Extra working space

PERTH MODERN SCHOOL
Exceptional schooling. Exceptional students.
Independent Public School

Course Methods Year 12

Student name: _____ Teacher name: _____

Date: 14 Feb

Task type: **Response**

Time allowed for this task: ____45_____ mins

Number of questions: **____8_____**

Materials required: Calculator with CAS capability (to be provided by the student)

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, and up to three calculators approved for use in the WACE examinations

Marks available: **__47___ marks**

Task weighting: **__10__%**

Formula sheet provided: Yes

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

Q1 (3.1.7) **(9 marks)**

Use the product rule and/or quotient rule to differentiate the following.(Simplify)
Note: Zero marks for answer only here.

i) $y = (x - 11)(x^3 + 2)$ (3 marks)

ii) $y = \dfrac{2x + 1}{(3 - x)}$ (3 marks)

iii) $y = (5 - 2x)(x^2 + 1)^3$ (3 marks)

Q2 **(3 marks)**

Determine the equation of the tangent to $y = (3x + 1)^3$ at the point $(1, 64)$.

Extra working space

Q7 (3.1.11) (6 marks)

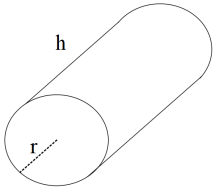
A colony of bacteria is represented as a circle on a petri dish and is increasing in such a way that the number of bacteria present is given by N where $N = \sqrt{3x+2}$, x being the radius of the circle of bacteria.

a) Determine $N'(2)$ and explain its meaning. (3 marks)

b) Determine $N''(2)$ and explain its meaning. (3 marks)

Q8 (3.1.16) (4 marks)

Consider a **closed** hollow cylinder with end radius r metres and length h metres.



If the outside of the closed cylinder has a surface area of $300\,m^2$ determine the dimensions of the radius and length, nearest cm, to maximise the capacity of the cylinder using calculus techniques.

Q3 (3.1.8) (8 marks)

Consider the functions $P(x) \& Q(x)$ and their derivatives $P'(x) \& Q'(x)$ with values given for the following x values.

X value	-1	3	7
$P(x)$	5	2	-4
$P'(x)$	0	1	-2
$Q(x)$	2	5	-3
$Q'(x)$	-1	-2	6

Determine the **derivatives** of the following at the given x values.'

a) $P(x)Q(x)$ at $x = 3$ (2 marks)

b) $\left[Q(x)\right]^3$ at $x = -1$ (3 marks)

c) $\dfrac{\left[P(x)\right]^2}{Q(x)}$ at $x = 7$ (3 marks)

Q4 (3.1.14, 3.1.15) (7 marks)

Use calculus techniques to determine the **exact** coordinates of any stationary points on the following curves and use the second derivative test to determine the nature of the stationary point.

a) $y=(x-4)^3-1$ (3 marks)

b) $y=2x^3+9x^2-60x+12$ (4 marks)

Q5 (3.1.12) (7 marks)

The displacement of a body from an origin O, at time t seconds, is x metres where $x=t^2-11t+18$, $t\geq 0$.

Determine the following.

a) The velocity function. (2 marks)

b) The times and displacements when the body is at rest. (3 marks)

c) The distance travelled in the first 12 seconds. (2 marks)

d) $x''(1)$ and explain its meaning. (2 marks)

Q6 (3.1.10) (3 marks)

If $y=3x^5$ use the small increments formula $\delta y \approx \frac{dy}{dx}\delta x$ to determine the approximate percentage change in y when x decreases by 2%.