ST PIUS X COLLEGE
CHATSWOOD

2022 HSC Task #2

Weighting 30%

7 April 2022

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
- Section I use the multiple choice answer sheet (attached)
- Section II answer Question 7 and 8 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 The vectors $\underset{\sim}{u}, \underset{\sim}{v}$ *and* $\underset{\sim}{w}$ are written in column form $\begin{bmatrix} -3 \\ 4 \end{bmatrix}, \begin{bmatrix} 12 \\ 5 \end{bmatrix}$ *and* $\begin{bmatrix} 8 \\ -15 \end{bmatrix}$.

What is the magnitude of the resultant?

A $\sqrt{325}$ B $\sqrt{1225}$ C $\sqrt{353}$ D can't be found

2 Evaluate $\int_0^{\pi/3} -\cos x.dx$.

A $\frac{-\sqrt{3}}{2}$ B $-\frac{1}{2}$ C $\frac{1}{2}$ D $\frac{\sqrt{3}}{2}$

3 Which of the following vectors **is not** parallel to $3\underset{\sim}{i} - 5\underset{\sim}{j}$.

A $6\underset{\sim}{i} - 10\underset{\sim}{j}$ B $9\underset{\sim}{i} + 15\underset{\sim}{j}$ C $-6\underset{\sim}{i} + 10\underset{\sim}{j}$ D $-3\underset{\sim}{i} + 5\underset{\sim}{j}$

4 For what values of x is the curve $y = log_e(2 - x)$ undefined?

A $x \leq 2$ B $x \leq -2$ C $x < -2$ D $x \geq 2$

5 Solve for: $\frac{27^{x-3} \times 9^{x-5}}{3^{2x+3}} = 243$

A $x = 3$ B $x = 6$ C $x = 9$ D $x = 12$

Section II Question 6 **12 marks**

Answer question 7 in a separate booklet

a) i) Use the quotient rule or function of a function rule to find $\frac{d}{dx}\sec x$.

1

ii) Hence evaluate $\int_{\pi/3}^{\pi/6} \sec x \tan x dx$. **2**

b) i) Given that $\sin^2 x + \cos^2 x = 1$ complete the identity $\tan^2 x + 1 = ?$ **1**

ii) Find the value of $\int_0^{\pi/4} \tan^2 x dx$. **2**

c) The vectors $\underset{\sim}{u}$ and $\underset{\sim}{v}$ have column representation $\begin{bmatrix} 3 \\ 4 \end{bmatrix}$ and $\begin{bmatrix} -8 \\ 5 \end{bmatrix}$.

i) Calculate $|\underset{\sim}{u}|$ and $|\underset{\sim}{v}|$. **1**

ii) Calculate $\underset{\sim}{u} \cdot \underset{\sim}{v}$ and find the angle between the 2 vectors to the nearest degree. **2**

d) The graph shows the curves $y = 2^x$ and $y = 1 + 2x - x^2$. **3**
Find the exact area between the two curves.

Section II continued Question 7 **13 marks**

Answer Q7 in a separate booklet

a) i) Show that the tangent to $y = \log_e x$ at point P, where $x = e$ passes through the origin. **2**

ii) The normal at P intersects the x axis at M. **2**
Find the x intercept of M and the area of the triangle OPM.
in simplest exact form.

b) OPRQ is a rhombus. The position vector $\overrightarrow{OP}$ is $8\underset{\sim}{i} + 6\underset{\sim}{j}$ while $\overrightarrow{OQ}$ has position vector $10\underset{\sim}{i}$

i) Find the component form of $\overrightarrow{OR} = \overrightarrow{OP} + \overrightarrow{OQ}$. **1**

ii) Find $\overrightarrow{PQ}$ in component form. **1**

iii) Calculate $\overrightarrow{PQ} \cdot \overrightarrow{OR}$ and explain what geometrical feature is shown by this calculation. **1**

c) Find $proj_{\underset{\sim}{v}}\underset{\sim}{u}$ where $\underset{\sim}{u} = \begin{bmatrix} 8 \\ 3 \end{bmatrix}$ and $\underset{\sim}{v} = \begin{bmatrix} -3 \\ 4 \end{bmatrix}$. **2**

d) i) Draw a half page sketch of the graph of $y = \sin 2x$ **2**

for $\frac{-\pi}{2} \le x \le \frac{\pi}{2}$ showing intersections with the axes and turning points.

ii) The line $y = mx$ intersects 3 times with $y = \sin 2x$ for $\frac{-\pi}{4} \le x \le \frac{\pi}{4}$. **2**
What are the constraints on m?

End of assessment

Multiple Choice Answer Sheet

Student Number	
Teacher's name	

Colour your Choice for each section

	A	B	C	D
1	○	○	○	○
2	○	○	○	○
3	○	○	○	○
4	○	○	○	○
5	○	○	○	○