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

Q2 (4 marks)

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

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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.

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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.

Q5 (4 marks)

Consider the function $f(x)$ which is graphed below.
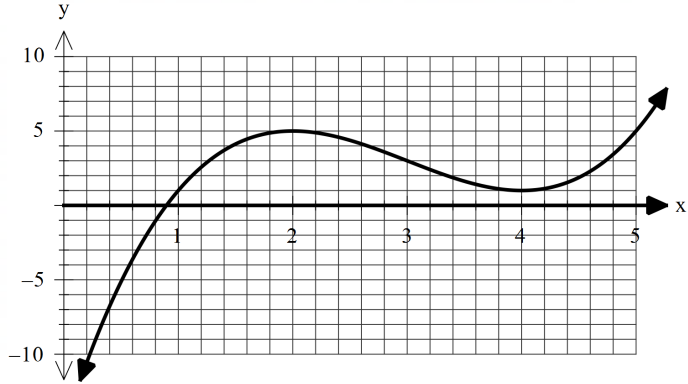
On the **axes below**, sketch the gradient function $f'(x)$ indicating on your sketch the location of any stationary points and any inflection points for $f(x)$. (labelled)
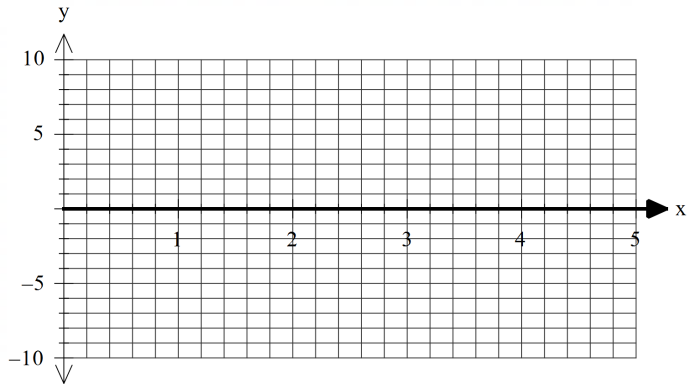
Q6 (2 & 3 = 5 marks)

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

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 $V = \dfrac{4}{3}\pi r^3$. Using the increments formula determine the approximate percentage change in volume for a 3% change in the radius.