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Student Number

**ST PIUS X COLLEGE  
CHATSWOOD**

**HSC 2022 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

## **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



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. What are the vertical asymptotes of the graph below?

$$y = \frac{1}{x^2 - 9}$$

- (A)  $x = 3$  and  $x = -3$   
(B)  $x = 9$  and  $x = -9$   
(C)  $y = 3$  and  $y = -3$   
(D)  $y = 9$  and  $y = -9$

2. What is the value of  $S_{99}$  for the Arithmetic Progression given by  $T_n = 7n - 4$ ?

- (A) 689      (B) 19 404  
(C) 34 254      (D) 34 650

3.

What is the change in the amplitude and period when the function  $f(x) = \frac{1}{2} \cos 4x$  is transformed into  $g(x) = \cos 2x$ ?

- (A) Amplitude is halved and period is halved
- (B) Amplitude is halved and period is doubled
- (C) Amplitude is doubled and period is halved
- (D) Amplitude is doubled and period is doubled

4. The first three terms of an AP are 5, 9 and 13. What is the 15<sup>th</sup> term in the series?

- (A) 61
- (B) 66
- (C) 495
- (D) 585

5. Which of the following is the correct value  $S_n$  for the series given below?

$$5 + 15 + 45 + \dots + 98\,415$$

- (A) 125 640
- (B) 147 620
- (C) 155 600
- (D) 162 350

**End of Multiple-Choice Section I**

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 (13 marks)

Write your solutions in the spaces provided

Marks

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- (a) An arithmetic sequence has a first term of 5 and a common difference of  $d$ . The sum of the first 20 terms is 4 times the sum of the first 10 terms. Find  $d$ .
- 3

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- (b) The second and 5<sup>th</sup> terms of a geometric progression are 750 and -6 respectively.
- (i) Find the common ratio of the series.
- 2

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(ii) What is the limiting sum of the series?

2

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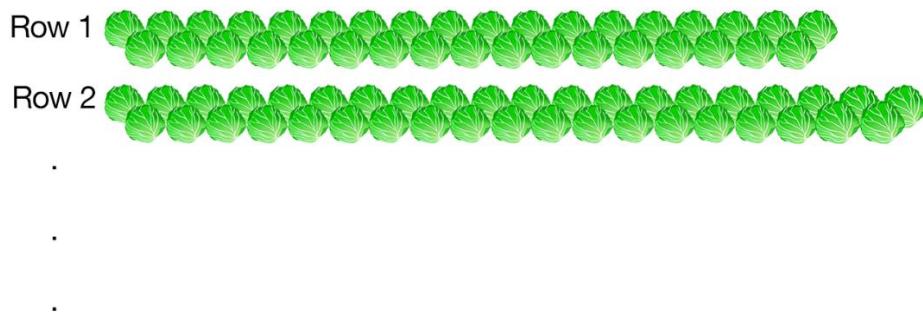
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- (c) Farmer Fred plants his cabbages in rows. The first row has 35 cabbages. The second row has 39 cabbages. Each subsequent row contains 4 more cabbages than the previous row, as shown in the diagram below:



- (i) How many cabbages will be in the 7<sup>th</sup> row?

1

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- (ii) Which row will be the first to feature more than 80 cabbages?

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- (iii) Farmer Fred is only going to plant 945 cabbages in total. How many rows will he need? **3**

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**Question 7 on next page**

**Question 7** (9 marks)

*Write your solutions in the spaces provided*

**Marks**

- (a) For what values of  $x$  is  $|3x - 2| = 4$ ?

**2**

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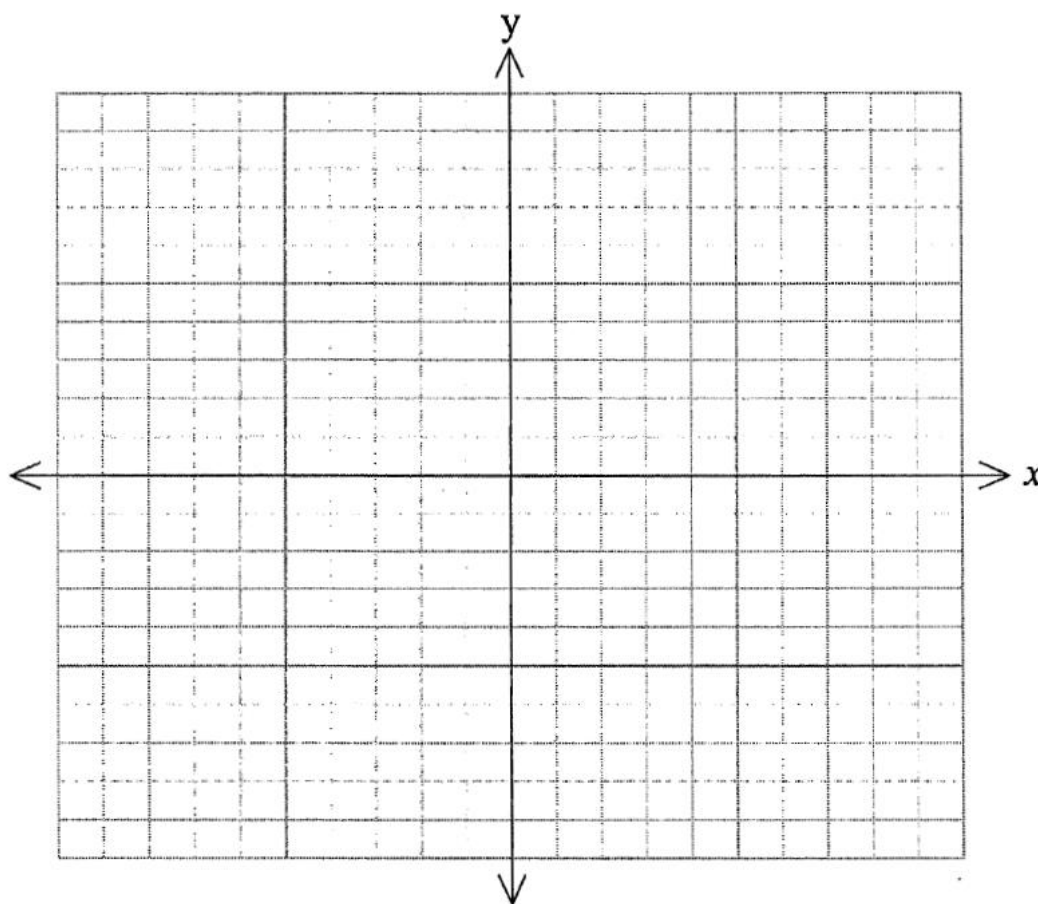
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- (b) (i) Sketch the hyperbola  $y = \frac{1}{x-1}$  after shifting it horizontally by 3 units to the right and 1 unit down.

**2**





- (ii) State the equation of the shifted hyperbola, then find all the intercepts of the shifted hyperbola with the axes and mark them on the graph in part (i). 2

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- (c) (i) What is the period and amplitude of the function  $y = 3 \sin 2x$  ? 1

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- (ii) Sketch the function for  $-\pi \leq x \leq \pi$ . 2

**Question 8 on next page**

**Question 8** (8 marks)

*Write your solutions in the spaces provided*

**Marks**

The probability of a discrete random variable  $X$  is shown below:

|            |       |       |               |                      |
|------------|-------|-------|---------------|----------------------|
| $X$        | -1    | 0     | 1             | 2                    |
| $P(X = x)$ | $t^2$ | $t^2$ | $\frac{t}{4}$ | $\frac{(4t + 1)}{8}$ |
| $xP(x)$    |       |       |               |                      |
| $x^2P(x)$  |       |       |               |                      |

(a) By solving a suitable quadratic equation, show that  $t = \frac{1}{2}$ . **3**

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(b) Hence find the expected value,  $E(X)$ , of the probability distribution.

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(c) Find the variance and standard deviation of the probability distribution.  
Express each value correct to 2 decimal places.

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**End of Task**

## Section II extra writing space

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

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Student Number

## Mathematics Advanced – Multiple Choice Answer Sheet

Attempt all questions:

- |          |   |                         |                         |                         |                         |
|----------|---|-------------------------|-------------------------|-------------------------|-------------------------|
| Question | 1 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
|          | 2 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
|          | 3 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
|          | 4 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
|          | 5 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |