



ST PIUS X COLLEGE  
CHATSWOOD

## 2022 HSC Task #1

**Weighting 20%**

**14 February 2022**

## MATHEMATICS EXTENSION 1

### 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
- Section I – use multiple choice answer sheet
- Section II – answer each question in a new booklet

Student Number	
Teacher's name	Mr Wall / Mr Reay
Multiple Choice	/6
Question 7	/12
Question 8	/12
Total	/30

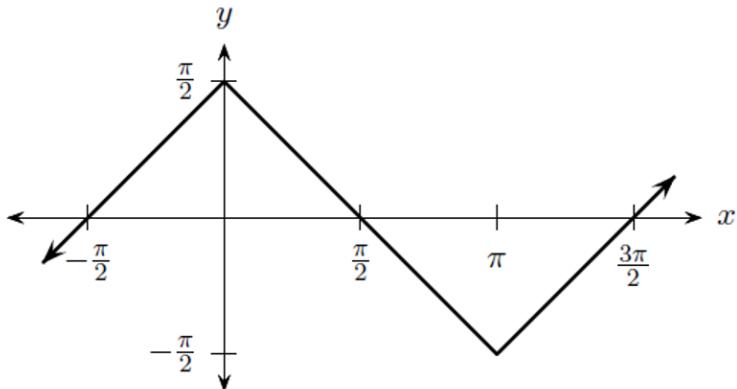
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## Section I – 6 Marks

**MULTIPLE CHOICE** one mark per question.

Answer this section on the multiple choice sheet.

1. Which of the following equations is shown in the sketch below?



- (A)  $y = \sin^{-1}(\sin x)$       (C)  $y = \cos(\sin^{-1} x)$   
(B)  $y = \sin^{-1}(\cos x)$       (D)  $y = \sin(\sin^{-1} x)$

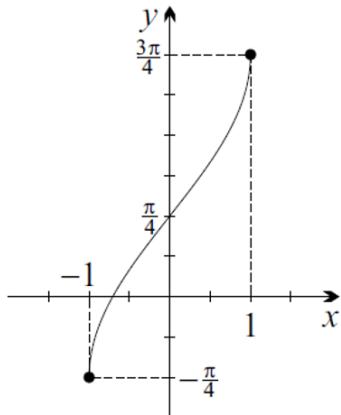
2. Which of the following is a *true* statement?

- (A)  $\sin 3x \sin 4y = \frac{1}{2}[\cos(3x - 4y) - \cos(3x + 4y)]$   
(B)  $\sin 3x \sin 4y = \frac{1}{2}[\cos(3x + 4y) - \sin(3x - 4y)]$   
(C)  $\sin 3x \sin 4y = \frac{1}{2}[\cos(3x + 4y) - \cos(3x - 4y)]$   
(D)  $\sin 3x \sin 4y = \frac{1}{2}[\cos(3x - 4y) - \sin(3x + 4y)]$

3. The value of  $\cot\left(\sin^{-1}\frac{5}{13}\right)$  is?

- (A)  $\frac{5}{12}$       (C)  $\frac{12}{13}$   
(B)  $\frac{13}{12}$       (D)  $\frac{12}{5}$

4. Which of the following equations is represented by the graph shown below?



- (A)  $y = -\cos^{-1} x - \frac{\pi}{4}$   
(B)  $y = \sin^{-1} x + \frac{\pi}{4}$   
(C)  $y = \tan x + \frac{\pi}{4}$   
(D)  $y = \cos^{-1} x - \frac{\pi}{4}$

5. A function is defined by the rule  $f(x) = \begin{cases} 1 & \text{for } x < 1 \\ x + 2 & \text{for } x \geq 1 \end{cases}$

Which statement is *incorrect*?

- (A) The value of  $f(-2)$  is 1.  
(B) The graph is not continuous at  $x = 1$ .  
(C) The domain is all real values of  $x$ .  
(D) The range is  $f(x) \geq 1$ .
6. What is the domain of the function  $f(x) = \frac{1}{\sqrt{x^2-9}}$ ?

- (A)  $(-\infty, -3) \cup (3, \infty)$   
(B)  $(-\infty, -3)$   
(C)  $[-\infty, -3] \cup [3, \infty]$   
(D)  $(3, -3)$

**End of Section I**

## Section II – 24 marks

### Question 7 – 12 marks

*Start this question in a new booklet*

- a. It is given that  $(\sin \alpha - \cos \alpha)^2 = 1 - \sin 2\alpha$ . 2

What is the exact value of  $\sin 75^\circ - \cos 75^\circ$ ? Leave your answer with a rational denominator.

- b. Use the principle of mathematical induction to show for all integers  $n \geq 1$ , 3

$$(1 \times 2) + (2 \times 3) + (3 \times 4) + \cdots + n(n+1) = \frac{n(n+1)(n+2)}{3}$$

- c. Consider the function  $y = 2 \cos^{-1}(x - 1)$ .

- i. Write the domain of this function. 1

- ii. Write the range of this function. 1

- iii. Sketch the function  $y = 2 \cos^{-1}(x - 1)$ . 2

- d. Prove by mathematical induction that  $4^n + 14$  is divisible by 6, for all integers  $n \geq 1$ . 3

**Question 8 – 12 marks***Start this question in a new booklet*

- a. Prove the trigonometric identity  $\tan 3\theta = \frac{3 \tan \theta - \tan^3 \theta}{1 - 3 \tan^2 \theta}$ . 3
- b. Consider the curve  $y = 4x^2 - 2x^3$ .
- Find the stationary points of the curve  $y = 4x^2 - 2x^3$  and determine their nature. 3
  - It is known there is ONE point of inflection on this cubic. Find the coordinates of the point of inflection. 1
  - Hence, sketch the graph of the curve  $y = 4x^2 - 2x^3$ . Clearly label the stationary points, the point of inflection and any intercepts with the axes. 2
- c. Solve the equation  $\tan^{-1} \frac{1}{2} - \tan^{-1} \frac{1}{3} = \sin^{-1} x$ . 3

**End of assessment**

**2022 Year 12 Mathematics Extension 1**  
**Assessment #1**  
**Multiple Choice Answer Sheet**

<b>Student Number</b>	
Teacher's name	Mr Wall / Mr Reay

Colour your choice for each question.

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  
                

6.    A    B    C    D