

ALGEBRA AND EQUATIONS

Every question, eight papers

DBE · National Senior Certificate · Mathematics Paper 1

November 2021 - 2024 and May/June 2021, 2022, 2024, 2025

8 questions · 201 marks · 8 papers

Each question is a clip of the original DBE page. The wording, the mark allocations and the diagrams are exactly as they were printed - nothing has been retyped or redrawn. Only the blank answer space has been removed, so work in a separate book.

How it is arranged

One chapter per topic, so you can work through a whole skill at a time.

Inside a chapter the questions run from fewest marks to most. That is an order by size, not by difficulty: unlike the IEB, the DBE does not split its papers into an easier and a harder section, and its marking guidelines carry no cognitive-level tags. Nothing in these papers ranks one question as harder than another, so this booklet does not pretend otherwise.

Contents

| Solving for x - and the one harder idea at the end

24 to 27 marks each

8 questions, 201 marks

Solving for x - and the one harder idea at the end

Every one of these is Question 1 of its paper, and they are built to the same plan: four or five equations to solve - one by factorising, one by formula to two decimal places, one inequality, one with a surd or an exponent - then a simultaneous pair, then one closing part that is different every time. Work the openings for speed; the closing part is where the paper actually asks you to think.

8 questions · 201 marks

24 to 27 marks each

1. Four equations, a simultaneous pair, then 2^x times $3^y = 24$

DBE NSC Paper 1 · May/June 2021 · Q1 · 24 marks

QUESTION 1

1.1 Solve for x :

1.1.1 $x^2 - x - 20 = 0$ (3)

1.1.2 $3x^2 - 2x - 6 = 0$ (correct to TWO decimal places) (4)

1.1.3 $(x-1)^2 > 9$ (4)

1.1.4 $2\sqrt{x+6} + 2 = x$ (4)

1.2 Solve simultaneously for x and y :

$4x + y = 2$ and $4x + y^2 = 8$ (5)

1.3 If it is given that $2^x \times 3^y = 24^6$, determine the numerical value of $x - y$. (4)
[24]

2. A simultaneous pair, then proving a root cannot be real

DBE NSC Paper 1 · November 2021 · Q1 · 24 marks

QUESTION 1

1.1 Solve for x :

1.1.1 $x^2 - 2x - 24 = 0$ (3)

1.1.2 $2x^2 - 3x - 3 = 0$ (correct to TWO decimal places) (3)

1.1.3 $x^2 + 5x \leq -4$ (4)

1.1.4 $\sqrt{x+28} = 2 - x$ (4)

1.2 Solve simultaneously for x and y in:

$2y = 3 + x$ and $2xy + 7 = x^2 + 4y^2$ (6)

1.3 The roots of an equation are $x = \frac{-n \pm \sqrt{n^2 - 4mp}}{2m}$ where m , n and p are positive real numbers. The numbers m , n and p , in that order, form a geometric sequence. Prove that x is a non-real number. (4)
[24]

3. Reciprocals in a simultaneous pair, then $m + n$ from powers of 2 and 3

DBE NSC Paper 1 · November 2023 · Q1 · 24 marks

QUESTION 1

1.1 Solve for x :

1.1.1 $x^2 + x - 12 = 0$ (3)

1.1.2 $3x^2 - 2x = 6$ (answers correct to TWO decimal places) (4)

1.1.3 $\sqrt{2x+1} = x-1$ (4)

1.1.4 $x^2 - 3 > 2x$ (4)

1.2 Solve for x and y simultaneously:

$x + 2 = 2y$ and $\frac{1}{x} + \frac{1}{y} = 1$ (5)

1.3 Given: $2^{m+1} + 2^m = 3^{n+2} - 3^n$ where m and n are integers.

Determine the value of $m + n$. (4)
[24]

4. Show an expression is always even, then two exponential unknowns

DBE NSC Paper 1 · November 2022 · Q1 · 25 marks

QUESTION 1

1.1 Solve for x :

1.1.1 $(3x - 6)(x + 2) = 0$ (2)

1.1.2 $2x^2 - 6x + 1 = 0$ (correct to TWO decimal places) (3)

1.1.3 $x^2 - 90 > x$ (4)

1.1.4 $x - 7\sqrt{x} = -12$ (4)

1.2 Solve for x and y simultaneously:

$$2x - y = 2$$

$$xy = 4$$
 (5)

1.3 Show that $2 \cdot 5^n - 5^{n+1} + 5^{n+2}$ is even for all positive integer values of n . (3)

1.4 Determine the values of x and y if: $\frac{3^{y+1}}{32} = \sqrt{96^x}$ (4)
[25]

5. A rectangle from its perimeter and area, then a divisibility proof

DBE NSC Paper 1 · May/June 2025 · Q1 · 25 marks

QUESTION 1

1.1 Solve for x :

1.1.1 $x^2 - 3x - 10 = 0$ (3)

1.1.2 $3x^2 + 6x + 1 = 0$ (correct to TWO decimal places) (3)

1.1.3 $2^{x+4} + 2^x = 8\,704$ (3)

1.1.4 $(x - 8)(x + 2) \leq 0$ (3)

1.1.5 $x + 3\sqrt{x+2} = 2$ (4)

1.2 A rectangle having sides of $(y - 3)$ metres and $(x + 2)$ metres has a perimeter of 24 metres and an area of 32 square metres. Calculate the values of x and y . (6)

1.3 Show that $(1 + x^m + x^{-n})^2 - (1 - x^m - x^{-n})^2$ is divisible by 2 for all real values of m and n . (3)
[25]

6. A substitution into an exponential equation, then a ratio of powers of 2

DBE NSC Paper 1 · May/June 2022 · Q1 · 26 marks

QUESTION 1

1.1 Solve for x :

1.1.1 $x^2 + 2x - 15 = 0$ (3)

1.1.2 $5x^2 - x - 9 = 0$ (Leave your answer correct to TWO decimal places.) (3)

1.1.3 $x^2 \leq 3x$ (4)

1.2 Given: $a + \frac{64}{a} = 16$

1.2.1 Solve for a . (3)

1.2.2 Hence, solve for x : $2^x + 2^{6-x} = 16$ (3)

1.3 **Without using a calculator**, calculate the value of $\sqrt{\frac{2^{1002} + 2^{1006}}{17(2)^{998}}}$ (4)

1.4 Solve for x and y simultaneously:

$2x - y = 2$ and $\frac{1}{x} - 3y = 1$ (6)
[26]

7. An exponential equation, then a telescoping product $P \times T$

DBE NSC Paper 1 · May/June 2024 · Q1 · 26 marks

QUESTION 1

1.1 Solve for x :

1.1.1 $3x^2 + 5x = 0$ (2)

1.1.2 $4x^2 + 3x - 5 = 0$ (answers correct to TWO decimal places) (3)

1.1.3 $(x-1)^2 - 9 \geq 0$ (4)

1.1.4 $5^{2x} - 5^x = 0$ (4)

1.1.5 $\frac{x}{\sqrt{20-x}} = 1$ (5)

1.2 Solve for x and y simultaneously:

$x + y = 9$ and $2x^2 - y^2 = 7$ (5)

1.3 Given: $P = (1-a)$ and $T = (1+a)(1+a^2)(1+a^4) \dots (1+a^{512})$

Determine the value of $P \times T$ in terms of a . (3)

[26]

8. A simultaneous pair, then when an endless product stays an integer

DBE NSC Paper 1 · November 2024 · Q1 · 27 marks

QUESTION 1

1.1 Solve for x :

1.1.1 $x(x-3) = 0$ (2)

1.1.2 $2x^2 + 1 = 4x$ (correct to TWO decimal places) (4)

1.1.3 $x^2 - 2x - 3 > 0$ (4)

1.1.4 $2^{2x} - 2^{x+2} - 32 = 0$ (5)

1.1.5 $\sqrt{-2x+4} - x = 2$ (4)

1.2 Solve for x and y simultaneously:

$$2x + y = 3$$

$$y^2 + xy = 2$$
 (5)

1.3 Consider the product $\left(1 + \frac{1}{2}\right)\left(1 + \frac{1}{3}\right)\left(1 + \frac{1}{4}\right) \dots$

Each factor in the product is of the form $\left(1 + \frac{1}{n}\right)$ for $n \geq 2$.

Determine ALL the values of n for which the product will be an integer value.

(3)
[27]

Index by paper

Every algebra question in each paper, and where it sits in this booklet.

May/June 2021		1 question, 24 of 150 marks
Q1	Four equations, a simultaneous pair, then $2^x \times 3^y = 24$	24 marks p3
November 2021		1 question, 24 of 150 marks
Q1	A simultaneous pair, then proving a root cannot be real	24 marks p3
May/June 2022		1 question, 26 of 150 marks
Q1	A substitution into an exponential equation, then a ratio of powers of 2	26 marks p6
November 2022		1 question, 25 of 150 marks
Q1	Show an expression is always even, then two exponential unknowns	25 marks p5
November 2023		1 question, 24 of 150 marks
Q1	Reciprocals in a simultaneous pair, then $m + n$ from powers of 2 and 3	24 marks p4
May/June 2024		1 question, 26 of 150 marks
Q1	An exponential equation, then a telescoping product $P \times T$	26 marks p7
November 2024		1 question, 27 of 150 marks
Q1	A simultaneous pair, then when an endless product stays an integer	27 marks p8
May/June 2025		1 question, 25 of 150 marks
Q1	A rectangle from its perimeter and area, then a divisibility proof	25 marks p5

Index by topic

A question appears under every topic it uses, so it can be found even when it is filed in another chapter.

Solving a quadratic by factorising

8 questions

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| 1. | Four equations, a simultaneous pair, then $2^x \times 3^y = 24$ | p3 |
| 2. | A simultaneous pair, then proving a root cannot be real | p3 |
| 3. | Reciprocals in a simultaneous pair, then $m + n$ from powers of 2 and 3 | p4 |
| 4. | Show an expression is always even, then two exponential unknowns | p5 |
| 5. | A rectangle from its perimeter and area, then a divisibility proof | p5 |
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| 7. | An exponential equation, then a telescoping product $P \times T$ | p7 |
| 8. | A simultaneous pair, then when an endless product stays an integer | p8 |

The quadratic formula, to two decimal places

8 questions

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|----|--|----|
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| 2. | A simultaneous pair, then proving a root cannot be real | p3 |
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Quadratic inequalities

8 questions

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Equations containing a surd

7 questions

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Exponential equations

5 questions

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Simultaneous equations

7 questions

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| 2. | A simultaneous pair, then proving a root cannot be real | p3 |
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The nature of the roots

1 question

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|----|---|----|
| 2. | A simultaneous pair, then proving a root cannot be real | p3 |
|----|---|----|

A word problem that becomes an equation

1 question

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| 5. | A rectangle from its perimeter and area, then a divisibility proof | p5 |
|----|--|----|

Proving a numerical property

3 questions

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|----|--|----|
| 4. | Show an expression is always even, then two exponential unknowns | p5 |
| 5. | A rectangle from its perimeter and area, then a divisibility proof | p5 |
| 8. | A simultaneous pair, then when an endless product stays an integer | p8 |

Where these came from

So that "every algebra question" is a claim you can check.

Eight DBE NSC Mathematics Paper 1 papers were read end to end:
November 2021, 2022, 2023, 2024 and May/June 2021, 2022, 2024, 2025.

All 338 questions in them were classified. These papers are scans - they carry no text layer at all - so the structure was rebuilt by reading them with OCR, and then checked three ways: every paper adds back up to exactly 150, the Afrikaans paper matches the English question for question, and the official marking guideline, which IS ordinary text, agrees with the marks read off every question.

DBE publishes an official marking guideline for every one of these papers. The companion file "CAPS_P1_Algebra_Solutions.pdf" carries the guideline for each question here, in the same order and under the same numbers.