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Student Number

**ST PIUS X COLLEGE  
CHATSWOOD**

## **HSC 2023 Stage 6 Year 12**

### **Assessment Task #1**

20% of School Based Assessment

# **MATHEMATICS ADVANCED**

#### **General Instructions**

- Working time – 45 minutes
- Write using black or blue pen  
Black pen is preferred
- Draw diagrams using pencil
- NESA approved calculators may be used
- Marks may be deducted for careless or poorly arranged work
- Show all relevant mathematical reasoning and/or calculations
- Write your Student Number at the top of this cover page
- A multiple choice answer sheet is provided

#### **Total Marks – 35**

##### **Section I – Multiple Choice 5 marks**

- Attempt Questions 1 – 5
- Enter responses on the multiple choice answer sheet
- Allow 5 minutes for this section

##### **Section II – 30 marks**

- Attempt Questions 6 – 8
- Answer in the writing spaces provided
- Show all necessary working
- Allow 40 minutes for this section

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## Section I – Multiple-Choice

1 mark per question

5 Marks

Use the multiple-choice answer sheet.

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample:  $2 + 4 =$

(A) 2      (B) 6      (C) 8      (D) 9

A ☐      B ☒      C ☐      D ☐

If you think that you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

☒      ☒      ☐      ☐

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.

☒ <sup>correct</sup> ☒      ☐      ☐

1. Which value of  $p$  makes the following table a discrete probability distribution?

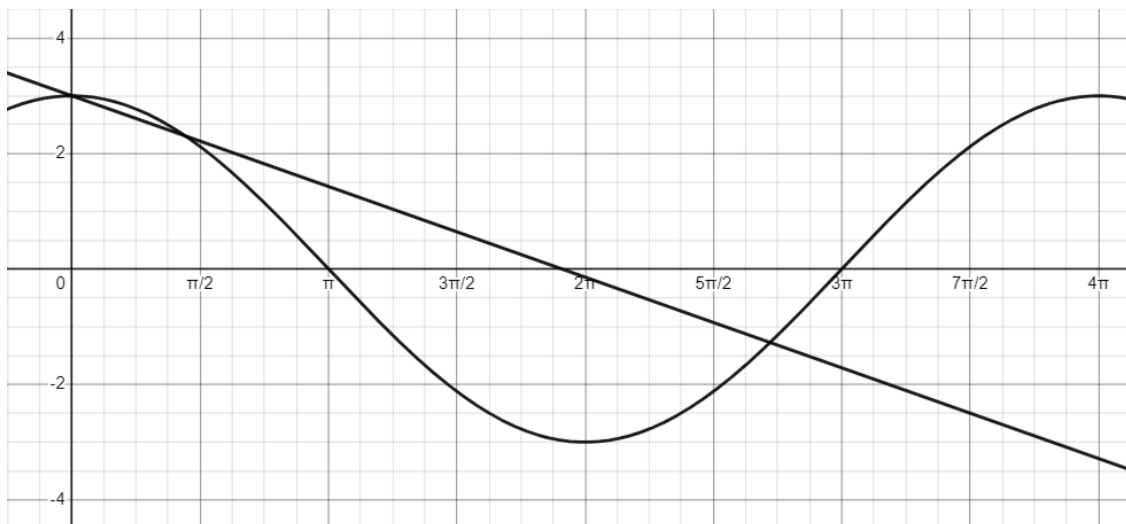
$x$	1	2	3	4
$P(X = x)$	$p - 0.1$	$p - 0.15$	$p + 0.1$	$p + 0.55$

- A 0.6
- B 0.15
- C 0.9
- D 0.1
2. Consider the curve  $y = \frac{1}{(x-2)} + 2$ .

What is the equation of the horizontal asymptote to this curve?

- A  $x = 2$
- B  $y = 2$
- C  $y = x - 2$
- D None of the above

3. The graphs of  $f(x) = 3 \cos\left(\frac{x}{2}\right)$  and  $g(x) = 3 - \frac{x}{2}$  are shown below.



How many solutions are there to the equation  $3 \cos\left(\frac{x}{2}\right) = -\frac{x}{2} + 3$  for  $0 < x < 4\pi$ ?

- A 1
  - B 2
  - C 3
  - D 4
4. The seventh term of an arithmetic sequence is 45 and the 11<sup>th</sup> term is 77.
- Find the first term ( $a$ ) and the common difference ( $d$ ).
- A  $a = -3$  and  $d = 8$
  - B  $a = 3$  and  $d = 8$
  - C  $a = 8$  and  $d = -3$
  - D  $a = 8$  and  $d = 3$
5. The linear function  $f(x) = 5 - x$  has range  $[-4, 5)$ . The domain of this function is?
- A  $(0, 9]$
  - B  $(0, 1]$
  - C  $[5, -4)$
  - D  $(-9, 0)$

**End of Multiple-Choice Section I**

Section II

30 Marks

Attempt Questions 6 to 8.  
Allow about 40 minutes for this section.

In Questions 6 to 8 your responses should include relevant mathematical reasoning and/or calculations.

Question 6 (10 marks)

Write your solutions in the spaces provided Marks

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- (a) Consider the series  $\sqrt{3}, 3\sqrt{3}, 5\sqrt{3}, \dots$   
What is the difference between the 27<sup>th</sup> and 15<sup>th</sup> terms?

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- (b) Consider the series  $2 - 1 + \frac{1}{2} - \frac{1}{4} + \dots$   
Calculate the sum of the first ten terms, correct to 3 decimal places.

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- (c) The first four terms of a geometric series are 6,  $x$ ,  $y$ , 384. **3**  
Calculate values for  $x$  and  $y$ .

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- (d) An Olympic hammer-thrower while training has an initial throw of 60 metres. However, on subsequent throws she is only able to achieve 95% of the previous throwing distance.

- (i) What will be the distance of her eighth throw? **2**

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- (ii) At the given rate what will be the total distance thrown when the athlete is totally exhausted? **1**

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**Question 7** (10 marks)

*Write your solutions in the spaces provided*

**Marks**

- (a) For what values of  $x$  is  $|4x - 7| = 11$ ?

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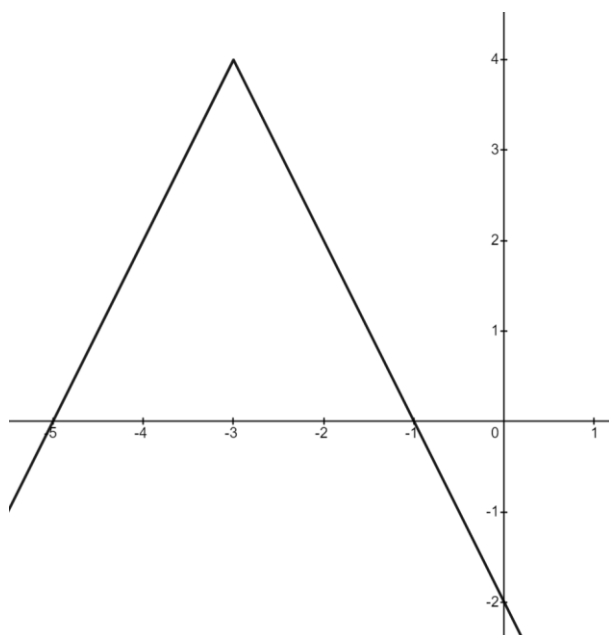
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- (b) The function  $F(x) = |x|$  is transformed and the new function is written in the form  $y = kF(x + b) + c$ , where  $b$ ,  $c$ , and  $k$  are integer constants. The transformed graph is shown below.

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Write the equation of the transformed graph in the form  $y = kF(x + b) + c$ .

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(c) The function  $f(x) = \sin x$  is transformed into  $g(x) = -2\sin 3x$ .

(i) Describe how the amplitude and period changed in this transformation.

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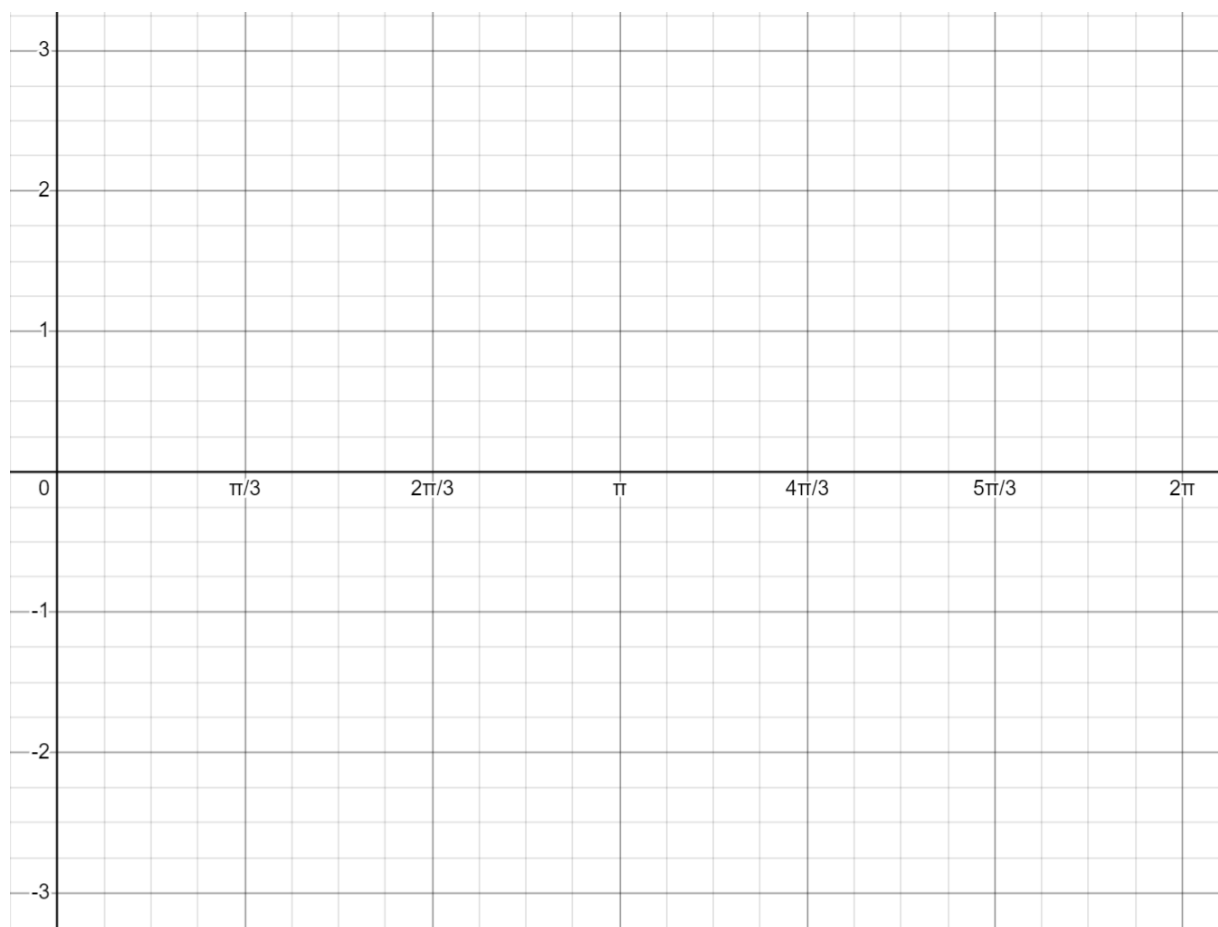
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(ii) In the space provided, sketch  $g(x) = -2\sin 3x$ .

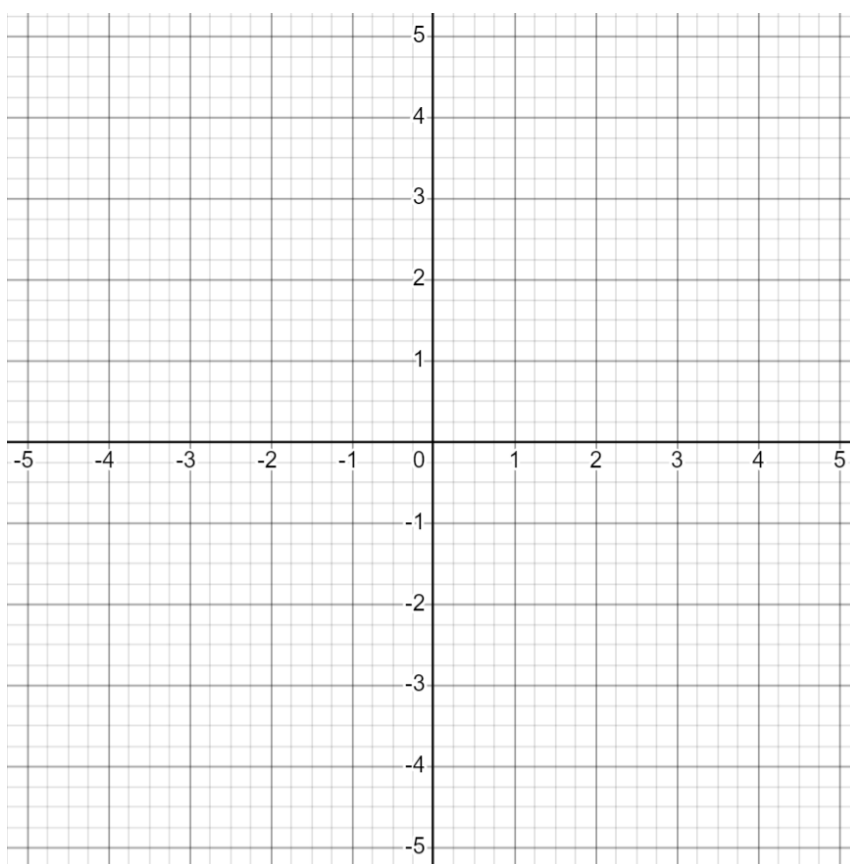
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(d) Sketch  $y = \frac{4}{x^2-4}$ , in the space provided, showing asymptotes and intercepts.

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**Question 8** (10 marks)

Write your solutions in the spaces provided

**Marks**

- (a) (i) Complete this table of values for a discrete random variable  $x$ .

**2**

$x$	0	1	2	3	4	Sum
$p(x)$	$\frac{1}{16}$	$\frac{4}{16}$	$\frac{6}{16}$	$\frac{4}{16}$	$\frac{1}{16}$	1
$xp(x)$	0	$\frac{4}{16}$			$\frac{4}{16}$	
$x^2p(x)$	0	$\frac{4}{16}$	$\frac{24}{16}$		$\frac{16}{16}$	

- (ii) Use the formula  $Var(x) = \Sigma x^2p(x) - \mu^2$  to calculate the variance.

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- (b) In a game a six-sided die is rolled twice. The difference between the two results is recorded.

- (i) A table of results has been created with some missing results.  
Complete the table.

**1**

		Second Roll					
		1	2	3	4	5	6
First roll	1	0	1	2	3		5
	2	1	0	1	2	3	
	3	2	1			2	3
	4		2	1	0	1	
	5	4	3	2	1	0	1
	6	5	4	3	2		0

- (ii) What is the value of  $P(1)$ ?

**1**

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- (iii) A probability distribution table is drawn to summarise the results.  
Complete the table.

2

$x$	0	1	2	3	4	5
$P(X=x)$			$\frac{2}{9}$			$\frac{1}{18}$

- (iv) Find the expected value,  $E(X)$ , and the standard deviation  $\sigma$ .

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**End of Assessment.**

## Section II extra writing space

**If you use this space, clearly indicate which question you are answering.**

