infty)$

/2

E. The intervals of decreasing for the function  $f(x)$  are:  $(-\infty, -3)$  ,  $(0, 2)$

/2

F. There is an Absolute value for the function  $f(x)$  when  $x = -3$ .... And the type of it is **minimum** ..... (maximum or minimum)

/1

G. The function  $f(x)$  is **neither**..... (even or odd or neither)

/3

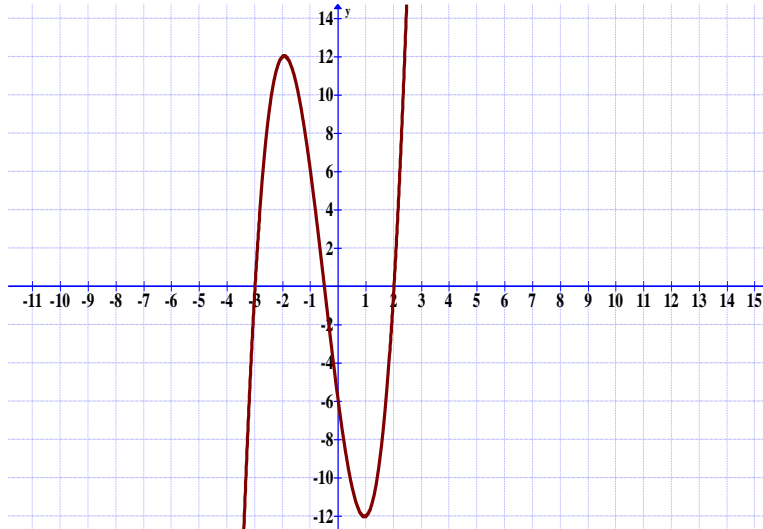
H. The rate of change for the function  $f(x)$  for the interval  $[-2, 2]$  is equal to:

$$\frac{f(2)-f(-2)}{2-(-2)} = \frac{-16--32}{4} = \frac{-16+32}{4} = \frac{16}{4}=4$$

**Question Four:**

/10

8) Using the following graph which represents the function  $f(x) = 2x^3 + 3x^2 - 11x - 6$



Find the following:

/1

A. The range is?  $(-\infty, \infty)$

/2

B. The End Behavior of the function is?  $\lim_{x \rightarrow -\infty} f(x) = -\infty$ ,  $\lim_{x \rightarrow \infty} f(x) = \infty$

/2

C. The rational zeros for the function  $f(x)$  are?  $-3, -\frac{1}{2}, 2$

/3

D. Find all the real factors of the function  $f(x)$ ?  $(x - 2)(x + 3)(2x + 1)$

/2

E. The remainder of the division of the function  $f(x)$  by  $(x - 1)$  is equal to?  $-12$

/9

9) If  $f(x) = \frac{(x-2)(x+1)}{(x-1)(x-2)}$  find:

/2

A. The domain of the function?  $\mathbb{R} \setminus \{1, 2\}$

/1

B. The equation of the horizontal asymptote?  $y = 1$

/2

C. The equation of the vertical asymptote?  $x = 1, x = 2$

/4

D. The intersection points with the function?

$$\frac{(x-2)(x+1)}{(x-1)(x-2)} = 0 \longrightarrow (x - 2)(x + 1) = 0 \longrightarrow x = 2, x = -1$$