



PERTH MODERN SCHOOL
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Independent Public School

Course Methods Year 12 test one 2022

Student name: _____ Teacher name: _____

Task type: Response

Time allowed for this task: ____40____ mins

Number of questions: ____8____

Materials required: **No calculators nor classpads allowed**

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

Special items: Drawing instruments, templates, **NO notes**.

Marks available: ____40____ 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, 4 & 3 = 10 marks)

Differentiate the following:

a) $(3x - 1)^5$

b) $(5x^2 - 1)^7 3x^2$ and **simplify**

c) $\frac{3x+1}{\sqrt{7-2x}}$ do **not** simplify

Q2 (4 marks)

Determine the equation of the tangent to $y = (5x - 1)(2x^3)$ at (1,8)

Q3 (5 marks)

Determine the coordinates of the stationary points and their nature for $y = x^3 + 2x^2 + x + 2$. Justify.

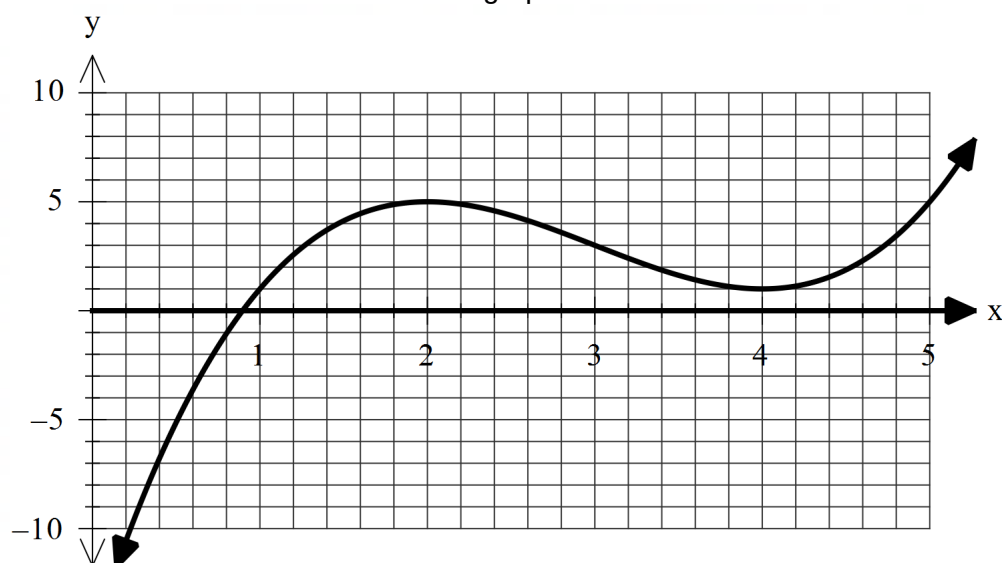
Q4 (3 marks)

The displacement of a body from an origin O, at time t seconds, is x metres where

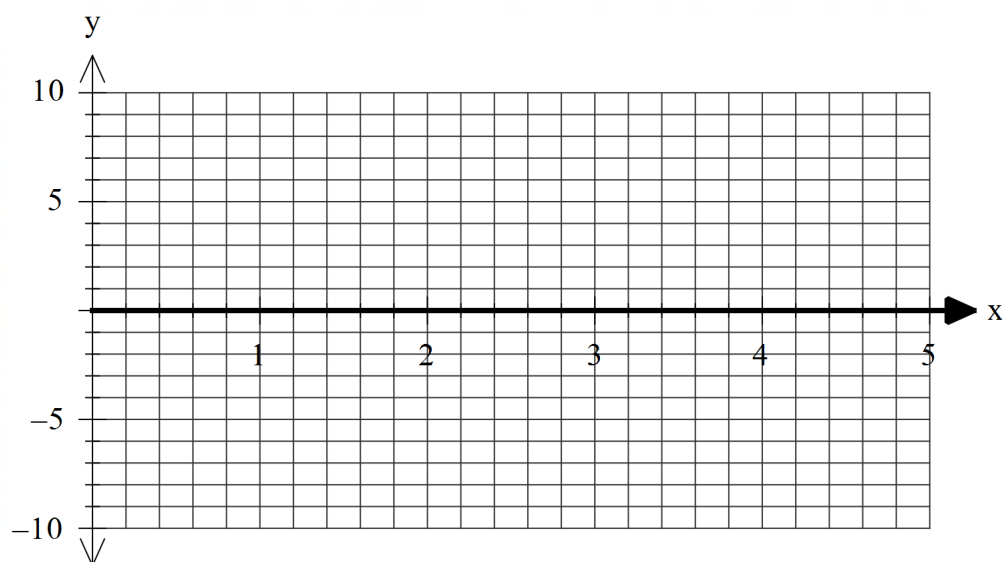
$$x = t^3 - 3t^2 + 5t + 1, \quad t \geq 0$$

Determine the velocity and the displacement of the body when the acceleration is zero.

Q5 (4 marks)

Consider the function $f(x)$ which is graphed below.

On the **axes below**, sketch the gradient function $f'(x)$ indicating on your sketch the location of any stationary points and any inflection points for $f(x)$. (labelled)



Q6 (2 & 3 = 5 marks)

Consider the function $y = g(x)$ where $g(2) = 10$, $g'(2) = 5$.

- a) Using the increments formula (small change) determine an approximate value for $g(2.1)$.

- b) The volume of a sphere of radius r metres is given by $V = \frac{4}{3}\pi r^3$. Using the increments formula determine the approximate percentage change in volume for a 3% change in the radius.

Q7 (4 marks)

Let A equal the number of hectares that a farmer will use to grow corn one season. The amount of corn to be harvested per hectare is given by $(800 - 20A)$ kg for $A \leq 40$. **Using calculus** determine the number of hectares that should be used to maximise the amount of corn produced.

Q8 (5 marks)

Let the cost, \$ C , to make x items in a factory be given by $C = 3x^3 - 12x^2 + 40x$ dollars. Using calculus show that the minimum **average cost** per item is equal to the marginal cost at this number of items.