



PERTH MODERN SCHOOL  
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Independent Public School

## Course    Methods test 2    Year 12

Student name: \_\_\_\_\_  
Teacher name: \_\_\_\_\_

Task type: Response

Time allowed for this task: 40 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: 41 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 &amp; 3 = 6 marks) (3.2.9)

Determine  $y$  in terms of  $x$  for the following. Show all working.

a)  $\frac{dy}{dx} = 15x^2 + 14x$  and  $y = 13$  when  $x = 1$ .

b)  $\frac{dy}{dx} = 10(2x + 1)^4$  and  $y = 10$  when  $x = -1$ .

Q2 (3 &amp; 2 = 5 marks) (3.2.22, 3.2.5)

A car travels in a straight line from the origin, initially at rest, with constant acceleration  $4\cos(3t) \text{ m/s}^2$  with  $t$  time in seconds.

a) Determine the distance from the origin at  $t = \frac{\pi}{3}$  seconds?

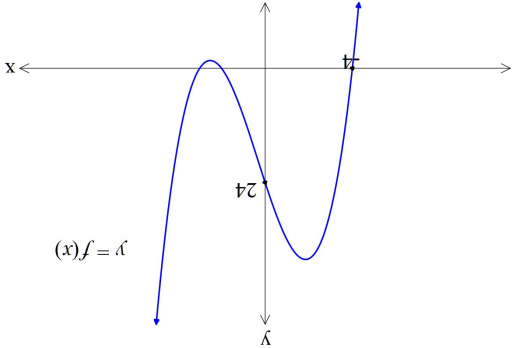
b) What is the velocity of the car at  $t = \frac{\pi}{3}$  seconds?

Q8 (5 marks) (3.1.15)

Consider the function  $f(x) = ax^3 + bx^2 + cx + d$  where  $a, b, c$  &  $d$  are constants.

Below is a graph of  $f(x)$

(Note: diagram is not drawn to scale)



There is an  $x$  intercept at  $x = -4$ ,  $y$  intercept at  $y = 24$  and  $\int_{-4}^{24} f(x) dx = \frac{368}{3}$ .  
There is an inflection point at  $x = \frac{1}{3}$ .  
Determine the exact values of  $a, b, c$  &  $d$ .

Q3 (2 marks) (3.2.19)

Determine the exact area between  $y = x^3 + x^2 - 37x + 35$  and the  $x$  axis from  $x = -10$  to  $x = 10$ .

Q4 (2, 2 & 3 = 7 marks) (3.2.18)

A factory produces electric vehicles. The total number,  $E$ , that the company has produced  $t$  months after production commenced is such that:

$$\frac{dE}{dt} = 450 - \frac{(t + 5)^2}{800}$$

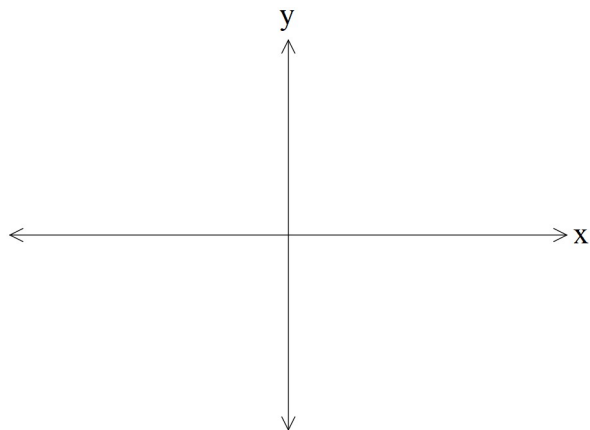
a) The first 6 months  
Determine the number produced in

b) The third month

Determine the minimum number of months required to produce:  
c) 10000 vehicles.

Q5 (5 &amp; 3 = 8 marks) (3.2.20)

- a) On the axes below, sketch the following graphs:  $y = x^3 + 2x^2$  and  $y = 5x - 2x^2$ . Indicate on your sketch coordinates (one decimal place) of any stationary points, and label their nature, and of any points where the graphs intersect each other.



- b) Determine the exact area between  $y = x^3 + 2x^2$  and  $y = 5x - 2x^2$ .

Q6 (2 &amp; 2 = 4 marks) (3.1.3, 3.1.4)

The number of kangaroos,  $N$ , in a particular site that have developed disease W are increasing such that  $\frac{dN}{dt} = 0.08N$  with  $t$  the time in years. There are initially 2300 kangaroos with the disease.

- a) Determine the number of kangaroos with disease W in 5 years' time.
- b) Determine the time taken to triple the number with the disease in years to one decimal place.

Q7 (4 marks) (3.2.16)

Consider the function  $G(x) = \int f(t) dt$  such that  $G'(x) = \frac{3}{4x^2}$  and  $G(4) = \frac{79}{2}$ . Determine the rule for the function  $f(x)$ .