



PERTH MODERN SCHOOL

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Independent Public School

Course: Methods **Year:** 11

Student Name: _____ Teacher Name: _____

Date: 29/07/22

Task Type: **Response**

Time Allowed: 40 minutes

Number of Questions: 6

Materials Required: One double-sided A4 pages of notes (to be provided by the student)

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

Special Items: Drawing instruments, templates, notes on one unfolded sheet of A4 paper (both sides)

Marks Available: 40 marks

Task Weighting: 10 %

Formula Sheet Provided: Yes

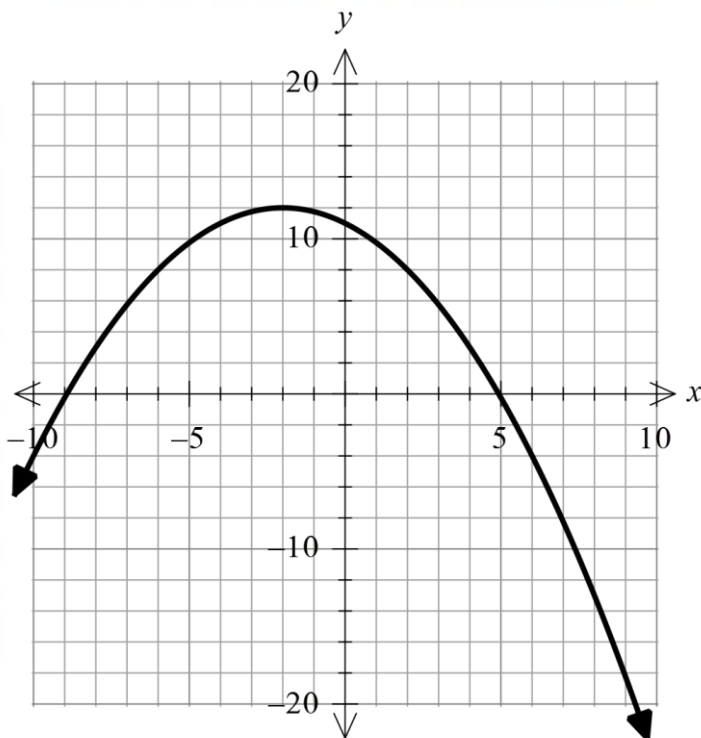
Note: All questions worth more than 2 marks require working to obtain full marks.

TEST 3: DIFFERENTIAL CALCULUS

Question 1 [2 marks – 1, 1]

(2.3.1-3)

Consider the function shown below. For the interval $[2, 6]$:



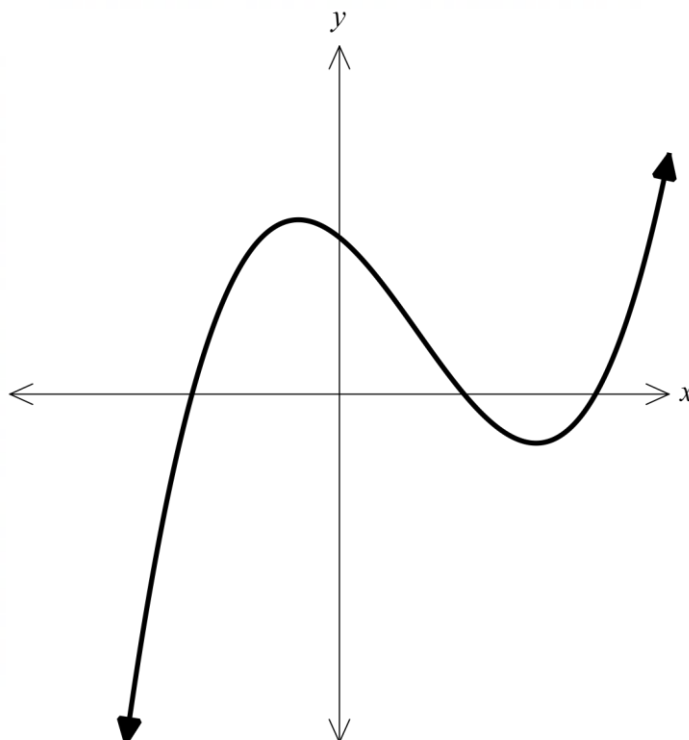
a) State the values of δx and δy .

b) Determine the average rate of change of the function.

Question 2 [3 marks]

(2.3.8-9, 11, 20)

Sketch a possible graph of $\frac{dy}{dx}$ for the cubic shown below, on the same axes.



Question 3 [8 marks – 1, 2, 2, 3]

(2.3.7, 12-15, 22)

a) Differentiate the following:

i) $f(x) = 4x^5 - 9x^4$

ii) $y = (2x + 3)(6x - 7)$

b) Anti-differentiate the following:

i) $\frac{dy}{dx} = 24x^3 + 27x^2$

ii) $f'(x) = \frac{12x^5 - 9x^2}{6x^2}$

Question 4 [7 marks – 3, 4]

(2.3.4, 6, 9, 17)

Consider points $A(3, 18)$ and $B(3 + h, f(3 + h))$ on the curve $f(x) = 2x^2$.

- a) Determine the expression for the gradient of chord AB , using the difference quotient

formula $\frac{\delta y}{\delta x} = \frac{f(x + h) - f(x)}{h}$.

- b) Hence, by applying first principles to your answer above, determine the gradient and equation of the tangent to point A .

Question 5 [10 marks – 3, 4, 3]

(2.3.16, 18-20)

An object moves such that its position x metres from point O after t seconds is given by $x(t) = t^3 + at^2 + 24t$ for $0 \leq t \leq 5$. After 1 second, it has a velocity of 9 m/s.

a) Show that $a = -9$.

b) Determine when the object is stationary and its positions at those times.
You do not need to prove the nature of these stationary points.

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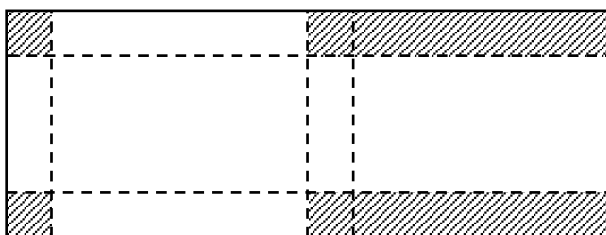
Question 5 (continued)

- c) Hence, calculate the distance travelled over the given interval.

Question 6 [10 marks – 4, 6]

(2.3.20-21)

A rectangular sheet of metal, 9 cm by 24 cm, will be made into a closed rectangular box. Two squares of side x cm and two rectangles will be removed from the corners to form the net of the box as shown right.



- a) Label the diagram with the appropriate dimensions and variables, then clearly show below that the volume of the box, $V \text{ cm}^3$, is given by $V(x) = x(12 - x)(9 - 2x)$.

(continued on next page)

Question 6 (continued)

- b) Given that $V(x) = 2x^3 - 33x^2 + 108x$, find the dimensions of the box that will maximise its volume, state the volume and show that it is a maximum, using calculus.

End of Test

SUPPLEMENTARY PAGE

Question: _____

Question: _____