



**BAULKHAM HILLS HIGH SCHOOL
YEAR 11 ASSESSMENT TASK 1 2024
MATHEMATICS ADVANCED**

MARKING COVER SHEET

FINAL MARK

Student Name: _____ **Teacher:** _____

	Outcomes		
Page	Functions F1	Statistics S1	Total
Multiple Choice	Q1-4, 6, 7, 9 /7	Q5, 8, 10 /3	/10
Page 9	Q11 /5		/5
Page 10	Q12-14 /6		/6
Page 11	Q16 /1	Q15 /2	/3
Page 12	Q17-19 /5		/5
Page 13	Q20 /4		/4
Page 14	Q21-22 /5		/5
Page 15	Q24 /1	Q23 /4	/5
Page 16	Q25-26 /4		/4
Page 17	Q27 /3		/3
Page 18	Q29 /2	Q28 /2	/4
Page 19	Q30-31 /6		/6
Page 20	Q32-33 /5		/5
Page 21	Q35 /3	Q34 /2	/5
Pages 22-24	Q37-38 /6	Q36 /3	/9
TOTAL	/63	/16	/79

BLANK PAGE



BAULKHAM HILLS HIGH SCHOOL

YEAR 11 ASSESSMENT TASK 1 2024

Mathematics Advanced

General Instructions

- Reading time – 5 minutes
- Working time – 1 hour 30 minutes
- Write using black pen
- Board-approved calculators may be used
- Show all necessary working in Questions 11-38
- Marks may be deducted for careless or badly arranged work
- Reference sheet has been attached

Total marks – 79

Exam consists of 24 pages.

This paper consists of TWO sections.

Section I – (10 marks) Pages (4-7)

Questions 1-10

- Attempt Questions 1-10
- Answer on answer sheet provided
- Allow about 15 minutes for this section

Section II – (69 marks) Pages (9-24)

- Attempt Questions 11-38
- Allow about 1 hour and 15 minutes

Section I - 10 marks**Use the multiple choice answer sheet for questions 1-10**

1. Let f and g be two functions such that $f(3) = 2$, $f(5) = 3$, $g(2) = 3$, $g(4) = 5$.

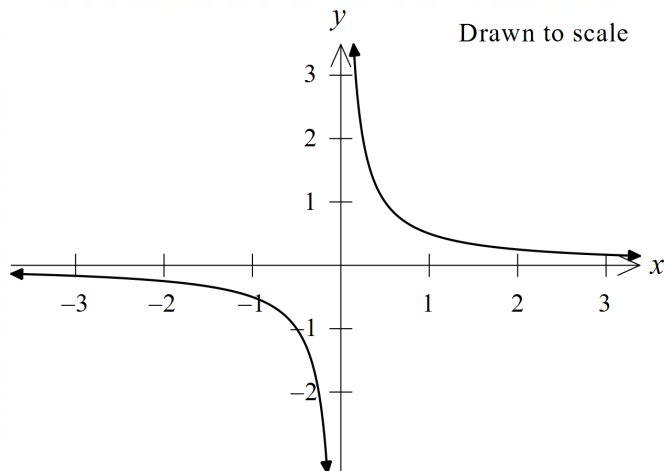
What is the value of $f(g(4))$?

- (A) 2
- (B) 3
- (C) 4
- (D) 5

2. Which of the following is equivalent to $\frac{x^6}{y^6} \div x^2 y^{-3}$?

- (A) $\frac{x^3}{y^2}$
- (B) $\frac{x^4}{y^2}$
- (C) $\frac{x^4}{y^3}$
- (D) $\frac{x^4}{y^9}$

3. Which of the following equations represents the graph below?



- (A) $y = \left(\frac{1}{2}\right)^x$
- (B) $y = 2^x$
- (C) $xy = \frac{1}{2}$
- (D) $xy = 2$

4. What are the solutions of $2x^2 - 5x - 1 = 0$?

(A) $x = \frac{-5 \pm \sqrt{17}}{4}$

(B) $x = \frac{5 \pm \sqrt{17}}{4}$

(C) $x = \frac{-5 \pm \sqrt{33}}{4}$

(D) $x = \frac{5 \pm \sqrt{33}}{4}$

5. Two hundred people were tested for COVID with the following results.

	Tests positive	Tests negative
Showed symptoms	96	24
Did not show symptoms	8	72

What is the probability that the person tests positive to COVID, given that they didn't show symptoms?

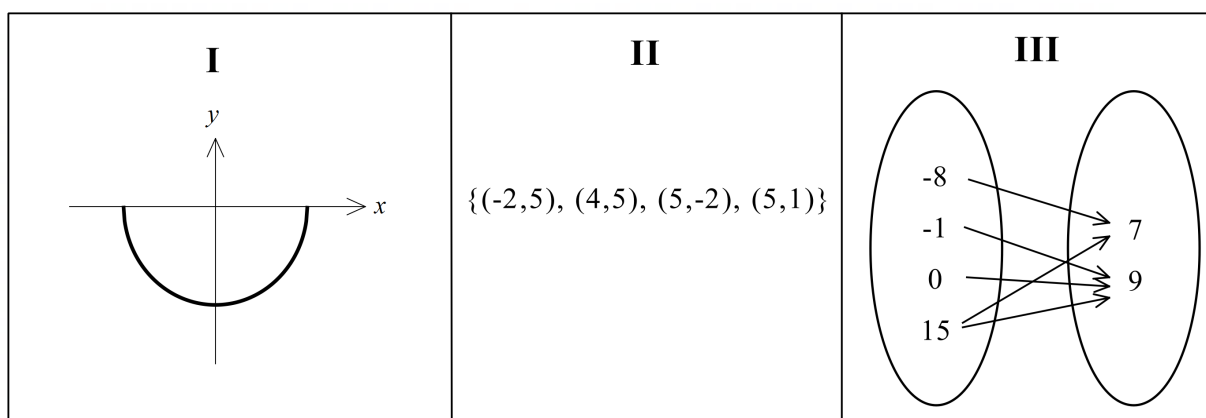
(A) $\frac{1}{10}$

(B) $\frac{1}{13}$

(C) $\frac{1}{9}$

(D) $\frac{1}{12}$

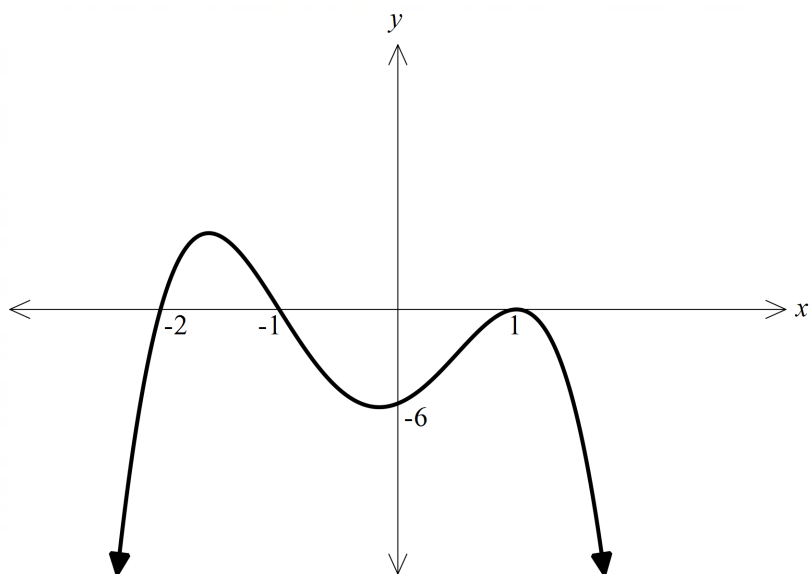
6. Which of the following represents a many-to-one relation?



- (A) I only
 (B) I and II only
 (C) I and III only
 (D) I, II and III

7. The diagram shows the graph of $y = a(x + b)(x + c)(x + d)^2$.

What are possible values of a , b , c and d ?



- (A) $a = -6$, $b = -2$, $c = -1$, $d = 1$
(B) $a = -6$, $b = 2$, $c = 1$, $d = -1$
(C) $a = -3$, $b = -2$, $c = -1$, $d = 1$
(D) $a = -3$, $b = 2$, $c = 1$, $d = -1$
8. Consider the two sets $A = \{6, 7, 8\}$ and $B = \{11, 12, 13\}$. A number is randomly selected from each set.

What is the probability that the sum of the numbers selected is equal to or greater than 20?

- (A) $\frac{1}{9}$
(B) $\frac{2}{9}$
(C) $\frac{1}{3}$
(D) $\frac{1}{6}$

9. Which of the following equations is **not** one-to-one?

(A) $y = x^3$

(B) $x^2 + y^2 = 4$

(C) $y = 1 - 4x$

(D) $y = \frac{4}{x}$

10. A game is played in which two different coloured dice are thrown once. The six faces of the red die are numbered 3, 5, 7, 8, 9 and 11. The six faces of the white die are numbered 1, 2, 4, 6, 10 and 12. The player wins if the number on the white die is larger than the number on the red die. What is the probability that the player wins exactly once in two successive games?

(A) $\frac{7}{18}$

(B) $\frac{11}{18}$

(C) $\frac{77}{162}$

(D) $\frac{77}{324}$

Mathematics Advanced
Section II Answer Booklet

69 marks

Attempt Questions 11-38

Allow about 1 hour and 15 minutes for this section

Instructions:

- 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.

Please turn over

Question 11 (5 marks)**Marks**

Simplify the following:

a) $\frac{18ab}{3a^2} \times \frac{c}{b}$

1

.....

.....

.....

.....

b) $\frac{x+2y}{3} - \frac{2x-y}{4}$

2

.....

.....

.....

.....

.....

.....

.....

c) $\frac{(2x^{-4})^3}{5x^{-1}}$

2

.....

.....

.....

.....

.....

.....

.....

.....

Question 12 (2 marks)

A function is given by the formula $f(x) = 4 \times 2^x$.

a) Evaluate $f(3)$.

1

.....

.....

.....

b) Given that $f(m) = 4$, find the value of m .

1

.....

.....

.....

Question 13 (2 marks)

Fully factorise $3x^2 + 6x - 9$.

2

.....

.....

.....

.....

.....

.....

Question 14 (2 marks)

Given the function $f(x) = x^2 - 3x + 4$, find and simplify $f(\sqrt{a} + 2)$.

2

.....

.....

.....

.....

.....

Question 15 (2 marks)

Two bags contain a number of red and green marbles:

- bag A contains 3 red marbles and 4 green marbles.
- bag B contains 5 red marbles and 2 green marbles.

A six-sided die is rolled. If the uppermost face of the die shows a number that is 1 or 2, then a marble from bag A will be selected at random. Otherwise, a marble from bag B will be selected.

What is the probability that a green marble will be selected?

2

.....

.....

.....

.....

.....

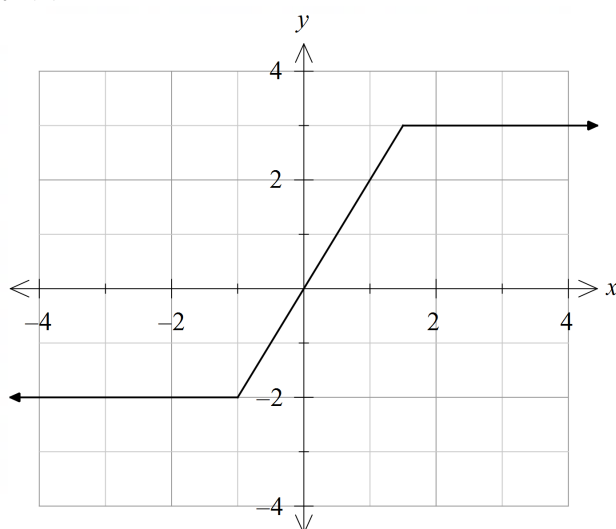
.....

.....

.....

Question 16 (1 mark)

Consider the graph $y = f(x)$ shown below.



Evaluate $f(-3) + 2f(2)$.

1

.....

.....

Question 17 (1 mark)

Write an equation of a straight line which is **not** a function.

1

.....

.....

Question 18 (2 marks)

Express $(A - B)^2 + (A + B)^2$ in simplest form, if $A^2 + B^2 = 3$.

2

.....

.....

.....

.....

.....

.....

.....

.....

Question 19 (2 marks)

Solve $\frac{7x}{3} = 1 + \frac{4x}{2}$.

2

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Question 20 (4 marks)

The perimeter of a rectangle is 34 cm and its area is 72 cm^2 .

- a) If the width of the rectangle is x cm, show the area of the rectangle is $A = 17x - x^2$.

2

.....

.....

.....

.....

.....

.....

.....

.....

.....

- b) Hence find the length and width of the rectangle.

2

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Question 21 (3 marks)

In 1 hour, 80 people attend a swimming pool and the money taken at the gate amounts to \$139. **3**

If the adults are charged \$2.50 and children \$1.50, how many of each entered the pool that hour?

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Question 22 (2 marks)

The amount of petrol (P) used in a car is directly proportional to the distance (D) travelled. If **2**

the car uses 34.2 litres of petrol for an 85.5 km trip, find how far the car travelled if it used 35.5 L of petrol.

.....

.....

.....

.....

.....

.....

.....

.....

.....

Question 23 (4 marks)

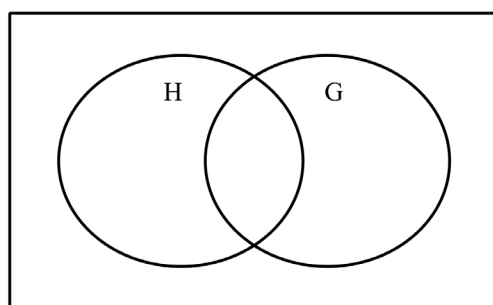
History (H) and Geography (G) are two of the subjects students may decide to study.

For a group of 40 students, the following is known.

- 7 students study neither History nor Geography
- 20 students study History
- 18 students study Geography

- a) A student is chosen at random. By completing the Venn diagram below, find the probability that the student studies both History and Geography.

2



- b) Two different students are chosen at random, one after the other. What is the probability that the first student studies History and the second student does not study History?

2

.....

.....

Question 24 (1 mark)

Show that $\frac{1}{3+\sqrt{3}} = \frac{3-\sqrt{3}}{6}$.

1

.....

.....

.....

.....

.....

.....

Question 25 (2 marks)

2

Solve the following simultaneous equations:

$$y = 2x + 3$$

$$xy = 2$$

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Question 26 (2 marks)

2

Simplify $\frac{6^{3n} \times 9^n}{2^{3n}}$.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Question 27 (3 marks)

Sketch the quadratic function $y = -x^2 + 2x + 3$, showing all important features.

3

.....

.....

.....

.....

.....

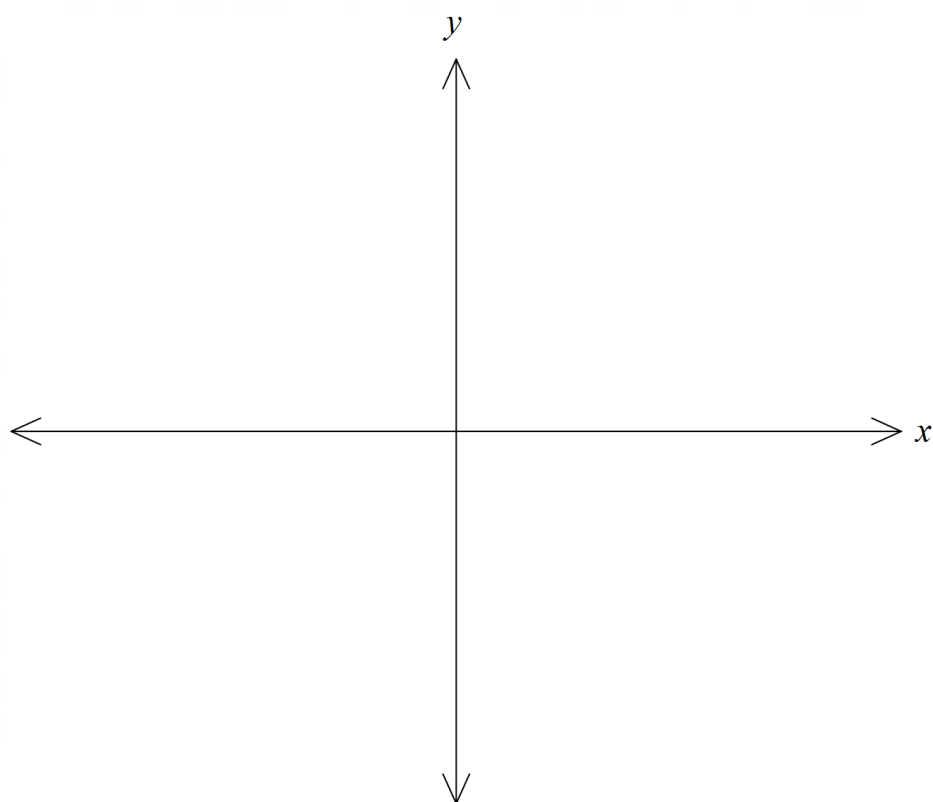
.....

.....

.....

.....

.....



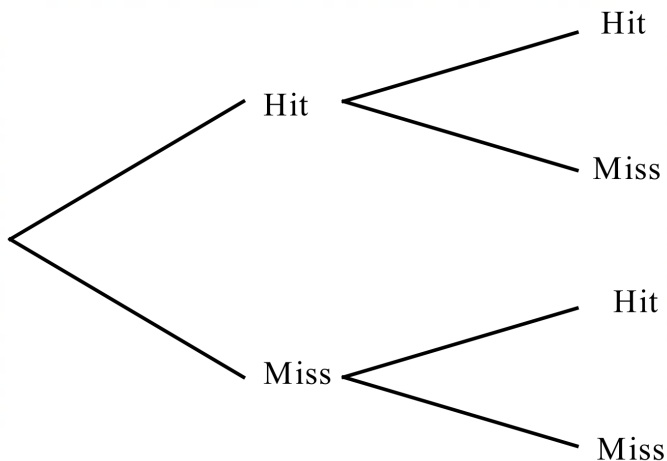
Question 28 (2 marks)

Vaani is playing darts. She throws two darts aiming for a target.

The probability Vaani hits the target on her first throw is $\frac{1}{4}$. The probability she hits the target on her second throw is $\frac{1}{3}$.

- a) Complete the probability tree diagram showing the above information.

1



- b) Find the probability that Vaani hits the target at least once.

1

.....

.....

.....

.....

Question 29 (2 marks)

Simplify $\frac{x^2 - 9}{x^2 - x - 6} \div \frac{x^3 + 3x^2}{x^2 + 4x + 4}$.

2

.....

.....

.....

.....

.....

.....

.....

Question 30 (2 marks)

By completing the square, solve $x^2 + 6x + 7 = 0$. Express your answer in surd form.

2

.....

.....

.....

.....

.....

.....

.....

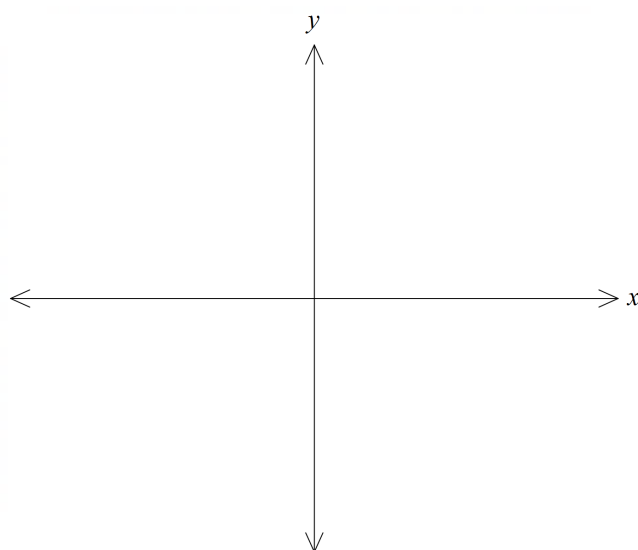
.....

Question 31 (4 marks)

Consider $f(x) = \sqrt{4 - x^2}$

a) Sketch $f(x)$.

2



b) State the domain and range of $f(x)$.

2

.....

.....

.....

.....

Question 32 (2 marks)

For what value(s) of k does $2x^2 - 3x - (k + 1) = 0$ have no real solutions?

2

.....

.....

.....

.....

.....

.....

.....

.....

.....

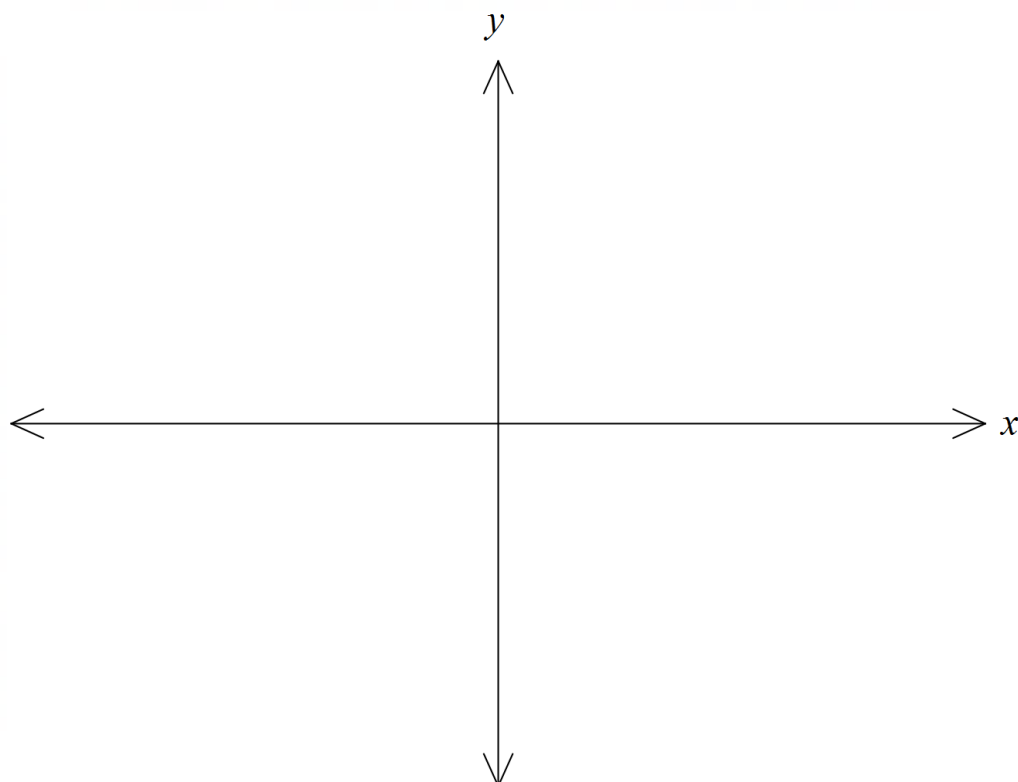
.....

.....

Question 33 (3 marks)

Sketch the graph of $y = (x - 3)(x + 1)(x - 1)^3$, showing all intercepts.

3



Question 34 (2 marks)

Two events, A and B , are such that $P(A) = \frac{2}{7}$ and $P(B) = \frac{3}{5}$. Find the value of $P(\overline{A} \cap B)$, if

2

$$P(A \cup B) = \frac{4}{5}.$$

.....

.....

.....

.....

.....

.....

.....

.....

.....

Question 35 (3 marks)

Solve $4y^4 - 5y^2 + 1 = 0$.

3

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Question 36 (3 marks)

A market research company is conducting a survey on health, diet, and exercise on the staff of a large factory.

They found that $\frac{1}{3}$ of the factory workers took regular exercise and $\frac{1}{2}$ of the factory workers ate breakfast. They further found that of those factory workers who took regular exercise $\frac{1}{8}$ also ate breakfast.

A factory worker is selected at random.

- a) Find the probability that the worker does not eat breakfast and does not take regular exercise.

2

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- b) Determine, with reason, whether the events “take regular exercise” and “eat breakfast” are statistically independent.

1

.....

.....

.....

.....

.....

.....

Question 37 (3 marks)

If $\frac{2}{3x-2c} + \frac{3}{2x-3c} = \frac{7}{2c}$, find x in terms of c .

3

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

Question 38 (3 marks)

The function f satisfies $2f(x) + 3f\left(\frac{2x+3}{x-2}\right) = 3x+1$, $x \in \mathbb{R}$. Find the value of $f(9)$.

3

This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

End of Exam



BAULKHAM HILLS HIGH SCHOOL
YEAR 11 ASSESSMENT TASK 1 2024
MATHEMATICS ADVANCED

Student Name: _____

Teacher: _____

Mathematics

Section I – Multiple Choice

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 the correct answer by writing the word *correct* and drawing an arrow as follows.

A ☒ B ☒ C ☐ D ☐
correct (arrow pointing to B)

- Start Here →
- | | | | | | | | |
|----------------------------|-------------------------|-------------------------|-------------------------|-----------------------------|-------------------------|-------------------------|-------------------------|
| 1. A ☐ | B ☐ | C ☐ | D ☐ | 6. A ☐ | B ☐ | C ☐ | D ☐ |
| 2. A ☐ | B ☐ | C ☐ | D ☐ | 7. A ☐ | B ☐ | C ☐ | D ☐ |
| 3. A ☐ | B ☐ | C ☐ | D ☐ | 8. A ☐ | B ☐ | C ☐ | D ☐ |
| 4. A ☐ | B ☐ | C ☐ | D ☐ | 9. A ☐ | B ☐ | C ☐ | D ☐ |
| 5. A ☐ | B ☐ | C ☐ | D ☐ | 10. A ☐ | B ☐ | C ☐ | D ☐ |

BLANK PAGE



Mathematics Advanced
Mathematics Extension 1
Mathematics Extension 2

REFERENCE SHEET**Measurement****Length**

$$l = \frac{\theta}{360} \times 2\pi r$$

Area

$$A = \frac{\theta}{360} \times \pi r^2$$

$$A = \frac{h}{2}(a + b)$$

Surface area

$$A = 2\pi r^2 + 2\pi rh$$

$$A = 4\pi r^2$$

Volume

$$V = \frac{1}{3}Ah$$

$$V = \frac{4}{3}\pi r^3$$

Functions

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

For $ax^3 + bx^2 + cx + d = 0$:

$$\alpha + \beta + \gamma = -\frac{b}{a}$$

$$\alpha\beta + \alpha\gamma + \beta\gamma = \frac{c}{a}$$

$$\text{and } \alpha\beta\gamma = -\frac{d}{a}$$

Relations

$$(x - h)^2 + (y - k)^2 = r^2$$

Financial Mathematics

$$A = P(1 + r)^n$$

Sequences and series

$$T_n = a + (n - 1)d$$

$$S_n = \frac{n}{2}[2a + (n - 1)d] = \frac{n}{2}(a + l)$$

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(1 - r^n)}{1 - r} = \frac{a(r^n - 1)}{r - 1}, r \neq 1$$

$$S = \frac{a}{1 - r}, |r| < 1$$

Logarithmic and Exponential Functions

$$\log_a a^x = x = a^{\log_a x}$$

$$\log_a x = \frac{\log_b x}{\log_b a}$$

$$a^x = e^{x \ln a}$$

Trigonometric Functions

$$\sin A = \frac{\text{opp}}{\text{hyp}}, \quad \cos A = \frac{\text{adj}}{\text{hyp}}, \quad \tan A = \frac{\text{opp}}{\text{adj}}$$

$$A = \frac{1}{2}ab \sin C$$

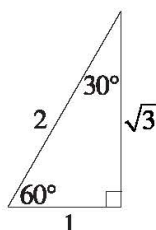
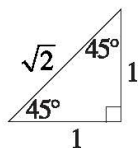
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$c^2 = a^2 + b^2 - 2ab \cos C$$

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

$$l = r\theta$$

$$A = \frac{1}{2}r^2\theta$$



Trigonometric identities

$$\sec A = \frac{1}{\cos A}, \quad \cos A \neq 0$$

$$\operatorname{cosec} A = \frac{1}{\sin A}, \quad \sin A \neq 0$$

$$\cot A = \frac{\cos A}{\sin A}, \quad \sin A \neq 0$$

$$\cos^2 x + \sin^2 x = 1$$

Compound angles

$$\sin(A + B) = \sin A \cos B + \cos A \sin B$$

$$\cos(A + B) = \cos A \cos B - \sin A \sin B$$

$$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$\text{If } t = \tan \frac{A}{2} \text{ then } \sin A = \frac{2t}{1+t^2}$$

$$\cos A = \frac{1-t^2}{1+t^2}$$

$$\tan A = \frac{2t}{1-t^2}$$

$$\cos A \cos B = \frac{1}{2} [\cos(A - B) + \cos(A + B)]$$

$$\sin A \sin B = \frac{1}{2} [\cos(A - B) - \cos(A + B)]$$

$$\sin A \cos B = \frac{1}{2} [\sin(A + B) + \sin(A - B)]$$

$$\cos A \sin B = \frac{1}{2} [\sin(A + B) - \sin(A - B)]$$

$$\sin^2 nx = \frac{1}{2} (1 - \cos 2nx)$$

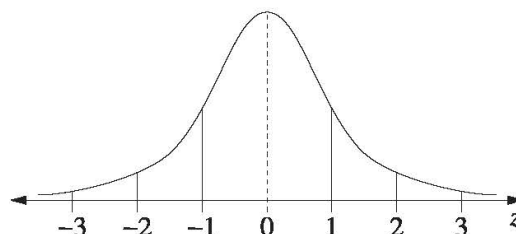
$$\cos^2 nx = \frac{1}{2} (1 + \cos 2nx)$$

Statistical Analysis

$$z = \frac{x - \mu}{\sigma}$$

An outlier is a score
less than $Q_1 - 1.5 \times IQR$
or
more than $Q_3 + 1.5 \times IQR$

Normal distribution



- approximately 68% of scores have z-scores between -1 and 1
- approximately 95% of scores have z-scores between -2 and 2
- approximately 99.7% of scores have z-scores between -3 and 3

$$E(X) = \mu$$

$$\operatorname{Var}(X) = E[(X - \mu)^2] = E(X^2) - \mu^2$$

Probability

$$P(A \cap B) = P(A)P(B)$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)}, \quad P(B) \neq 0$$

Continuous random variables

$$P(X \leq r) = \int_a^r f(x) dx$$

$$P(a < X < b) = \int_a^b f(x) dx$$

Binomial distribution

$$P(X = r) = {}^nC_r p^r (1-p)^{n-r}$$

$$X \sim \operatorname{Bin}(n, p)$$

$$\Rightarrow P(X = x)$$

$$= \binom{n}{x} p^x (1-p)^{n-x}, \quad x = 0, 1, \dots, n$$

$$E(X) = np$$

$$\operatorname{Var}(X) = np(1-p)$$

Year 11 Assessment Task 1 2024

Mathematics Advanced

Section I - Multiple Choice

1. B 2. C 3. C 4. D 5. A 6. A 7. D 8. C 9. B 10. C

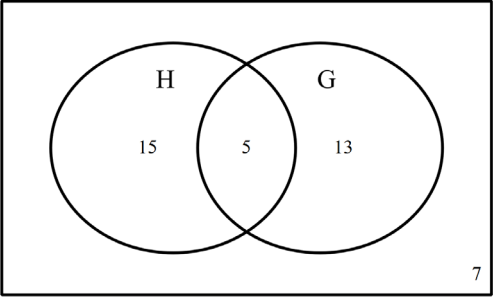
Question	Worked Solutions	Suggested Marking Criteria
1	$f(g(4)) = f(5)$ $= 3$	B
2	$\frac{x^6}{y^6} \div x^2 y^{-3} = \frac{x^6}{y^6} \div \frac{x^2}{y^3}$ $= \frac{x^6}{y^6} \times \frac{y^3}{x^2}$ $= \frac{x^4}{y^3}$	C
3	This is a hyperbola which eliminates options A and B. Testing when $x = 1$ for option C, $y = 0.5$. Testing when $x = 1$ for option D, $y = 2$. Since the graph is drawn to scale, must be option C	C
4	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(-5) \pm \sqrt{(-5)^2 - 4(2)(-1)}}{2(2)}$ $= \frac{5 \pm \sqrt{33}}{4}$	D
5	$P(\text{tests positive} \text{no symptoms}) = \frac{n(\text{test positive and no symptoms})}{n(\text{shows no symptoms})}$ $= \frac{8}{80}$ $= \frac{1}{10}$	A
6	I is many-to-one. II is many-to-many. III is many-to-many. $\therefore$ I only	A

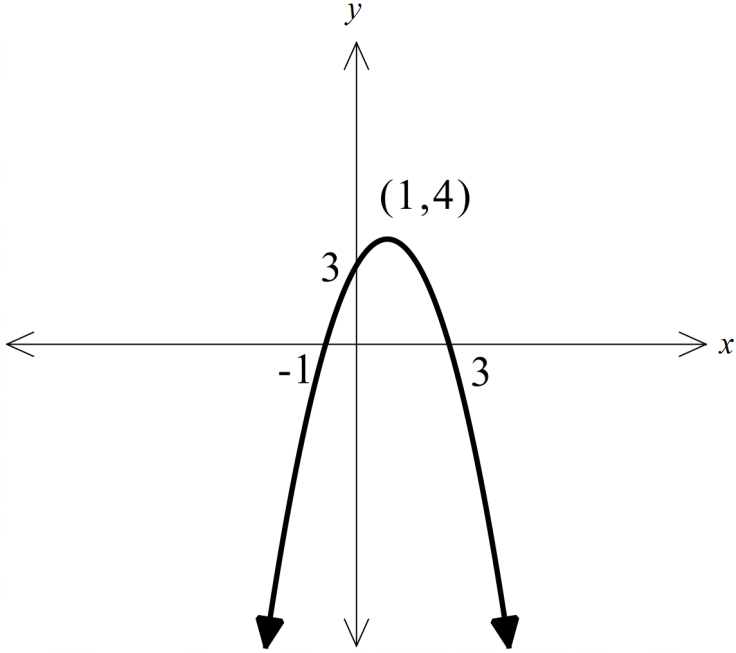
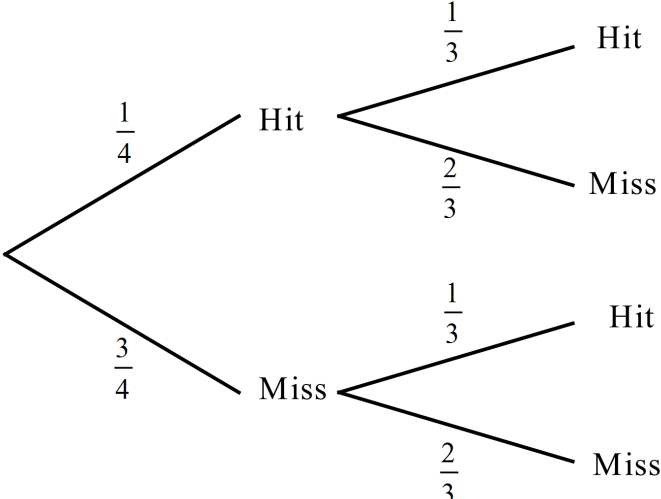
7	$y = a(x + b)(x + c)(x + d)^2$ $y = a(x + 2)(x + 1)(x - 1)^2$ $-6 = a(0 + 2)(0 + 1)(0 - 1)^2$ $a = -3$ $\therefore a = -3, b = 2, c = 1, d = -1$				D																																																											
8	<table><tr><td></td><td>11</td><td>12</td><td>13</td></tr><tr><td>6</td><td>17</td><td>18</td><td>19</td></tr><tr><td>7</td><td>18</td><td>19</td><td>20</td></tr><tr><td>8</td><td>19</td><td>20</td><td>21</td></tr></table> $P(\text{sum} \geq 20) = \frac{3}{9}$ $= \frac{1}{3}$		11	12	13	6	17	18	19	7	18	19	20	8	19	20	21				C																																											
	11	12	13																																																													
6	17	18	19																																																													
7	18	19	20																																																													
8	19	20	21																																																													
9	Options A, C and D are all one-to-one. $\therefore x^2 + y^2 = 4$ is many-to-many, not one-to-one				B																																																											
10	<table><tr><td></td><td></td><td colspan="6">White die</td></tr><tr><td></td><td>+</td><td>1</td><td>2</td><td>4</td><td>6</td><td>10</td><td>12</td></tr><tr><td rowspan="6">Red die</td><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>7</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>8</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>9</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>11</td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> $P(W) = \frac{14}{36}$ $\therefore P(LW) + P(WL) = \frac{22}{36} \times \frac{14}{36} + \frac{14}{36} \times \frac{22}{36}$ $= \frac{77}{162}$			White die							+	1	2	4	6	10	12	Red die	3							5							7							8							9							11										C
		White die																																																														
	+	1	2	4	6	10	12																																																									
Red die	3																																																															
	5																																																															
	7																																																															
	8																																																															
	9																																																															
	11																																																															

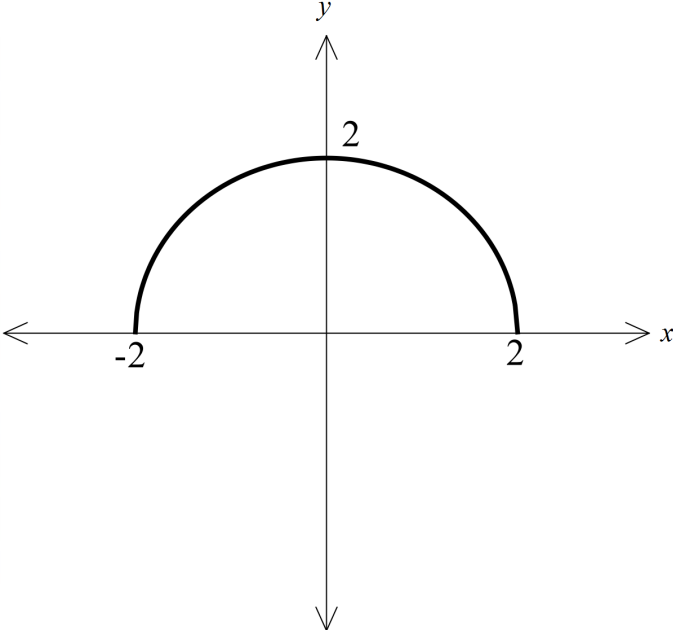
Section II – Short answer questions

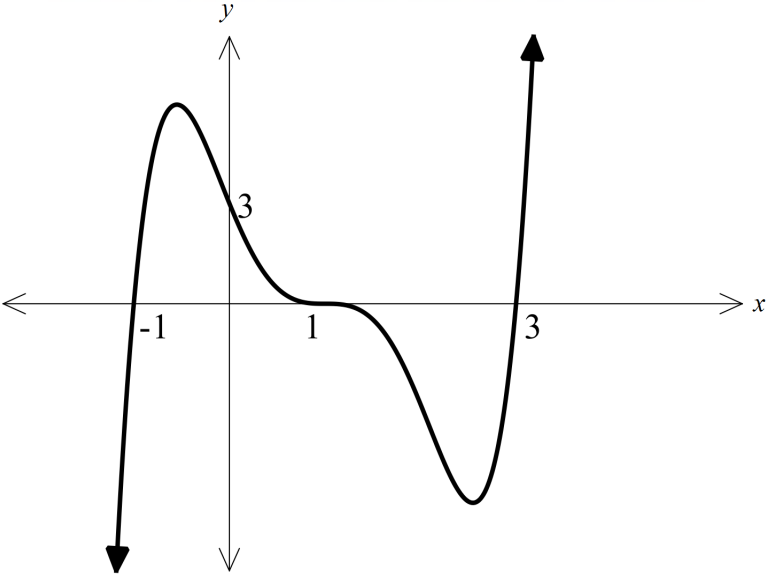
Q	Worked Solutions	Suggested Marking Criteria
11a	$\frac{18ab}{3a^2} \times \frac{c}{b} = \frac{6c}{a}$	1 correct solution
11b	$\frac{x+2y}{3} - \frac{2x-y}{4} = \frac{4(x+2y) - 3(2x-y)}{12}$ $= \frac{4x+8y-6x+3y}{12}$ $= \frac{-2x+11y}{12}$	2 correct solution 1 correct attempt to making the denominator the same
11c	$\frac{(2x^{-4})^3}{5x^{-1}} = \frac{8x^{-12}}{5x^{-1}}$ $= \frac{8x^{-11}}{5} \text{ or } \frac{8}{5x^{11}}$	2 correct solution 1 expanding the bracket
12a	$f(3) = 4 \times 2^3$ $= 32$	1 correct solution
12b	$4 = 4 \times 2^m$ $1 = 2^m$ $\therefore m = 0$	1 correct solution
13	$3x^2 + 6x - 9 = 3(x^2 + 2x - 3)$ $= 3(x-1)(x+3)$	2 correct solution 1 correctly factorises 3 as a HCF
14	$f(\sqrt{a}+2) = (\sqrt{a}+2)^2 - 3(\sqrt{a}+2) + 4$ $= a + 4\sqrt{a} + 4 - 3\sqrt{a} - 6 + 4$ $= \sqrt{a} + a + 2$	2 correct solution 1 correctly expands the perfect square
15	$\text{Bag A then Green} = \frac{2}{6} \times \frac{4}{7} = \frac{4}{21}$ $\text{Bag B then Green} = \frac{4}{6} \times \frac{2}{7} = \frac{4}{21}$ $\therefore \frac{4}{21} + \frac{4}{21} = \frac{8}{21}$	2 correct solution 1 correctly identifies the probability of obtaining bag A and the probability of bag B

16	$f(-3) = -2$ $f(2) = 3$ $\therefore f(-3) + 2f(2) = -2 + 6$ $= 4$	1 correct solution
17	$x = 2$ or $x = -2$ etc Any vertical line	1 correct solution
18	$(A - B)^2 + (A + B)^2 = A^2 - 2AB + B^2 + A^2 + 2AB + B^2$ $= 2A^2 + 2B^2$ $= 2 \times 3$ $= 6$	2 correct solution 1 correctly expands the expression
19	$\frac{7x}{3} = 1 + \frac{4x}{2}$ $14x = 6 + 12x$ $2x = 6$ $x = 3$	2 correct solution 1 multiplies both sides by 6
20a	let length be l $P = 2x + 2l$ $34 = 2x + 2l$ $l = 17 - x$ $A = xl$ $= x(17 - x)$ $= 17x - x^2$	2 correctly shows the area is $17x - x^2$ 1 correctly shows the length is $17 - x$
20b	$72 = 17x - x^2$ $x^2 - 17x + 72 = 0$ $(x - 9)(x - 8) = 0$ $x = 9$ or 8 if $x = 9$, $l = 8$ or if $x = 8$, $l = 9$	2 correct solution 1 forms a quadratic to solve Note: Does not need both solutions
21	let a = adult and c = children $a + c = 80 \Rightarrow c = 80 - a$ $2.50a + 1.50c = 139$ $2.50a + 1.50(80 - a) = 139$ $2.50a + 120 - 1.50a = 139$ $a = 19$, $c = 61$ $\therefore$ 19 adults and 61 children	3 correct solution 2 correctly attempts simultaneous equations 1 correctly forms the 2 equations before simultaneous equations

22	$P = kD$ $34.2 = k \times 85.5$ $k = 0.4$ $35.5 = 0.4 \times D$ $D = 88.75 \text{ km}$	2 correct solution 1 correctly finds the constant term
23a	To find the intersection: $40 - 7 - 20 - 18 = 5$  $\frac{5}{40}$	2 correct venn diagram and probability 1 correct venn diagram or probability
23b	$\frac{20}{40} \times \frac{20}{39} = \frac{10}{39}$	2 correct solution 1 correctly identifies the probability that the first student studies History
24	$\frac{1}{3 + \sqrt{3}} \times \frac{3 - \sqrt{3}}{3 - \sqrt{3}} = \frac{3 - \sqrt{3}}{9 - 3}$ $= \frac{3 - \sqrt{3}}{6}$	1 shows multiplying the conjugate surd
25	$x(2x + 3) = 2$ $2x^2 + 3x - 2 = 0$ $(x + 2)(2x - 1) = 0$ $x = -2, \quad x = \frac{1}{2}$ if $x = -2, y = -1$ if $x = \frac{1}{2}, y = 4$	2 correct solutions 1 correctly substitutes and solves for x
26	$\frac{6^{3n} \times 9^n}{2^{3n}} = \frac{(2 \times 3)^{3n} \times 3^{2n}}{2^{3n}}$ $= \frac{2^{3n} \times 3^{3n} \times 3^{2n}}{2^{3n}}$ $= 3^{5n}$	2 correct solution 1 correctly obtains $2^{3n} \times 3^{3n}$ for 6^{3n}

27		3 correct graph with all important features provided - x and y intercepts - Turning point - Correct shape 2 correct x intercept and correct turning point 1 correct x intercept or correct turning point
28a		1 correct shows the probability on all branches
28b	$1 - (\text{miss both}) = 1 - \left(\frac{3}{4} \times \frac{2}{3} \right)$ $= \frac{1}{2}$	1 correct solution

29	$\frac{x^2 - 9}{x^2 - x - 6} \div \frac{x^3 + 3x^2}{x^2 + 4x + 4} = \frac{(x-3)(x+3)}{(x-3)(x+2)} \times \frac{(x+2)^2}{x^2(x+3)}$ $= \frac{x+2}{x^2}$	3 correct solution 2 correctly factorises three expressions and multiplies by the reciprocal 1 correctly factorises at least two expressions
30	$x^2 + 6x + 7 = 0$ $x^2 + 6x + \left(\frac{6}{2}\right)^2 - \left(\frac{6}{2}\right)^2 + 7 = 0$ $(x+3)^2 = 2$ $x+3 = \pm\sqrt{2}$ $x = -3 \pm \sqrt{2}$	2 correct solution 1 correctly forms a perfect square
31a		2 correct graph showing all important features 1 identifies it is a semi circle
31b	Domain: $-2 \leq x \leq 2$ Range: $0 \leq y \leq 2$	2 correct solution 1 correct domain or range

32	$b^2 - 4ac < 0$ $(-3)^2 - 4(2)(-k - 1) < 0$ $9 - 8(-k - 1) < 0$ $k < -\frac{17}{8}$	2 correct solution 1 identifies $\Delta < 0$
33		3 correct graph 2 identifies a cubic root and has correct and has correct x and y intercepts 1 correct x and y intercepts
34	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ $\frac{4}{5} = \frac{2}{7} + \frac{3}{5} - P(A \cap B)$ $P(A \cap B) = \frac{3}{35}$ $P(\bar{A} \cap B) = \frac{3}{5} - \frac{3}{35}$ $= \frac{18}{35}$	2 correction solution 1 correctly finds P(A and B)
35	let $x = y^2$ $4x^2 - 5x + 1 = 0$ $(4x - 1)(x - 1) = 0$ $x = \frac{1}{4}$ or $x = 1$ When $x = \frac{1}{4}, y = \pm \frac{1}{2}$ When $x = 1, y = \pm 1$	3 correct solutions 2 correctly finds x or equivalent 1 correctly reduces the quartic to a quadratic equation

36a	$P(E) = \frac{1}{3}$ $P(B) = \frac{1}{2}$ $P(B E) = \frac{1}{8}$ $P(B E) = \frac{P(B \cap E)}{P(E)}$ $\frac{1}{8} = \frac{P(B \cap E)}{\frac{1}{3}}$ $P(B \cap E) = \frac{1}{24}$ $\therefore P(\bar{B} \cap \bar{E}) = 1 - \left(\frac{1}{3} + \frac{1}{2} - \frac{1}{24} \right) = \frac{5}{24}$	2 correct solution 1 correctly finds $P(B \cap E)$ 0 bold answer
36b	<u>Method 1:</u> If independent: $P(E) \times P(B) = P(E \cap B)$ $P(E) \times P(B) = \frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$ $P(E \cap B) = \frac{1}{24}$ Since $P(E) \times P(B) \neq P(E \cap B)$ $\therefore$ Not independent events	1 correct proof (must identify rules used and clearly state values of $P(E)$, $P(B)$ and $P(E \cap B)$)
	<u>Method 2:</u> If independent: $P(B E) = P(B)$ $P(B E) = \frac{1}{8}$ $P(B) = \frac{1}{2}$ Since $P(B E) \neq P(B)$ $\therefore$ Not independent events	1 correct proof (must identify rules used and clearly state values of $P(B)$, $P(B E)$)
37	$\frac{2}{3x-2c} + \frac{3}{2x-3c} = \frac{7}{2c}$ $\frac{2(2x-3c) + 3(3x-2c)}{(3x-2c)(2x-3c)} = \frac{7}{2c}$ $\frac{4x-6c+9x-6c}{6x^2-9cx-4cx+6c^2} = \frac{7}{2c}$ $\frac{13x-12c}{6x^2-13cx+6c^2} = \frac{7}{2c}$ $2c(13x-12c) = 7(6x^2-13cx+6c^2)$ $26cx-24c^2 = 42x^2-91cx+42c^2$ $42x^2-117cx+66c^2 = 0$ $3(x-2c)(14x-11c) = 0$ $x = 2c \text{ or } x = \frac{11c}{14}$	3 correct solution 2 Finds a correct equation by substituting and and attempts to solve simultaneously 1 Finds a correct equation by substituting or

38	When $x = 9$, $2f(9) + 3f\left(\frac{2(9)+3}{9-2}\right) = 3(9) + 1$ $2f(9) + 3f(3) = 28 \quad (1)$ When $x = 3$, $2f(3) + 3f\left(\frac{2(3)+3}{3-2}\right) = 3(3) + 1$ $2f(3) + 3f(9) = 10$ $f(3) = 5 - \frac{3}{2}f(9) \quad (2)$ Sub (2) into (1) $2f(9) + 3\left(5 - \frac{3}{2}f(9)\right) = 28$ $2f(9) + 15 - \frac{9}{2}f(9) = 28$ $-\frac{5}{2}f(9) = 13$ $\therefore f(9) = -\frac{26}{5}$	3 correct solution 2 finds an expression for $f(3)$ and $f(9)$, and attempts to solve simultaneously 1 correctly finds $f(9)$ in terms of $f(3)$ or equivalent
----	---	---