MARKING GUIDELINE

MARKS	DURATION	QUESTIONS
35	55 minutes	3

Name: _____ Class: _____

Date: _____

MARK ____ / 35

INSTRUCTIONS AND INFORMATION

1. Answer **ALL** the questions in this question paper.
2. Answer QUESTION 1 by **circling** the letter (A–D) in the answer grid at the end of that section.
3. Show **ALL** calculations clearly.
4. Show all units where applicable.
5. Number the answers correctly according to the numbering system used in this question paper.
6. A non-programmable calculator may be used, unless stated otherwise.
7. Write neatly and legibly.

QUESTION 1 [10 MARKS]

Four options are given as possible answers to the following questions. Choose the correct answer and circle the letter (A–D) in the grid at the end of this section. If you want to change your choice, put a cross through the wrong letter and circle your new choice.

1.1 $\frac{x^2-4}{x+2}$ simplifies to ... (1)

A) -2 **B)** x^2-2

C) $x+2$ **D)** $x-2$ ✓

Answer: D — $x^2-4=(x+2)(x-2)$, so the $(x+2)$ cancels.

- **A** — cancelled x^2 against x, which cannot be done across a sum
- **B** — cancelled the 4 against the 2 without factorising first
- **C** — cancelled the wrong factor

1.2 $\frac{x}{3}+\frac{x}{4}=\ldots$ (1)

A) $\frac{2x}{12}$ **B)** $\frac{2x}{7}$

C) $\frac{7x}{12}$ ✓ **D)** $\frac{x^2}{12}$

Answer: C — The lowest common denominator is 12, so it is $\frac{4x}{12}+\frac{3x}{12}=\frac{7x}{12}$.

- **A** — added the numerators without first writing each over 12
- **B** — added the numerators AND the denominators
- **D** — MULTIPLIED the two fractions instead of adding them

1.3 $\frac{3x+6}{x^2-4}$ simplifies to ... (1)

A) $\frac{3}{x-2}$ ✓ **B)** $\frac{3}{x+2}$

C) $\frac{3x}{x-2}$ **D)** $\frac{3(x+2)}{x-2}$

Answer: A — $3x+6=3(x+2)$ and $x^2-4=(x+2)(x-2)$, so the $(x+2)$ cancels.

- **B** — cancelled $(x-2)$ instead of $(x+2)$
- **C** — cancelled the 6 against the 4 and left the x in the numerator
- **D** — cancelled the denominator's $(x+2)$ but not the numerator's

1.4 $\frac{x}{2} \div \frac{x}{6} = \ldots$ (1)

A) $\frac{x^2}{12}$ **B)** $\frac{1}{3}$

C) 3 ✓ **D)** $\frac{x}{3}$

Answer: C — Dividing means multiplying by the reciprocal: $\frac{x}{2} \times \frac{6}{x} = \frac{6x}{2x} = 3$.

- **A** — multiplied straight across without inverting the second fraction
- **B** — inverted the FIRST fraction instead of the second
- **D** — cancelled the x and then wrote it in again

1.5 $\frac{2}{x} - \frac{1}{x+1} = \ldots$ (1)

A) $\frac{x+2}{x(x+1)}$ ✓ **B)** $\frac{x+2}{2x+1}$

C) $\frac{1}{x(x+1)}$ **D)** $\frac{1}{2x+1}$

Answer: A — Over the LCD $x(x+1)$ this is $\frac{2x+2-x}{x(x+1)} = \frac{x+2}{x(x+1)}$.

- **B** — found the right numerator but subtracted the denominators
- **C** — subtracted the numerators without first multiplying each by its missing factor
- **D** — subtracted the numerators AND the denominators

1.6 For which value of x is $\frac{x+3}{x-5}$ UNDEFINED? (1)

A) $x=-3$ **B)** $x=3$

C) $x=5$ ✓ **D)** $x=-5$

Answer: C — A fraction is undefined only when its DENOMINATOR is zero, and $x-5=0$ at $x=5$.

- **A** — that makes the NUMERATOR zero, which gives 0, not undefined
- **B** — changed the sign of the numerator's 3 instead of solving the denominator
- **D** — $x-5=0$ gives $x=+5$, not -5

1.7 $\frac{x^2+5x+6}{x^2-9}$ simplifies to ... (1)

A) $\frac{5x+6}{-9}$

B) $\frac{x+2}{x-3}$ ✓

C) $\frac{x+2}{x+3}$

D) $\frac{x+3}{x-3}$

Answer: B — $(x+2)(x+3)$ over $(x+3)(x-3)$ — the $(x+3)$ cancels.

- **A** — cancelled the x^2 terms, which cannot be done across a sum
- **C** — cancelled $(x-3)$ instead of $(x+3)$
- **D** — cancelled $(x+2)$ instead of $(x+3)$

1.8 $\frac{x+1}{x-2} \times \frac{x-2}{x+3} = \ldots$ (1)

A) $\frac{x+1}{x-2}$

B) $\frac{(x+1)(x-2)}{(x-2)(x+3)}$

C) $\frac{x-2}{x+3}$

D) $\frac{x+1}{x+3}$ ✓

Answer: D — The $(x-2)$ appears in a numerator and in a denominator, so it cancels.

- **A** — cancelled $(x+3)$ instead of $(x-2)$
- **B** — a correct product, but the common $(x-2)$ has not been cancelled
- **C** — cancelled $(x+1)$ instead of $(x-2)$

1.9 $\frac{x^3-8}{x-2}$ simplifies to ... (1)

A) x^2+2x+4 ✓

B) x^2-4

C) x^2-2x+4

D) x^2+4

Answer: A — $x^3-8=(x-2)(x^2+2x+4)$, so the $(x-2)$ cancels.

- **B** — treated x^3-8 as a difference of squares
- **C** — the middle sign of the trinomial is the OPPOSITE of the binomial's
- **D** — left out the middle term $2x$

1.10 $\frac{2x-6}{9-x^2}$ simplifies to ... (1)

A) $\frac{2}{3-x}$

B) $\frac{-2}{3+x}$ ✓

C) $\frac{2}{3+x}$

D) $\frac{-2}{3-x}$

Answer: B — $2x-6=-2(3-x)$ and $9-x^2=(3-x)(3+x)$, so the $(3-x)$ cancels and the minus stays.

- **A** — cancelled $(3+x)$ instead of $(3-x)$, and lost the minus too
- **C** — lost the minus that comes from reversing $x-3$ into $3-x$
- **D** — cancelled $(3+x)$ instead of $(3-x)$

ANSWER GRID — MARKING GUIDELINE

1.1	A	B	C	**D**
1.2	A	B	**C**	D
1.3	**A**	B	C	D
1.4	A	B	**C**	D
1.5	**A**	B	C	D
1.6	A	B	**C**	D
1.7	A	**B**	C	D
1.8	A	B	C	**D**
1.9	**A**	B	C	D
1.10	A	**B**	C	D

QUESTION 2 [11 MARKS]

Simplify the following FULLY.

2.1 $\dfrac{x^2-16}{x+4}$ (3)

Factorise the numerator: $\dfrac{(x+4)(x-4)}{x+4}$ *(2)*

$= \boldsymbol{x-4}$ *(1)*

2.2 $\dfrac{x^2-1}{x} \div \dfrac{x+1}{3x}$ (4)

Multiply by the reciprocal *(1)*

$= \dfrac{(x+1)(x-1)\times 3x}{x(x+1)}$ *(2)*

$= \boldsymbol{3(x-1)}$ *(1)*

2.3 $\dfrac{2}{x+1} + \dfrac{3}{x-1}$ (4)

LCD $= (x+1)(x-1)$ *(1)*

$= \dfrac{2(x-1)+3(x+1)}{x^2-1}$ *(2)*

$= \boldsymbol{\dfrac{5x+1}{x^2-1}}$ *(1)*

QUESTION 3 [14 MARKS]

Simplify the following FULLY, and answer the question that follows.

3.1 $\dfrac{x-2}{x^3-8}$ (4)

The denominator is a difference of two cubes *(1)*

$= \dfrac{x-2}{(x-2)(x^2+2x+4)}$ *(2)*

$= \boldsymbol{\dfrac{1}{x^2+2x+4}}$ *(1)*

3.2 $\dfrac{x^2+5x+6}{x^2-4}$ **(4)**

$= \dfrac{(x+2)(x+3)}{(x+2)(x-2)}$ *(3)*

$= \boldsymbol{\dfrac{x+3}{x-2}}$ *(1)*

3.3 Write down the value(s) of x for which $\dfrac{x+3}{x-2}$ is undefined, and explain why. **(3)**

$\boldsymbol{x=2}$ *(2)* — the denominator becomes 0, and division by 0 is undefined *(1)*

3.4 Explain why you may NOT cancel the x^2 terms in $\dfrac{x^2+5x+6}{x^2-4}$ before factorising. **(3)**

Only FACTORS may be cancelled *(1)*
Before factorising, x^2 is a TERM in a sum, not a factor *(1)*
Cancelling terms changes the value of the expression *(1)*

TOTAL: 35 marks

This question paper consists of 3 questions.

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