



**ST PIUS X COLLEGE
CHATSWOOD**

35 Anderson St Chatswood

2021 HSC Task #1 weighting 20%

9 February 2021

Extension 1 Mathematics

General Instructions

- **Working time 45 minutes**
- **Write using blue or black pen**
- **Show all relevant mathematical reasoning and calculations**
- **NESA approved calculators may be used**

Total marks – 30

- **Attempt sections I and II**
- **Section I 5 marks**
- **Section II 25 marks**
- **Use the multiple choice sheet for section I and answer each of question 6 and 7 in a separate booklet**

Student Number	
Teacher's name	
Multiple Choice	/5
Question 6	/12
Question 7	/13
Total	/30

Section I – 5 Marks MULTIPLE CHOICE one mark per question.

Answer this section on the multiple choice sheet at the back of this exam.

1. A point (a, b) is on the curve $y = f(x)$.

h is a small positive amount and

$$f'(a-h) > 0 \quad f'(a) > 0 \quad f'(a+h) > 0$$

$$f''(a-h) > 0 \quad f''(a) = 0 \quad f''(a+h) < 0$$

(a, b) is a

(A) maximum

(B) minimum

(C) point of inflection

(D) insufficient information to say

2. A student is required to graph $y = \cos^{-1}(x+2)$. The domain of this function is

(A) $0 < y < \pi$

(B) $-3 \leq x \leq -1$

(C) $1 \leq x \leq 3$

(D) $1 < x < 3$

3. By utilising the t results, a solution is sought to the equation

$$\cos 2x + \sin 2x + \tan x = 0$$

The resultant formula in t will become

(A) $1-t^2 + 2t = t+t^3$

(B) $1+t^2 - 2t = t-t^3$

(C) $1-t^2 - 2t = t+t^3$

(D) $t^3 - t^2 + 3t + 1 = 0$

4. Which of the following is **not** equal to $\cos 2A$?

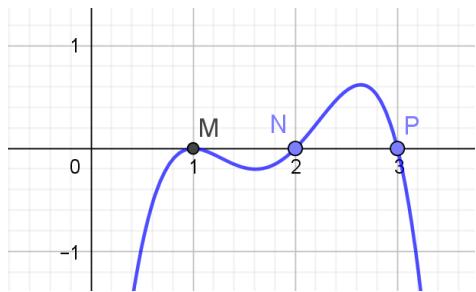
(A) $\sin^2 A - \cos^2 A$

(B) $1 - 2\sin^2 A$

(C) $2\cos^2 A - 1$

(D) $\frac{2\tan A}{2-\sec^2 A}$

5. The graph shown displays y' graphed against x .



Which of the following is true for the graph of y against x

- (A) M is a maximum, N is a point of inflection and P is a point of inflection
- (B) M is a point of inflection, N is a maximum and P is a minimum
- (C) M is a minimum, N is a maximum and P is a point of inflection
- (D) M is a point of inflection, N is a minimum, P is a maximum

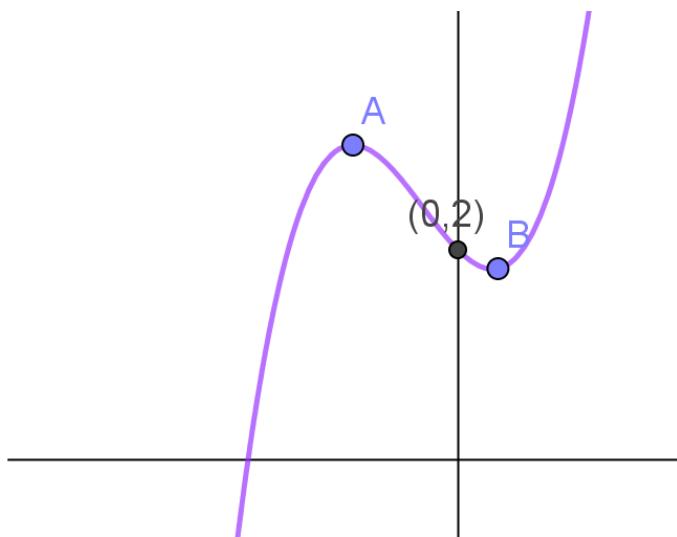
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Section II Question 6**12 marks****Answer each question in a separate booklet**

- a) Use the principle of mathematical induction to prove for $n \geq 1$ that 3

$$7^{2n-1} + 5 \text{ is divisible by } 12$$

b)



The graph of $y = x^3 + x^2 - x + 2$ is shown

- i) Find the coordinates of A and B, justifying the nature of each turning point. 3

- ii) For what values of x is the curve concave up? Justify your answer. 2

- c) Consider the curve $\frac{y}{3} = \sin^{-1}(x - 2)$

- (i) What is the domain and range of this function? 2

- (ii) Make a half page graph of the function 2

Section II continued Question 7**13 marks****Answer Q 7 in a separate booklet**

- a) Prove by mathematical induction for $n \geq 1$ that

3

$$\frac{1}{1 \times 3} + \frac{1}{3 \times 5} + \frac{1}{5 \times 7} + \dots + \frac{1}{(2n-1)(2n+1)} = \frac{n}{2n+1}$$

- b) Use the addition theorems to show

1

(i) $\sin(90 - A) = \cos A$

- (ii) $2\cos A \cos B = \cos(A+B) + \cos(A-B)$ and hence express
 $\cos 75^\circ + \cos 15^\circ$ in simplest exact form

2

- c) Solve, using the t results, expressing your answer to the nearest minute

3

$$3\sin x - 2\cos x = 1$$

$$0 \leq x \leq 90^\circ$$

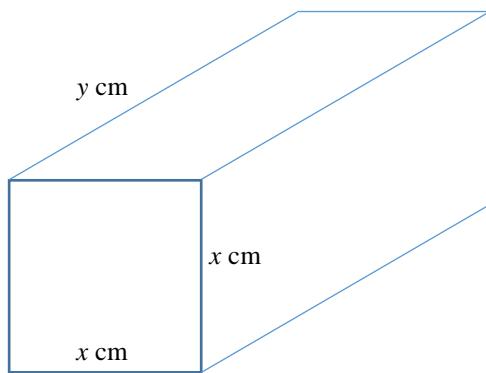
- d) A parcel is in the shape of a square prism with sides x cm, x cm, y cm and $x < y$

4

The girth is the smallest distance around the parcel.

The courier company only delivers parcels for which $\text{length} + \text{girth} \leq 100\text{cm}$

Find x so that the volume of the parcel is a maximum and calculate this maximum volume.



End of assessment ☺

Multiple Choice Answer Sheet

Student Number	
Teacher's name	

Colour your Choice for each section

1 A B C D

2 A B C D

3 A B C D

4 A B C D

5 A B C D