G3 MATHEMATICS HOLIDAY REVISION

Week 1

Intensive algebra

Student worksheet

Upper Secondary - Sec 3 and Sec 4

19 original questions

Show your working. Choose a method, keep track of restrictions and check that your answer fits the question.

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STUDENT WORKSHEET

Week 1 · Intensive algebra

WARM-UPS

Q1

[2 marks]

Factorise $x^2-5x-14$ completely. State its zeros.

WORKING SPACE

STUDENT WORKSHEET

Week 1 · Intensive algebra

WARM-UPS

Q2

[2 marks]

Evaluate $16^{3/4}$ without a calculator. Explain which operation the denominator 4 represents.

WORKING SPACE

STUDENT WORKSHEET

Week 1 · Intensive algebra

WARM-UPS

Q3

[2 marks]

Simplify $(x^2-9)/(x-3)$ and give its original restriction. Can the simplified expression give a value for the original fraction at $x=3$?

WORKING SPACE

STUDENT WORKSHEET

Week 1 · Intensive algebra

CORE APPLICATIONS

Q4

[4 marks]

Factorise $6x^2-x-2$. Hence solve $6x^2-x-2=0$ and check one root by substitution.

WORKING SPACE

STUDENT WORKSHEET

Week 1 · Intensive algebra

CORE APPLICATIONS

Q5

[4 marks]

Write 2/(x−1)−3/(x+2) as one simplified fraction. State every excluded value.

WORKING SPACE

STUDENT WORKSHEET

Week 1 · Intensive algebra

CORE APPLICATIONS

Q6

[4 marks]

Simplify $[(x^2-9)/(x^2+5x+6)] \div [(x-3)/(x+2)]$. Give all restrictions from the original expression, including the condition that the divisor is nonzero.

WORKING SPACE

STUDENT WORKSHEET

Week 1 · Intensive algebra

CORE APPLICATIONS

Q7

[4 marks]

Solve $4^{x-1}=8^{2-x}$. Explain why comparing exponents is valid, then check your answer.

WORKING SPACE

STUDENT WORKSHEET

Week 1 · Intensive algebra

CORE APPLICATIONS

Q8

[4 marks]

The quadratic $x^2+(k-3)x-3k$ has a root $x=-2$. Find k, factorise the quadratic and state its other root.

WORKING SPACE

STUDENT WORKSHEET

Week 1 · Intensive algebra

CHALLENGING REASONING

Q9

[5 marks]

Solve $\frac{2}{(x-1)}+\frac{3}{(x+2)}=1$. State restrictions before clearing denominators and check that each candidate is allowed.

WORKING SPACE

STUDENT WORKSHEET

Week 1 · Intensive algebra

CHALLENGING REASONING

Q10

[5 marks]

A rectangle has width (x−1) cm and length (x+4) cm, where x>1. Its area is 36 cm². Find x, both dimensions and the perimeter. Explain why the other algebraic root is rejected.

WORKING SPACE

STUDENT WORKSHEET

Week 1 · Intensive algebra

CHALLENGING REASONING

Q11

[5 marks]

Find the least positive integer n for which both 12n is a perfect square and 18n is a perfect cube. Prove your choice is least.

WORKING SPACE

STUDENT WORKSHEET

Week 1 · Intensive algebra

CHALLENGING REASONING

Q12

[5 marks]

Let $G=(x^2-4)/(x^2-x-6)+(x-2)/(x+2)$. Simplify G to one fraction, state every original restriction, then find all x for which $G=0$.

WORKING SPACE

STUDENT WORKSHEET

Week 1 · Intensive algebra

CHALLENGING REASONING

Q13

[5 marks]

The equations $x^2-5x+6=0$ and $x^2-(k+1)x+2k=0$ have exactly one common real root. Find k and all roots of the second equation. Explain why the other root of the first equation cannot be common.

WORKING SPACE

STUDENT WORKSHEET

Week 1 · Intensive algebra

CHALLENGING REASONING

Q14

[5 marks]

Solve the simultaneous equations $2x+3y=17$ and $x/2-y/3=1$. Show why your chosen elimination or substitution step is valid, then find x^2-y^2 without expanding a new equation.

WORKING SPACE

STUDENT WORKSHEET

Week 1 · Intensive algebra

MISCONCEPTION ANALYSIS

Q15

[3 marks]

A student claims $3/(x-1)-2/(x+1)=1/(x^2-1)$, saying they “subtracted the numerators and multiplied the denominators”. Identify the invalid step, find the correct single fraction and state its domain.

WORKING SPACE

STUDENT WORKSHEET

Week 1 · Intensive algebra

MISCONCEPTION ANALYSIS

Q16

[3 marks]

A student solves $(x^2-9)/(x-3)=6$ by multiplying through, gets $(x-3)^2=0$ and reports $x=3$. Is there a solution? Explain.

WORKING SPACE

STUDENT WORKSHEET

Week 1 · Intensive algebra

MISCONCEPTION ANALYSIS

Q17

[3 marks]

A student writes $3^x+3^x=3^{2x}$ and therefore cannot solve $3^x+3^x=54$. Repair the step and solve the equation.

WORKING SPACE

STUDENT WORKSHEET

Week 1 · Intensive algebra

STRETCH

Q18

[4 marks]

Suppose $a>0$ and $2^{x+1}=a\cdot 4^x$. Find a so that $x=-2$ is a solution. Show that for this a the solution is unique, using only index laws.

WORKING SPACE

STUDENT WORKSHEET

Week 1 · Intensive algebra

STRETCH

Q19

[5 marks]

For a real parameter k, solve $(x+1)/(x-2)-(x-1)/(x+2)=k/(x^2-4)$ for x. Determine the two values of k for which the equation has no solution, and explain why.

WORKING SPACE