Student's Name: _____

Student Number: | | | | | | | | | |

Teacher's Name: _____

ABBOTSLEIGH

2022

Preliminary Course
Assessment 1

Mathematics Advanced

General Instructions

- Working time – 70 minutes
- Write using black pen.
- NESA approved calculators may be used.
- A NESA reference sheet is provided.
- All necessary working should be shown in every question. At most one mark will be awarded for answers without working.
- Answer all questions in the spaces provided.
- Extra writing pages are provided at the end of each booklet. Please label questions answered in the extra space clearly, writing only one question on each page.
- Answer the Multiple Choice questions on the answer sheet provided.

Total marks – 57

- Attempt Sections I and II

Section 1 Pages 3 - 6

5 marks

- Attempt Questions 1–5.
- Allow about 5 minutes for this section.

Section II Pages 7 - 30

52 marks

- Attempt Questions 6 -24.
- Allow about 65 minutes for this section.

Outcomes to be assessed:

Advanced Mathematics Preliminary:

A student:

MA11-1 uses algebraic and graphical techniques to solve, and where appropriate, compare alternative solutions to problems

MA11-2 uses the concepts of functions and relations to model, analyse and solve practical problems

MA11-8 uses appropriate technology to investigate, organise, model and interpret information in a range of contexts

MA11-9 provides reasoning to support conclusions which are appropriate to the context

Section I

Multiple Choice 5 marks

Attempt Questions 1 – 5

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

(A) ● (B) ⊗ (C) ○ (D) ○

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

correct ←

(A) ⊗ (B) ⊗ (C) ○ (D) ○

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1 What is the domain of $y = \sqrt{5-2x}$?

A. $\left[\frac{5}{2}, \infty\right)$

B. $\left(\frac{5}{2}, \infty\right)$

C. $\left(-\infty, \frac{5}{2}\right)$

D. $\left(-\infty, \frac{5}{2}\right]$

2 Which of the following is the equation of the line perpendicular to $3x-5y+7=0$ which passes through the point $(2,1)$?

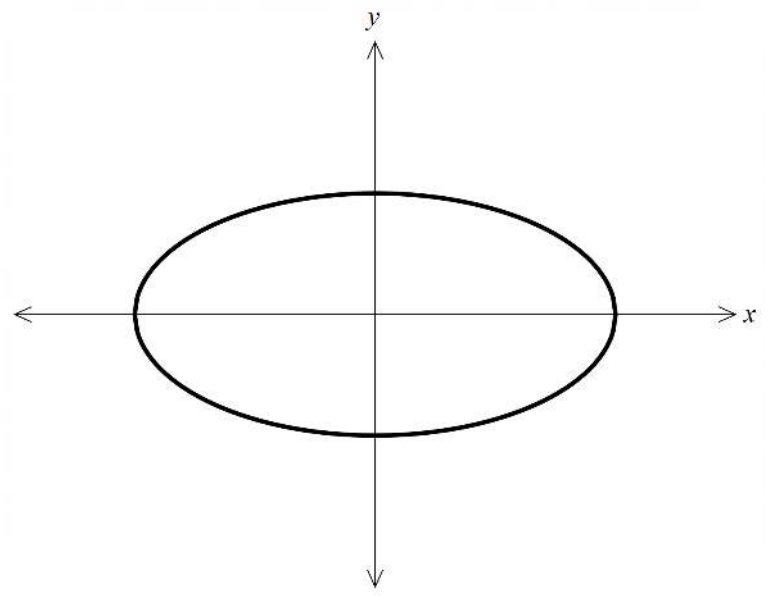
A. $5x+3y-13=0$

B. $5x-3y-7=0$

C. $5x+3y-11=0$

D. $5x-3y-1=0$

3



The relation $\frac{x^2}{9}+\frac{y^2}{4}=1$ is shown above. The relation $\frac{x^2}{9}+\frac{y^2}{4}=1$ is?

A. Many-to-one

B. Many-to-many

C. One-to-many

D. One-to-one

4 What is the angle of inclination of the line $4x+2y-7=0$, correct to the nearest degree?

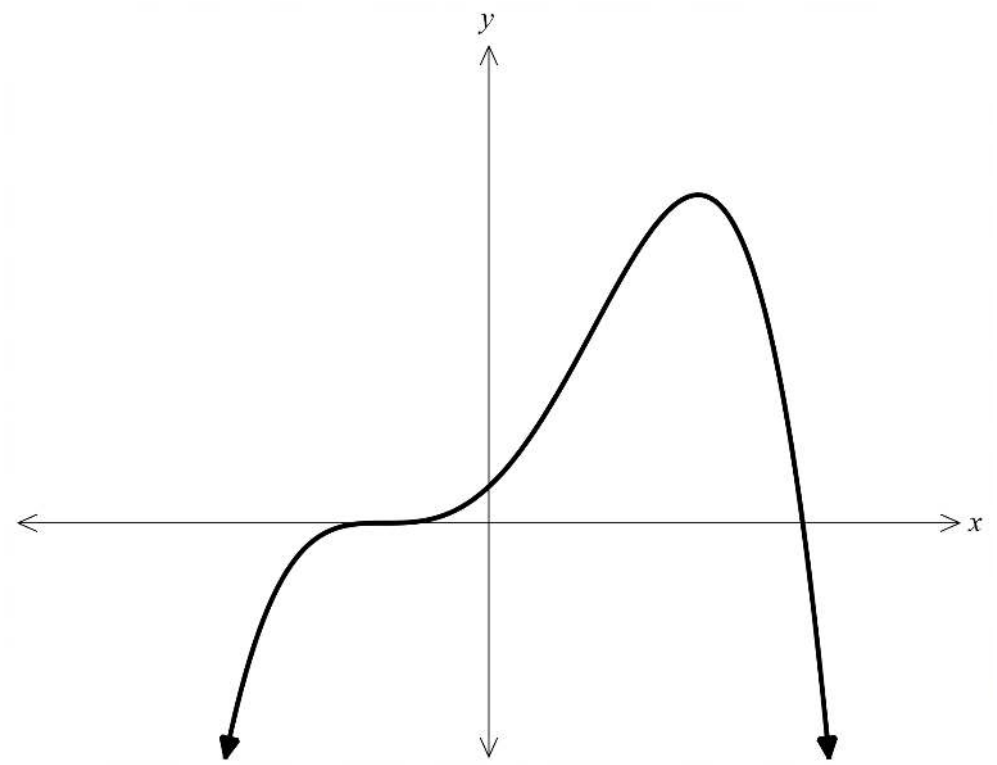
A. 104°

B. 63°

C. 117°

D. 76°

5 The diagram below shows the graph of a polynomial



Which of the following could be the equation of the polynomial?

A. $y = (x-3)(x+1)^3$

B. $y = (x+3)(x-1)^3$

C. $y = (3-x)(x+1)^3$

D. $y = (x+3)(1-x)^3$

End of Section 1

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Section II

Student Number:

Total Marks – 52

Attempt Questions 6 - 24

Answer the questions in the spaces provided.

These spaces provide guidance for the expected length of response.

Your responses should include relevant mathematical reasoning and/or calculations.

Extra writing space is provided at the end of each booklet. If you use this space, clearly indicate which question you are answering

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Question 6 (2 marks)

Solve the equation $\frac{5x-3}{2} - x = 11$

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Question 7 (2 marks)

Find the equation of a parabola with x-intercepts $x = -3$ and $x = 2$ which passes through the point $(3,18)$.

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Question 8 (2 marks)

Simplify by rationalising the denominator $\dfrac{\sqrt{5}+\sqrt{3}}{2\sqrt{10}-\sqrt{6}}$.

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Question 9 (3 marks)

Simplify $\dfrac{\left(-2p^2q\right)^3 \times \left(5pq^4\right)^2}{-10p^5q^{17}}$, writing your answer without negative indices.

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Question 10 (2 marks)

Find the value of the integer a such that $19-\sqrt{a}=\left(4-\sqrt{3}\right)^2$

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End of Question 10

Section II Extra writing space

Student Number:

Question Number:

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Question 11 (2 marks)

Solve $2x^2 - 4x + 1 = 0$, writing your answer in simplest, exact form.

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Question 12 (3 marks)

Fully factorise the expression $5x^4 - 7x^3 - 6x^2$ and hence solve the equation $5x^4 - 7x^3 - 6x^2 = 0$.

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Question 13 (4 marks)

The vertices of a triangle ABC are $A(2,5)$, $B(7,-3)$ and $C(-2,1)$.

(a) The midpoints of AC and AB are D and E respectively. **2**

Find the coordinates of D and E.

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(b) Show that DE is parallel to CB. **2**

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Question 14 (2 marks)

Simplify the expression $\frac{x^2}{2x^2+3x-2}-\frac{3x}{x+2}$, writing it as a single fraction.

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End of Question 14

Section II Extra writing space

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Question 15 (3 marks)

(a) In the space provided below sketch $y = -\sqrt{9-x^2}$. **2**

(b) Classify $y = -\sqrt{9-x^2}$ as one-to-one, one-to-many, many-to-one or many-to-many. **1**

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Question 16 (2 marks)

The number of hours h that it takes to paint a building varies inversely with the number of people n painting the building. That is, $h = \frac{k}{n}$, where k is some constant.

Ace Painters say that it will take 3 of their workers 102 hours to paint the building. If Janet wants the building painted in at most 48 hours, how many workers will be needed?

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Question 17 (3 marks)

Two numbers x and y are connected by the two equations $x + y = 29$ and $y^2 = 20x + 49$.

Find the values of x and y.

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Question 18 (3 marks)

Given $f(x) = x^2 - 5$, solve the equation $f(x) + 2 = f(x+2)$.

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End of Question 18

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Question 19 (3 marks)

By writing the equation of the parabola $y = x^2 - 4x + 5$ in the form $y = (x - h)^2 + k$, or otherwise, sketch it, clearly showing its vertex and y-intercept.

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Question 20 (3 marks)

(a) Show that the point $(-1, a)$ lies on both $y = a^{-x}$ and $y = -\frac{a}{x}$. **1**

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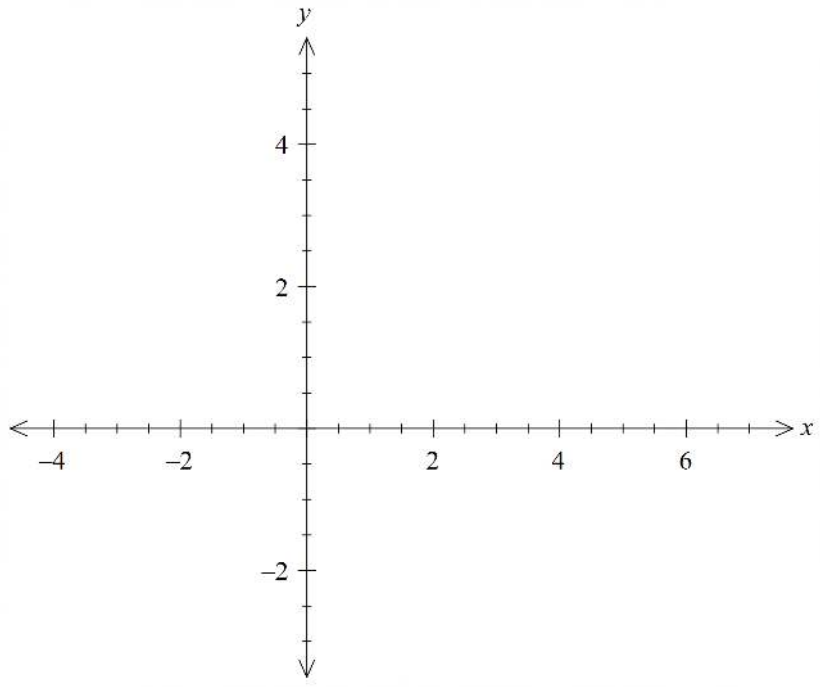
(b) Sketch the curves $y = 3^{-x}$ and $y = -\frac{3}{x}$ on the same set of axes, clearly showing their point of intersection and any asymptotes and *y*-intercepts. **2**

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Question 21 (5 marks)

The equation of the line l is $2x-3y=2$.

(a) Sketch the line l on the number plane below, clearly labelling the point $P(4,2)$ which lies on the line and also the x-intercept Q of the line l. **1**



(b) On your diagram, without finding its equation, sketch the line k which passes through P and is perpendicular to the line $2x-3y=2$. **1**

(c) **Without calculating its coordinates**, indicate a point R on the line k which is one unit from P. **1**

(d) Find the exact area of triangle QPR. **2**

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End of Question 21

Section II Extra writing space

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Question Number: |

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Question 22 (2 marks)

Solve the equation $x^{-\frac{5}{4}} = \frac{1}{4\sqrt{2}}$, showing all necessary working.

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Question 23 (3 marks)

Sonia places a large rectangular carpet with area 32 square metres in a rectangular function room with dimensions 12 metres by 8 metres. This leaves a uniform border of x metres all around the carpet between the carpet and the edges of the room.
Use an appropriate equation to find the width x metres of the border.

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Question 24 (3 marks)

Find the value of p in terms of n given that $\dfrac{2^{2n+2}-2^{2n}}{6}=2^{p}$

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Section II Extra writing space

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Question Number: |