



Attempt all questions. Questions 1, 2, 3, 4, 5 and 6 are contained in this section.

All necessary working and reasoning must be shown for full marks.

Where appropriate, answers should be given as exact values. Marks may not be awarded for untidy or poorly arranged work.

1. [2+2+2+3=9 marks]

Determine the derivative of each of the following with respect to x of, clearly showing use of appropriate rules. Do not simplify your answers.

(a) $y = (2x^3 + 1)(5x - 16)$

(b) $y = \sqrt[3]{(x^2 - 4x)}$

(c) $y = \frac{\frac{x^2}{1}}{\frac{x+1}{1}}$

(d) $y = \cos^3(4x + 1)$

2. [2+2= 4 marks]

Determine:

(a) $\lim_{h \rightarrow 0} \frac{(x+h)^3 - x^3}{h}$

(b) $\frac{d}{dt} 2 \cos(t^\circ)$ where t° denotes t degrees

3. [4 marks]

Determine the equation of the tangent to $y = x \sin x$ at the point $(\frac{-5\pi}{2}, \frac{5\pi}{2})$.

9. [3+2+2= 7 marks]

A particle, P, moves along the x-axis with position given by $x(t) = 5.2 \sin\left(\frac{t}{2}\right) + 3$ cm where t is the time in seconds, $0 \leq t \leq 18$

(a) Determine the initial position, velocity and acceleration of P and give these values.

(b) Describe the motion of the particle when $t = 3.2$ seconds

(c) Determine the time or times when the particle's velocity is increasing at its fastest rate $0 \leq t \leq 18$ and explain your answer.

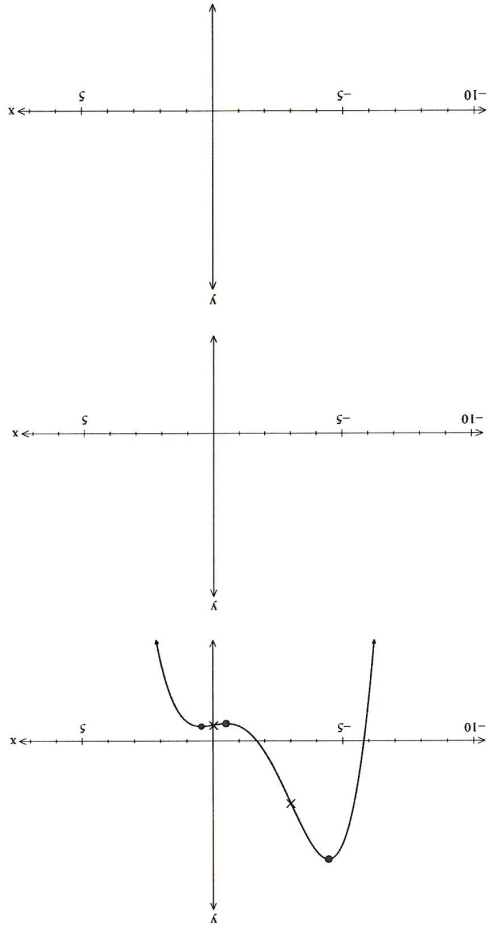
10. [3 marks]

A metal plate of square shape, length x cm, is heated so that its sides expand at a rate of 0.01cm/min.

$\frac{dA}{dx}$ is rate of change of the area of the square with respect to its side length and $\frac{dx}{dt} = 0.01$ is the rate the sides expand with respect to time. By first stating $\frac{dA}{dx}$, show how to use the chain rule to obtain $\frac{dA}{dt}$, the rate of change of the plate's area with respect to time. Evaluate this rate when the side of the square is 10 cm.

8. [3+2=5 marks]

The graph below shows a polynomial function with non-horizontal points of inflection at $x = -3$ and $x = 0$. On the sets of axes provided graph the first derivative and the second derivative graphs for this function, clearly indicating the relationship between relevant points.



4. [3 marks]

Use the table below to help find $\frac{d}{dx}(g(h(x)))$ at $x = 0$

x	$g(x)$	$h(x)$	$g'(x)$	$h'(x)$
2	11	8	7	5
0	5	2	-1	1

5 [4 marks]

If $y = \cos(2x)$, determine a simple expression for $\left(\frac{dy}{dx}\right)^2 + \frac{4}{1}\left(\frac{d^2y}{dx^2}\right)^2$

6. [4+4+3=11 marks]

Consider the function $f(x) = x^3(4 - x)$

(a) Use calculus to determine the location of all stationary points.

(b) Use the second derivative to determine the nature of these stationary points.

(c) Determine with justification the location of any non-stationary points of inflection.



SHENTON
COLLEGE

ATMAM Mathematics Methods

Test 1 2020 Calculator Assumed

Name:

Teacher (Please circle name) Ai Friday White

Time Allowed : 20 minutes

Marks	/ 19
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Materials allowed: Classpad calculator, Formula Sheet.

Attempt all questions. Questions 7, 8, 9 and 10 are contained in this section.

All necessary working and reasoning must be shown for full marks.

Marks may not be awarded for untidy or poorly arranged work.

7. [4 marks]

Show the use of differentiation to determine the approximate change in y when x changes from 2 to 2.1 if $y = 2\sin x + \cos x$.