PERTH MODERN SCHOOL
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Independent Public School

Course _ Mathematics Methods____ Year _11_

Student name: Mark Inguide Teacher name: _____

Date: **21 September 2020**_____

Task type: **Response**

Time allowed for this task: ___45____ **mins**

Number of questions: ___7_____

Materials required: ***This assessment is calculator-free***

Standard items: Pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: Drawing instruments, templates, notes on one unfolded sheet of A4 paper (double sided)

Marks available: __44____ **marks**

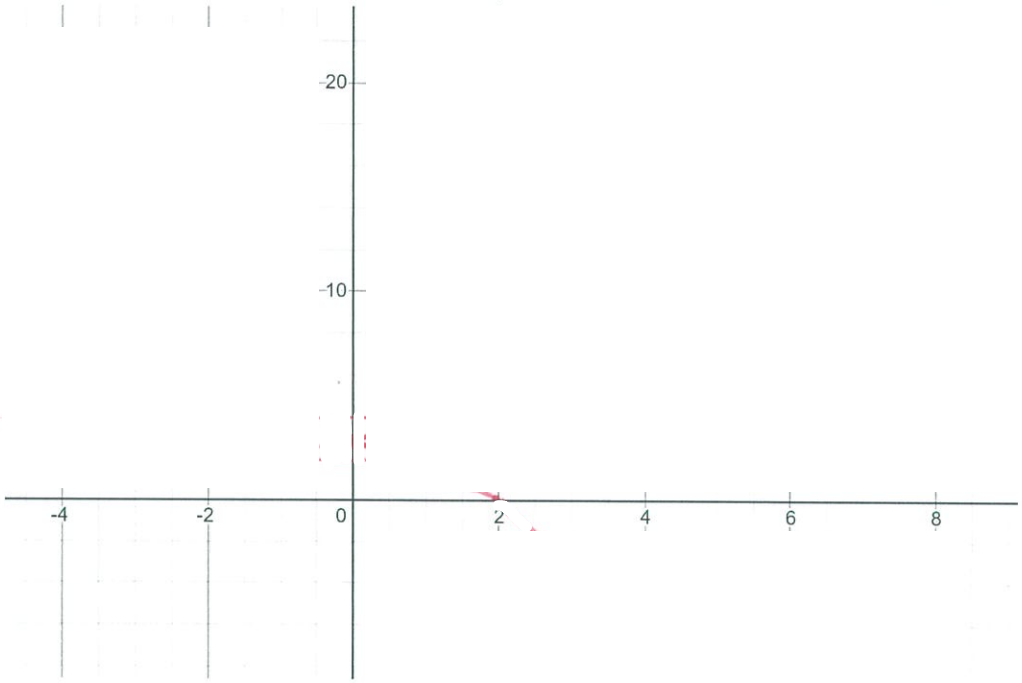
Task weighting: _16___%

Formula sheet provided: **Yes**

Note: All part questions worth more than 2 marks require working to obtain full marks.

Question 1 (2.1.1- 2.1.7) [5+1+4 = 10 marks]

(a) Sketch the graphs of $y = 2^x + 2$ and $y = -2^x + 4$ on the axes below, showing important features of each graph.



(b) Using your graph (or otherwise), find the intersection point of these two functions.

(c) Solve for x: $9^{2x-1} = 243$

Question 2 (2.3.1, 2.3.4, 2.3.5) [4+2 = 6 marks]

(a) For the function $f(x) = 3x^2$, use *first principles* to find $\lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$ and hence show that $f'(x) = 6x$

(b) Briefly describe what $\lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$ represents on a graph of $f(x)$.

Question 3 (2.3.7, 2.3.13 – 2.3.17) [4+4 = 8 marks]

The curve with the equation $y = (x+1)(x-2)(x-5)$ cuts the $x-axis$ at the points $A\ (-1, 0)$, $B\ (2, 0)$ and $C\ (5, 0)$. The expanded equation is $y = x^3 - 6x^2 + 3x + 10$

(a) Find $\frac{dy}{dx}$ and hence show that the *tangents* to the curve at points A and C are parallel.

(b) Find the equation of the *tangent* to the curve at the point C and find the point (x, y) where the *tangent* crosses the $y - axis$.

Question 4 (2.3.8 - 2.3.11) [3+3 = 6 marks]

A jet pilot follows a flight path defined by $f(x) = x^3 - 9x^2 + 15x - 8$.

(a) Is the gradient of the flight path positive (going up) or negative (down) at the point $(2, -6)$? Explain your answer.

(b) At what $\boldsymbol{x - values}$ on the curve $f(x)$ is the tangent *parallel* to the line $y = 3$?

Question 5 (2.3.3 - 2.3.7, 2.3.22) [4 marks]

Find y in terms of x if $\frac{dy}{dx} = 3x^2 - 2x - 6$ and the function $f(x)$ passes through the point $(2, 4)$.

Question 6 (2.3.10) [4 marks]

A section of roller coaster has been constructed using the function:

$$f(x) = x^3 + 3x^2 - 4$$

An amusement park photographer is taking "action shots" near the roller coaster where the gradient is equal to -3 ("*negative* 3"). In terms of $x - values$, where is the photographer working? Explain your answer with suitable working.

Question 7 (2.3.19, 2.3.22) [3+3 =6 marks]

A function $V(t)$ for which $V'(t) = 4t + k$, (where k is a constant), has a turning point at $(1, -2)$. $Find$:

(a) The value of k

(b) The value of $V(t)$ when $t = 4$