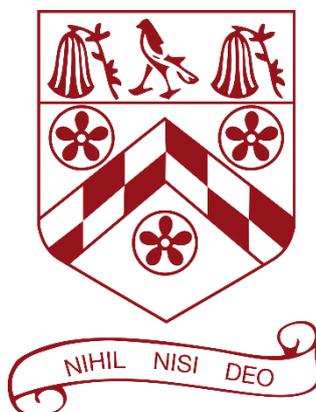


Name _____



Blessed Hugh Faringdon Catholic School

Mathematics

A-Level Induction Booklet

A refresher booklet to help with the transition from GCSE to AS-Level Mathematics

Hello and welcome to A level mathematics, this booklet aims to give you the opportunity to consolidate the key GCSE concepts that also appear in A-Level.

How to complete this booklet.

1. This booklet is designed to run alongside MyMaths.
2. You will need to **log onto** <https://www.mymaths.co.uk> using your details from Y11 to help you. (If you have issues, contact Miss Dobson, j.dobson@hughfaringdon.org)
3. The booklet has a number of questions to work through then a mock assessment at the end. The mock exam should be handed in in September.
4. All answers are provided at the end of the booklet to check your understanding.
5. At the end of the booklet is a MyMaths checklist that you will need to decide whether you are **green**, **amber** or **red** on. Any topics that are **red** you can begin to practice online using MyMaths.
6. If you cannot print this booklet, then please complete work on paper with clearly labelled sections.

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1. Arithmetic of Fractions

1. Express each of the following as a fraction in its simplest form. For example $\frac{3}{21}$ can be written as $\frac{1}{7}$. Remember, no calculators!

- a) $\frac{20}{45}$ b) $\frac{16}{36}$ c) $-\frac{42}{21}$ d) $\frac{18}{16}$ e) $\frac{30}{30}$ f) $\frac{17}{21}$ g) $-\frac{49}{35}$ h) $\frac{90}{30}$

2. Calculate

- a) $\frac{1}{2} + \frac{1}{3}$ b) $\frac{1}{2} - \frac{1}{3}$ c) $\frac{2}{3} + \frac{3}{4}$ d) $\frac{5}{6} - \frac{2}{3}$ e) $\frac{8}{9} + \frac{1}{5} + \frac{1}{6}$ f) $\frac{4}{5} + \frac{3}{7} - \frac{9}{10}$

3. Evaluate the following, expressing each answer in its simplest form.

- a) $\frac{4}{5} \times \frac{3}{16}$ b) $2 \times 3 \times \frac{1}{4}$ c) $\frac{3}{4} \times \frac{3}{4}$ d) $\frac{4}{9} \times 6$ e) $\frac{15}{16} \times \frac{4}{5}$ f) $\frac{9}{5} \times \frac{1}{3} \times \frac{15}{27}$

4. Evaluate

a) $3 \div \frac{1}{2}$ b) $\frac{1}{2} \div \frac{1}{4}$ c) $\frac{6}{7} \div \frac{16}{21}$ d) $\frac{3}{4}$ e) $5 \div \frac{10}{9}$ f) $\frac{3}{4} \div \frac{4}{3}$

5. Express the following as mixed fractions. A mixed fraction has a whole number part and a fractional part. For example, $\frac{13}{5}$ can be written as the mixed fraction $2\frac{3}{5}$.

a) $\frac{5}{2}$ b) $\frac{7}{3}$ c) $-\frac{11}{4}$ d) $\frac{6}{5}$ e) $\frac{12}{5}$ f) $\frac{18}{7}$ g) $\frac{16}{3}$ h) $\frac{83}{9}$

6. Express the following as improper fractions. An improper fraction is 'top-heavy'. Its numerator is greater than its denominator. For example, the mixed fraction $13\frac{4}{5}$ can be written as the improper fraction $\frac{69}{5}$.

a) $2\frac{1}{4}$ b) $3\frac{1}{2}$ c) $5\frac{2}{3}$ d) $-3\frac{2}{5}$ e) $11\frac{4}{6}$ f) $8\frac{2}{9}$ g) $16\frac{3}{4}$ h) $89\frac{2}{7}$

2. Rules and Manipulation of Indices

1. Simplify the following algebraic expressions.

- a) $x^3 \times x^4$ b) $y^2 \times y^3 \times y^5$ c) $z^3 \times z^2 \times z$ d) $t^2 \times t^{10} \times t$
e) $a \times a \times a^2$ f) $t^3 t^4$ g) $b^6 b^3 b$ h) $z^7 z^7$

2. Simplify

- a) $\frac{x^6}{x^2}$ b) $\frac{y^{14}}{y^{10}}$ c) $\frac{t^{16}}{t^{12}}$ d) $\frac{z^{10}}{z^9}$ e) $\frac{v^7}{v^0}$ f) x^7/x^4

3. Simplify the following:

- a) $\frac{10^7}{10^6}$ b) $\frac{10^{19}}{10^{16}}$ c) $\frac{x^7}{x^{14}}$ d) $\frac{x^7}{y^4}$
e) $\frac{(ab)^4}{a^2 b^2}$ f) $\frac{9^9 10^{10}}{10^9}$ g) $\frac{x^9 y^8}{y^7 x^6}$ h) $\frac{(abc)^3}{(abc)^2}$

4. Write the following expressions using only *positive* indices. For example $\frac{x^{-4}}{x^{-2}}$ can be written as $\frac{1}{x^2}$.

a) $x^{-2}x^{-1}$ b) $\frac{3x}{x^{-4}}$ c) $\frac{t^{-2}}{t^{-3}}$
d) $(2a^2b^3)(6a^{-3}b^{-5})$ e) $\frac{x^{-3}}{5^{-2}}$ f) $\frac{(27)^{-1}x^{-1}}{y^{-2}}$

5. Without using a calculator, evaluate

a) $\frac{3}{4^{-2}}$ b) 4×3^{-2} c) $3^{-1}9^2(27)^{-1}$
d) $(0.25)^{-1}$ e) $(0.2)^{-2}$ f) $(0.1)^{-3}$

6. Simplify

a) $t^{-6}t^3$ b) $(-y^{-2})(-y^{-1})$ c) $\frac{3y^{-2}}{6y^{-3}}$ d) $(-2t^{-1})(-3t^{-2})(-4t^{-3})$
e) $\frac{3t^{-2}}{6t^3}$ f) $\frac{(2t^{-1})^3}{6t^2}$ g) $\frac{(-2t)^3}{(-4t)^2}$

7. Write the following expressions using a *single* index. For example $(5^3)^{-4}$ can be written as 5^{-12} .

- a) $(5^3)^5$ b) $(3^3)^3$ c) $(17^2)^4$ d) $(y^3)^6$ e) $\left(\frac{y^{-1}}{y^{-2}}\right)^3$
f) $\left(\frac{t^{-2}}{t^4}\right)^3$ g) $(k^{-2})^{-6}$ h) $((-1)^4)^3$ i) $((-1)^{-4})^{-3}$

8. Without the use of a calculator, evaluate

- a) $(4^{-1})^2$ b) $(2^2)^{-1}$ c) $(3^2)^2$ d) $(6^{-2})^{-1}$
e) $\left(\frac{2}{5^2}\right)^{-1}$ f) $(-2)^{-1}$ g) $\left(-\frac{2}{3}\right)^{-2}$

9. Write the following expressions without using brackets.

a) $(4^2 5^3)^3$ b) $\left(\frac{3ab}{c^3}\right)^2$ c) $\left(\frac{4^{-2}a^{-3}}{b^{-1}}\right)^2$ d) $(2a^2b)^3$
e) $(3xy^2z^3)^2$ f) $\left(\frac{6}{ab^2}\right)^2$ g) $\left(-\frac{3}{x^2}\right)^2$ h) $\left(\frac{2z^2}{3t}\right)^3$
i) $(-2x)^2$ j) $(-2x^2)^{-2}$ k) $\left(-\frac{2}{x^2}\right)^{-3}$

10. Write the following expressions without using brackets.

a) $(6^{1/2})^3$ b) $(5^{1/3})^6$ c) $(10^{0.6})^4$ d) $(x^2)^{1/3}$
e) $(2x^2)^{1/3}$ f) $(a \times a^2)^{1/2}$ g) $(ab^2)^{1/2}$

11. Write the following expressions without using brackets.

- a) $(4^3)^{-1/2}$ b) $(3^{-1/2})^{-1/2}$ c) $(7^{2/3})^4$ d) $(19^{3/2})^{1/3}$
e) $(a^2b^{-3})^{-\frac{3}{2}}$ f) $\left(\frac{k^{-1.5}}{\sqrt{k}}\right)^{-2}$

12. Write the following expressions without using brackets.

- a) $(5b)^{1/6}$ b) $(3\sqrt{x})^3$ c) $3(\sqrt{x})^3$ d) $(\sqrt{3x})^3$

13. Simplify

- a) $x^{1/2}x^{1/3}$ b) $\frac{x^{1/2}}{x^{1/3}}$ c) $(x^{1/2})^{1/3}$ d) $(8x^3)^{1/3}$
e) $\sqrt{25y^2}$ f) $\left(\frac{27}{t^3}\right)^{1/3}$ g) $(16y^4)^{1/4}$ h) $(x^{1/4}x^{1/2})^4$
i) $\sqrt{a^2a^6}$ j) $\sqrt{\frac{a^{-4}}{a^{-1}}}$

3. Expanding Brackets and Factorising

1. Write the following expressions without using brackets:

- a) $2(mn)$ b) $2(m + n)$ c) $a(mn)$ d) $a(m + n)$ e) $a(m - n)$
f) $(am)n$ g) $(a + m)n$ h) $(a - m)n$ i) $5(pq)$ j) $5(p + q)$
k) $5(p - q)$ l) $7(xy)$ m) $7(x + y)$ n) $7(x - y)$ o) $8(2p + q)$
p) $8(2pq)$ q) $8(2p - q)$ r) $5(p - 3q)$ s) $5(p + 3q)$ t) $5(3pq)$

2. Write the following expressions without using brackets and simplify where possible:

- a) $(2 + a)(3 + b)$ b) $(x + 1)(x + 2)$ c) $(x + 3)(x + 3)$ d) $(x + 5)(x - 3)$

3. Write the following expressions without using brackets:

- a) $(7 + x)(2 + x)$ b) $(9 + x)(2 + x)$ c) $(x + 9)(x - 2)$ d) $(x + 11)(x - 7)$
e) $(x + 2)x$ f) $(3x + 1)x$ g) $(3x + 1)(x + 1)$ h) $(3x + 1)(2x + 1)$
i) $(3x + 5)(2x + 7)$ j) $(3x + 5)(2x - 1)$ k) $(5 - 3x)(x + 1)$ l) $(2 - x)(1 - x)$

4. Rewrite the following expressions without using brackets:

- a) $(s + 1)(s + 5)(s - 3)$ b) $(x + y)^3$

5. Factorise

- a) $5x + 15y$ b) $3x - 9y$ c) $2x + 12y$ d) $4x + 32z + 16y$ e) $\frac{1}{2}x + \frac{1}{4}y$

6. Factorise

a) $\frac{1}{3}x + \frac{1}{6}xy$ b) $\frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2h$ c) $a^2 - a + \frac{1}{4}$ d) $\frac{1}{x^2} - \frac{2}{x} + 1$

7. Factorise

a) $x^2 + 8x + 7$ b) $x^2 + 6x - 7$ c) $x^2 + 7x + 10$ d) $x^2 - 6x + 9$ e) $x^2 + 5x + 6$.

8. Factorise

a) $2x^2 + 3x + 1$ b) $2x^2 + 4x + 2$ c) $3x^2 - 3x - 6$ d) $5x^2 - 4x - 1$
e) $16x^2 - 1$ f) $-x^2 + 1$ g) $-2x^2 + x + 3$

9. Factorise

- a) $x^2 + 9x + 14$ b) $x^2 + 11x + 18$ c) $x^2 + 7x - 18$ d) $x^2 + 4x - 77$
e) $x^2 + 2x$ f) $3x^2 + x$, g) $3x^2 + 4x + 1$ h) $6x^2 + 5x + 1$
i) $6x^2 + 31x + 35$ j) $6x^2 + 7x - 5$ k) $-3x^2 + 2x + 5$ l) $x^2 - 3x + 2$

10. Rewrite the following expressions without using brackets, simplifying where possible:

- a) $15 - (7 - x)$ b) $15 - 7(1 - x)$
c) $15 - 7(x - 1)$ d) $(2x - y) - x(1 + y)$
e) $x(a + b) - x(a + 3b)$ f) $2(5a + 3b) + 3(a - 2b)$
g) $-(4a + 5b - 3c) - 2(2a + 3b - 4c)$ h) $2x(x - 5) - x(x - 2) - 3x(x - 5)$

11. Rewrite each of the following expressions without using brackets and simplify where possible

a) $2x - (3y + 8x)$, b) $2x + 5(x - y - z)$, c) $-(5x - 3y)$, d) $5(2x - y) - 3(x + 2y)$

4. Algebraic Fractions

1. Express each of the following as a single fraction.

a) $2 \times \frac{x+y}{3}$ b) $\frac{1}{3} \times 2(x+y)$ c) $\frac{2}{3} \times (x+y)$

2. Simplify

a) $3 \times \frac{x+4}{7}$ b) $\frac{1}{7} \times 3(x+4)$ c) $\frac{3}{7} \times (x+4)$ d) $\frac{x}{y} \times \frac{x+1}{y+1}$
e) $\frac{1}{y} \times \frac{x^2+x}{y+1}$ f) $\frac{\pi d^2}{4} \times \frac{Q}{\pi d^2}$ g) $\frac{Q}{\pi d^2/4}$ h) $\frac{1}{x/y}$

3. Simplify a) $\frac{6/7}{s+3}$ b) $\frac{3/4}{x-1}$ c) $\frac{x-1}{3/4}$

4. Simplify $\frac{3}{x+2} \div \frac{x}{2x+4}$

5. Simplify $\frac{5}{2x+1} \div \frac{x}{3x-1}$

6. Simplify

a) $\frac{x}{4} + \frac{x}{7}$ b) $\frac{2x}{5} + \frac{x}{9}$ c) $\frac{2x}{3} - \frac{3x}{4}$ d) $\frac{x}{x+1} - \frac{2}{x+2}$
e) $\frac{x+1}{x} + \frac{3}{x+2}$ f) $\frac{2x+1}{3} - \frac{x}{2}$ g) $\frac{x+3}{2x+1} - \frac{x}{3}$ h) $\frac{x}{4} - \frac{x}{5}$

7. Simplify

a) $\frac{1}{x+2} + \frac{2}{x+3}$ b) $\frac{2}{x+3} + \frac{5}{x+1}$ c) $\frac{2}{2x+1} - \frac{3}{3x+2}$
d) $\frac{x+1}{x+3} + \frac{x+4}{x+2}$ e) $\frac{x-1}{x-3} + \frac{x-1}{(x-3)^2}$

5. Surds

Roots, for example $\sqrt{2}$, $\sqrt{5}$, $\sqrt[3]{6}$ are also known as **surds**. A common cause of error is misuse of expressions involving surds. You should be aware that $\sqrt{ab} = \sqrt{a}\sqrt{b}$ but $\sqrt{a+b}$ is NOT equal to $\sqrt{a} + \sqrt{b}$.

1. It is often possible to write surds in equivalent forms. For example $\sqrt{48}$ can be written $\sqrt{3 \times 16} = \sqrt{3} \times \sqrt{16} = 4\sqrt{3}$.

Write the following in their simplest forms:

a) $\sqrt{180}$ b) $\sqrt{63}$

2. By multiplying numerator and denominator by $\sqrt{2} + 1$ show that

$$\frac{1}{\sqrt{2} - 1} \quad \text{is equivalent to} \quad \sqrt{2} + 1$$

3. Simplify, if possible, a) $\sqrt{x^2y^2}$ b) $\sqrt{x^2 + y^2}$.

4. Study the following expressions and simplify where possible.

a) $\sqrt{(x+y)^4}$ b) $(\sqrt[3]{x+y})^6$ c) $\sqrt{x^4+y^4}$

5. By considering the expression $(\sqrt{x} + \sqrt{y})^2$ show that

$$\sqrt{x} + \sqrt{y} = \sqrt{x+y+2\sqrt{xy}}$$

Find a corresponding expression for $\sqrt{x} - \sqrt{y}$.

6. Write each of the following as an expression under a single square root sign. (For parts c) and d) see Question 5 above.)

a) $2\sqrt{p}$ b) $\sqrt{p}\sqrt{q^3}$ c) $\sqrt{p} + \sqrt{2q}$ d) $\sqrt{3} - \sqrt{2}$

7. Use indices (powers) to write the following expressions without the root sign.

a) $\sqrt[4]{a^2}$ b) $(\sqrt{3} \times \sqrt{5})^3$

6. Linear Equations

In questions 1 – 35 solve each equation:

1. $3y - 8 = \frac{1}{2}y$ 2. $7t - 5 = 4t + 7$ 3. $3x + 4 = 4x + 3$ 4. $4 - 3x = 4x + 3$

5. $3x + 7 = 7x + 2$ 6. $3(x + 7) = 7(x + 2)$ 7. $2x - 1 = x - 3$ 8. $2(x + 4) = 8$

9. $-2(x - 3) = 6$ 10. $-2(x - 3) = -6$

11. $-3(3x - 1) = 2$ 12. $2 - (2t + 1) = 4(t + 2)$

13. $5(m - 3) = 8$ 14. $5m - 3 = 5(m - 3) + 2m$

15. $2(y + 1) = -8$ 16. $17(x - 2) + 3(x - 1) = x$

17. $\frac{1}{3}(x+3) = -9$ 18. $\frac{3}{m} = 4$ 19. $\frac{5}{m} = \frac{2}{m+1}$ 20. $-3x + 3 = 18$

21. $3x + 10 = 31$ 22. $x + 4 = \sqrt{8}$ 23. $x - 4 = \sqrt{23}$

24. $\frac{x-5}{2} - \frac{2x-1}{3} = 6$

25. $\frac{x}{4} + \frac{3x}{2} - \frac{x}{6} = 1$

26. $\frac{x}{2} + \frac{4x}{3} = 2x - 7$

27. $\frac{5}{3m+2} = \frac{2}{m+1}$

28. $\frac{2}{3x-2} = \frac{5}{x-1}$ 29. $\frac{x-3}{x+1} = 4$ 30. $\frac{x+1}{x-3} = 4$ 31. $\frac{y-3}{y+3} = \frac{2}{3}$

32. $\frac{4x+5}{6} - \frac{2x-1}{3} = x$ 33. $\frac{3}{2s-1} + \frac{1}{s+1} = 0$

34. $\frac{1}{5x} + \frac{1}{4x} = 10.$ 35. $\frac{3}{s-1} = \frac{2}{s-5}.$

7. Changing the Subject of a Formulae

1. Make t the subject of the formula $p = \frac{c}{\sqrt{t}}$.

2. Make N the subject of the formula $L = \frac{\mu N^2 A}{\ell}$.

3. In each case make the specified variable the subject of the formula:

a) $h = c + d + 2e$, e b) $S = 2\pi r^2 + 2\pi r h$, h

c) $Q = \sqrt{\frac{c+d}{c-d}}$, c d) $\frac{x+y}{3} = \frac{x-y}{7} + 2$, x

4. Make n the subject of the formula $J = \frac{nE}{nL + m}$.

8. Solving Quadratic Equations – Factorising

Solve the following equations by factorisation:

1. $x^2 - 3x + 2 = 0$ 2. $x^2 - x - 2 = 0$ 3. $x^2 + x - 2 = 0$ 4. $x^2 + 3x + 2 = 0$

5. $x^2 + 8x + 7 = 0$ 6. $x^2 - 7x + 12 = 0$ 7. $x^2 - x - 20 = 0$ 8. $x^2 - 1 = 0$

9. $x^2 - 2x + 1 = 0$ 10. $x^2 + 2x + 1 = 0$ 11. $x^2 + 11x = 0$ 12. $2x^2 + 2x = 0$

13. $x^2 - 3x = 0$ 14. $x^2 + 9x = 0$ 15. $2x^2 - 5x + 2 = 0$ 16. $6x^2 - x - 1 = 0$

17. $-5x^2 + 6x - 1 = 0$ 18. $-x^2 + 4x - 3 = 0$

9. Solving Quadratic Equations – Completing the Square and Using the Quadratic Formula

Solve each of the following quadratic equations twice: once by using the formula, then again by completing the square. Obtain your answers in surd, not decimal, form.

1. $x^2 + 8x + 1 = 0$ 2. $x^2 + 7x - 2 = 0$ 3. $x^2 + 6x - 2 = 0$
4. $4x^2 + 3x - 2 = 0$ 5. $2x^2 + 3x - 1 = 0$ 6. $x^2 + x - 1 = 0$
7. $-x^2 + 3x + 1 = 0$ 8. $-2x^2 - 3x + 1 = 0$ 9. $2x^2 + 5x - 3 = 0$
10. $-2s^2 - s + 3 = 0$ 11. $9x^2 + 16x + 1 = 0$ 12. $x^2 + 16x + 9 = 0$

13. Show that the roots of $x^2 - 2x + \alpha = 0$ are $x = 1 + \sqrt{1 - \alpha}$ and $x = 1 - \sqrt{1 - \alpha}$.

14. Show that the roots of $x^2 - 2\alpha x + \beta = 0$ are

$$x = \alpha + \sqrt{\alpha^2 - \beta} \quad \text{and} \quad x = \alpha - \sqrt{\alpha^2 - \beta}$$

10. Solving Simultaneous Linear Equations

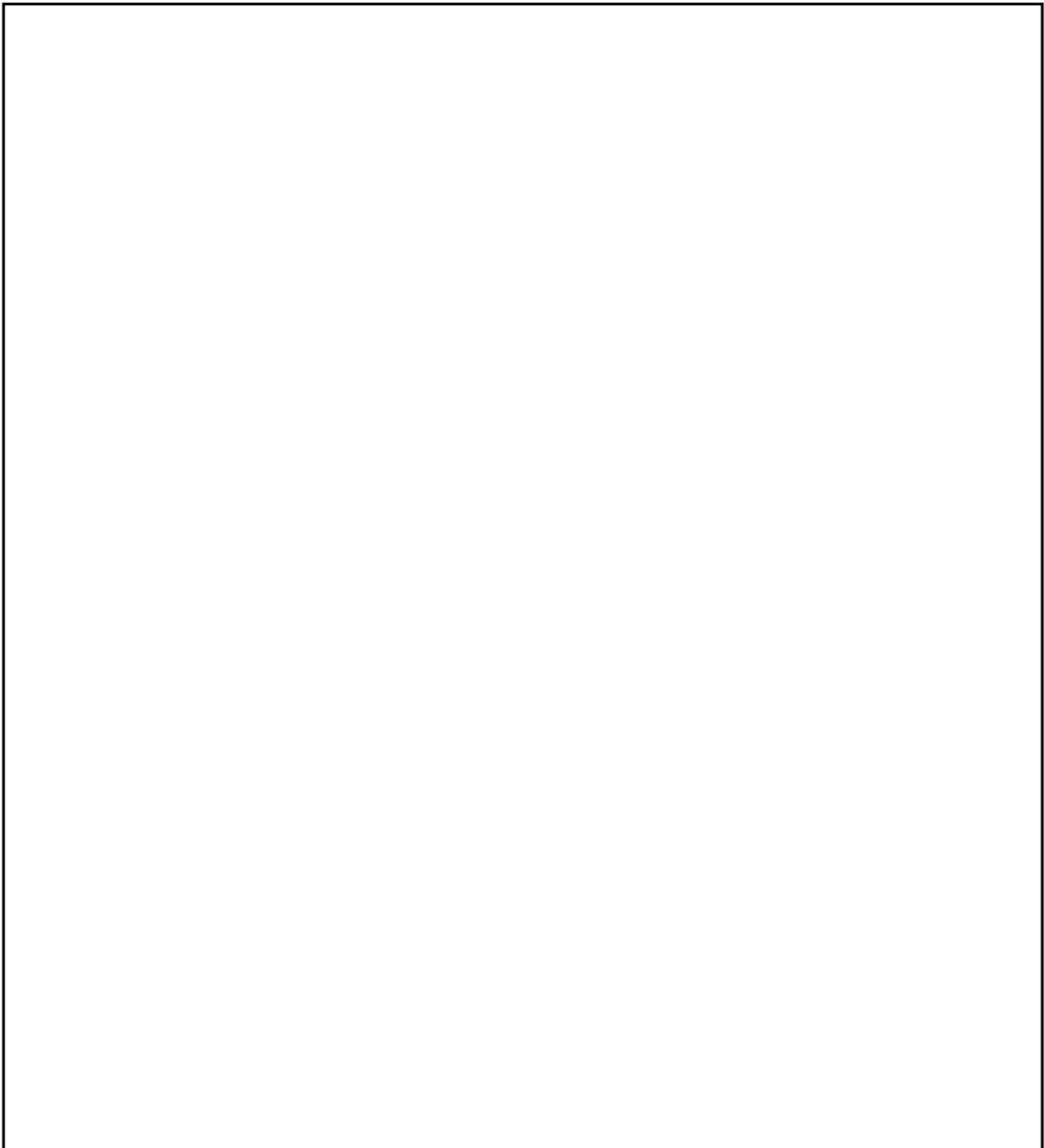
Solve each of the pairs of simultaneous equations. Where the answer is not a whole number, give your answer as an improper fraction.

1. $4x + 3y = 6$
 $5x - 3y = 21$

2. $3x + 5y = 13$
 $2x + 3y = 8$

3. $x + 4y = 5$
 $4x - 2y = 11$

4. $2a + b = 3$
 $4a - 5b = 20$



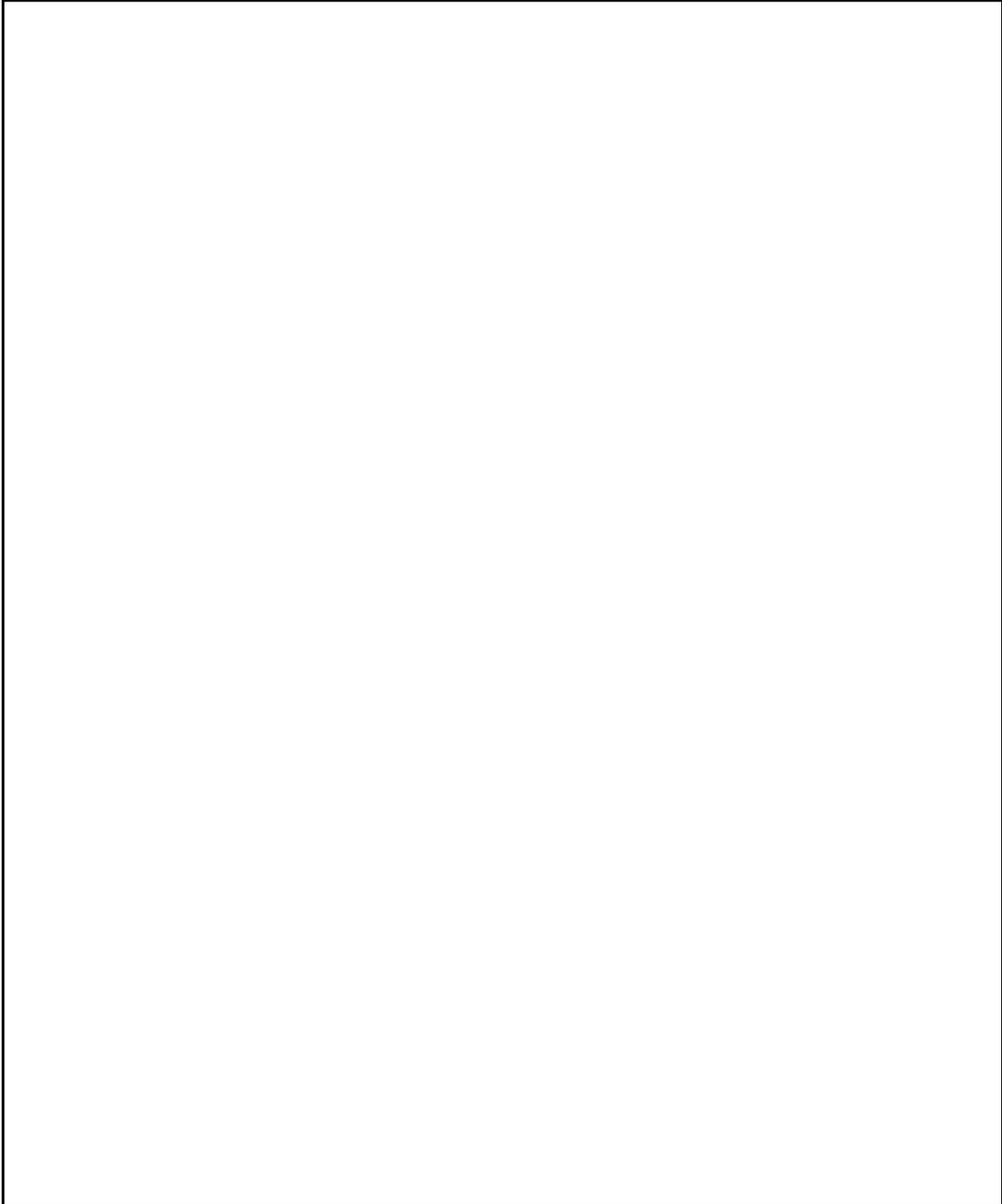
5. $5x + 3y = 4$
 $3x + 4y = 9$

6. $6x - 2y = 13$
 $2x + 3y = -3$

7. $3a - 2b = 14$
 $4a + 3b = 13$

8. $5x + 4y = 5$
 $2x + 7y = 29$

9. $2x + y = 6$
 $6x - 4y = 39$



Answers

Section 1. Arithmetic of fractions

1. a) $\frac{4}{9}$, b) $\frac{4}{9}$, c) -2 , d) $\frac{9}{8}$, e) 1 , f) $\frac{17}{21}$, g) $-\frac{7}{5}$, h) 3
2. a) $\frac{5}{6}$, b) $\frac{1}{6}$, c) $\frac{17}{12}$, d) $\frac{1}{6}$, e) $\frac{113}{90}$, f) $\frac{23}{70}$
3. a) $\frac{3}{20}$, b) $\frac{3}{2}$, c) $\frac{9}{16}$, d) $\frac{8}{3}$, e) $\frac{3}{4}$, f) $\frac{1}{3}$.
4. a) 6 , b) 2 , c) $\frac{9}{8}$, d) $\frac{3}{16}$, e) $\frac{9}{2}$, f) $\frac{9}{16}$
5. a) $2\frac{1}{2}$, b) $2\frac{1}{3}$, c) $-2\frac{3}{4}$, d) $1\frac{1}{5}$, e) $2\frac{2}{5}$, f) $2\frac{4}{7}$, g) $5\frac{1}{3}$, h) $9\frac{2}{9}$
6. a) $\frac{9}{4}$, b) $\frac{7}{2}$, c) $\frac{17}{3}$, d) $-\frac{17}{5}$, e) $\frac{35}{3}$, f) $\frac{74}{9}$, g) $\frac{67}{4}$, h) $\frac{625}{7}$

Section 2. Manipulation of expressions involving indices

1. a) x^7 , b) y^{10} , c) z^6 , d) t^{13} , e) a^4 , f) t^7 , g) b^{10} , h) z^{14} .
2. a) x^4 , b) y^4 , c) t^4 , d) z , e) v^7 , f) x^3
3. a) 10 , b) 10^3 , c) x^{-7} , d) $\frac{x^7}{y^4}$, e) a^2b^2 , f) $9^9 \cdot 10$, g) x^3y , h) abc
4. a) $\frac{1}{x^3}$, b) $3x^5$, c) t , d) $\frac{12}{ab^2}$, e) $\frac{5^2}{x^3}$, f) $\frac{y^2}{27x}$
5. a) 48 , b) $\frac{4}{9}$, c) 1 , d) 4 , e) 25 , f) 1000
6. a) t^{-3} , b) y^{-3} , c) $\frac{1}{2}y$, d) $-24t^{-6}$, e) $\frac{1}{2t^5}$, f) $\frac{4t^{-5}}{3}$, g) $-\frac{t}{2}$.
7. a) 5^{15} , b) 3^9 , c) 17^8 , d) y^{18} , e) y^3 , f) t^{-18} , g) k^{12} , h) $(-1)^{12} = 1$, i) $(-1)^{12} = 1$.
8. a) $\frac{1}{16}$, b) $\frac{1}{4}$, c) 81 , d) 36 , e) $\frac{25}{2}$, f) $-\frac{1}{2}$, g) $\frac{9}{4}$
9. a) 4^65^9 , b) $\frac{9a^2b^2}{c^6}$, c) $\frac{4^{-4}a^{-6}}{b^{-2}} = \frac{b^2}{4^4a^6}$, d) $8a^6b^3$, e) $9x^2y^4z^6$, f) $\frac{36}{a^2b^4}$,
g) $\frac{9}{x^4}$, h) $\frac{8z^6}{27t^3}$, (i) $4x^2$, j) $\frac{1}{4x^4}$, k) $-\frac{x^6}{8}$.
10. a) $6^{3/2}$, b) 5^2 , c) $10^{2.4}$, d) $x^{2/3}$, e) $2^{1/3}x^{2/3}$, f) $a^{3/2}$, g) $a^{1/2}b$.
11. a) $4^{-3/2}$, b) $3^{1/4}$, c) $7^{8/3}$, d) $19^{1/2}$, e) $a^{-3}b^{9/2}$, f) k^4 .
12. a) $5^{1/6}b^{1/6}$, b) $27x^{3/2}$, c) $3x^{3/2}$, d) $3^{3/2}x^{3/2}$
13. a) $x^{5/6}$, b) $x^{1/6}$, c) $x^{1/6}$, d) $2x$, e) $5y$, f) $\frac{3}{t}$, g) $2y$, h) x^3 , i) a^4 , j) $a^{-3/2}$

Section 3. Removing brackets and factorisation

1. a) $2mn$, b) $2m + 2n$, c) amn , d) $am + an$, e) $am - an$, f) amn , g) $an + mn$,
h) $an - mn$, i) $5pq$, j) $5p + 5q$, k) $5p - 5q$, l) $7xy$, m) $7x + 7y$, n) $7x - 7y$,
o) $16p + 8q$, p) $16pq$, q) $16p - 8q$, r) $5p - 15q$, s) $5p + 15q$, t) $15pq$
2. a) $6 + 3a + 2b + ab$, b) $x^2 + 3x + 2$, c) $x^2 + 6x + 9$, d) $x^2 + 2x - 15$
3. a) $14 + 9x + x^2$, b) $18 + 11x + x^2$, c) $x^2 + 7x - 18$,
d) $x^2 + 4x - 77$, e) $x^2 + 2x$, f) $3x^2 + x$, g) $3x^2 + 4x + 1$
h) $6x^2 + 5x + 1$, i) $6x^2 + 31x + 35$, j) $6x^2 + 7x - 5$
k) $-3x^2 + 2x + 5$, l) $x^2 - 3x + 2$
4. a) $s^3 + 3s^2 - 13s - 15$, b) $x^3 + 3x^2y + 3xy^2 + y^3$

5. a) $5(x + 3y)$, b) $3(x - 3y)$, c) $2(x + 6y)$, d) $4(x + 8z + 4y)$, e) $\frac{1}{2}(x + \frac{1}{2}y)$
6. a) $\frac{x}{3}\left(1 + \frac{y}{2}\right)$, b) $\frac{\pi r^2}{3}(2r + h)$, c) $\left(a - \frac{1}{2}\right)^2$, d) $\left(\frac{1}{x} - 1\right)^2$.
7. a) $(x + 7)(x + 1)$, b) $(x + 7)(x - 1)$, c) $(x + 2)(x + 5)$, d) $(x - 3)(x - 3) = (x - 3)^2$,
e) $(x + 3)(x + 2)$
8. a) $(2x + 1)(x + 1)$, b) $2(x + 1)^2$, c) $3(x + 1)(x - 2)$, d) $(5x + 1)(x - 1)$,
e) $(4x + 1)(4x - 1)$, f) $(x + 1)(1 - x)$, g) $(x + 1)(3 - 2x)$
9. a) $(7 + x)(2 + x)$, b) $(9 + x)(2 + x)$, c) $(x + 9)(x - 2)$, d) $(x + 11)(x - 7)$,
e) $(x + 2)x$, f) $(3x + 1)x$, g) $(3x + 1)(x + 1)$, h) $(3x + 1)(2x + 1)$ i) $(3x + 5)(2x + 7)$,
j) $(3x + 5)(2x - 1)$, k) $(5 - 3x)(x + 1)$ l) $(2 - x)(1 - x)$
10. a) $8 + x$, b) $8 + 7x$, c) $22 - 7x$, d) $x - y - xy$, e) $-2bx$, f) $13a$, g) $-8a - 11b + 11c$,
h) $7x - 2x^2$.
11. a) $-3y - 6x$, b) $7x - 5y - 5z$, c) $-5x + 3y$, d) $7x - 11y$.

Section 4. Arithmetic of Algebraic Fractions

1. a) $\frac{2(x+y)}{3}$, b) $\frac{2(x+y)}{3}$, c) $\frac{2(x+y)}{3}$
2. a) $\frac{3(x+4)}{7}$, b) $\frac{3(x+4)}{7}$, c) $\frac{3(x+4)}{7}$, d) $\frac{x(x+1)}{y(y+1)}$, e) $\frac{x(x+1)}{y(y+1)}$, f) $Q/4$, g) $\frac{4Q}{\pi d^2}$, h) $\frac{y}{x}$.
3. a) $\frac{6}{7(s+3)}$, b) $\frac{3}{4(x-1)}$, c) $\frac{4(x-1)}{3}$.
4. $\frac{6}{x}$. 5. $\frac{5(3x-1)}{x(2x+1)}$
6. a) $\frac{11x}{28}$, b) $\frac{23x}{45}$, c) $-\frac{x}{12}$, d) $\frac{x^2-2}{(x+1)(x+2)}$, e) $\frac{x^2+6x+2}{x(x+2)}$, f) $\frac{x+2}{6}$, g) $\frac{9+2x-2x^2}{3(2x+1)}$, h) $\frac{x}{20}$.
7. a) $\frac{3x+7}{(x+2)(x+3)}$, b) $\frac{7x+17}{(x+3)(x+1)}$, c) $\frac{1}{(2x+1)(3x+2)}$, d) $\frac{2x^2+10x+14}{(x+3)(x+2)}$, e) $\frac{x^2-3x+2}{(x-3)^2}$

Section 5. Surds

1. a) $\sqrt{180} = \sqrt{36 \times 5} = 6\sqrt{5}$. b) $\sqrt{63} = \sqrt{9 \times 7} = 3\sqrt{7}$.
3. a) xy . b) Note that $\sqrt{x^2 + y^2}$ is NOT equal to $x + y$.
4. a) $(x + y)^2$, b) $(x + y)^2$, c) $\sqrt{x^4 + y^4}$ is NOT equal to $x^2 + y^2$.
5. $\sqrt{x} - \sqrt{y} = \sqrt{x + y - 2\sqrt{xy}}$.
6. a) $\sqrt{4p}$, b) $\sqrt{pq^3}$, c) $\sqrt{p + 2q + 2\sqrt{2pq}}$, d) $\sqrt{5 - 2\sqrt{6}}$.
7. a) $a^{1/2}$, b) $15^{3/2}$

Section 6. Solving linear equations

- 16/5,
- 4,
- 1,
- 1/7,
- 5/4,
- 7/4,
- 2,
- 0,
- 0,
- 6,
- 1/9,
- 7/6,
- 23/5,
- 6,
- 5,
- 37/19,
- 30,
- 3/4,
- 5/3,
- 5,
- 7,
- $\sqrt{8} - 4$,
- $\sqrt{23} + 4$,
- 49,
- 12/19,
- 42,
- 1,
- 8/13,
- 7/3,
- 13/3,
- 15,
- 7/6,
- 2/5,
- $x = 9/200$,
- $s = 13$.

Section 7. Transposition of formulae

- $t = \frac{c^2}{p^2}$,
- $N = \sqrt{\frac{L\ell}{\mu A}}$,
- a) $e = \frac{h-c-d}{2}$, b) $h = \frac{S-2\pi r^2}{2\pi r}$, c) $c = \frac{d(1+Q^2)}{Q^2-1}$ d) $x = \frac{21-5y}{2}$.
- $n = \frac{mJ}{E-LJ}$

Section 8. Solving quadratic equations by factorisation

- 1,2,
- 1,2,
- 2,1,
- 1,-2,
- 7,-1,
- 4,3,
- 4,5,
- 1,-1,
- 1 twice,
- 1 twice
- 11,0,
- 0,-1,
- 0,3,
- 0,-9,
- $2, \frac{1}{2}$,
- $\frac{1}{2}, -\frac{1}{3}$,
- $\frac{1}{5}, 1$,
- 1,3.

Section 9. Solving quadratic equations by using a standard formula and by completing the square

Note that answers were requested in surd form. Decimal approximations are not acceptable.

- $-4 \pm \sqrt{15}$,
- $-\frac{7}{2} \pm \frac{\sqrt{57}}{2}$,
- $-3 \pm \sqrt{11}$,
- $-\frac{3}{8} \pm \frac{\sqrt{41}}{8}$,
- $-\frac{3}{4} \pm \frac{\sqrt{17}}{4}$,
- $-\frac{1}{2} \pm \frac{\sqrt{5}}{2}$,
- $\frac{3}{2} \pm \frac{\sqrt{13}}{2}$,
- $-\frac{3}{4} \pm \frac{\sqrt{17}}{4}$,
- $\frac{1}{2}, -3$,
- $-3/2, 1$,
- $-\frac{8}{9} \pm \frac{\sqrt{55}}{9}$,
- $-8 \pm \sqrt{55}$.

Section 10. Solving simultaneous linear equations

- $x = 3, y = -2$
- $x = 1, y = 2$
- $x = 3, y = \frac{1}{2}$
- $a = 5/2, y = -2$
- $x = -1, y = 3$
- $x = 3/2, y = -2$
- $a = 4, b = -1$
- $x = -3, y = 5$
- $x = 9/2, y = -3$

Mock Assessment

The test you will sit in September will ask questions similar to this one. Be sure you are able to answer these questions well! You should also be able to complete this test within 1 hour.

You may NOT use a calculator

1. Expand and simplify

(a) $(x + 3)(x - 1)$

(b) $(a + 3)^2$

(c) $(2x + 3)(x - 4)$

2. Factorise

(a) $x^2 - 7x$

(b) $y^2 - 64$

(c) $x^2 - 5x + 6$

(d) $6t^2 - 13t + 5$

3. Simplify

(a) $\frac{4x^3y}{8x^2y^3}$

(b) $\frac{3x + 2}{3} + \frac{4x - 1}{6}$

4. Solve the following equations

(a) $\frac{h-1}{4} + \frac{3h}{5} = 4$

(b) $x^2 - 8x = 0$

(c) $p^2 + 4p - 12 = 0$

5. Write each of the following as single powers of x and/or y

(a) $y^3 \times y^2$

(b) $\frac{1}{x^4}$

(c) $(x^2y)^3$

(d) $\frac{x^5}{x^{-2}}$

6. Work out the values of the following, giving your answers as fractions

(a) 4^{-2} (b) 10^0 (c) $\left(\frac{8}{27}\right)^{\frac{1}{3}}$

7. Solve the simultaneous equations

$$3x - 5y = -11$$

$$5x - 2y = 7$$

8. Rearrange the following equations to make x the subject

(a) $v^2 = u^2 + 2ax$

(b) $V = \frac{1}{3}\pi x^2 h$

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

9. Solve $5x^2 - x - 1 = 0$ giving your solutions in surd form

A-Level Transition Checklist



Please use this check list to self-assess your understanding of key transition topics for mathematics. Rate yourself **green (confident)**, **amber (recognise)** and **red (not known to me)**. Start to work on the red topics.

Number

Topics	Clip Number	R	A	G
Indices 1 Rules for multiplication, division and brackets with positive integer indices.	1033			
Indices 2 Negative indices and applying the three rules, including dealing with coefficients	1951			
Indices 3 Fractional powers $1/n$ and m/n .	1045			
Indices 4 Rewriting the base number using a lower base and using this to solve simple equations with indices.	1301			
Surds 1 Multiplying and dividing surds	1064			
Surds 2 Simplifying surds and rationalising the denominator.	1065			
Recurring Decimals 2 Turning any decimal with a repeating pattern of digits into a fraction.	1066			

Algebra

Topics	Clip Number	R	A	G
Rearranging 2 Turning any decimal with a repeating pattern of digits into a fraction.	1070			
Identities Understanding identities and arguing mathematically to prove them.	1942			
Brackets Expanding and simplifying expressions such as $(3x+2)(2x+5)$	1150			
Gradient and Intercept Finding the gradient between two points, and recognising positive and negative gradients	1312			
Equation of a line 2 Rearranging the equation to find gradient and intercept. Identifying parallel lines.	1314			

Equation of a line 3 Finding the equation of a line when the gradient and y-intercept are not explicitly given.	1957			
Distance-time Drawing and interpreting distance-time graphs.	1322			
Speed-time graphs Draw and interpret speed-time graphs. Finding acceleration by looking at the gradient, and distance by looking at the area under the graph.	1323			
Sketching quadratic graphs 1 Sketching quadratic graphs by identifying key points with a focus on roots and intercepts.	1960			
Sketching quadratic graphs 2 Sketching the graph of a quadratic without working out pairs of coordinates.	1180			
Sketching cubic graphs Recognising features of cubic graphs and using these features to sketch them.	1958			
Reciprocals Introducing reciprocals. Understanding how to sketch reciprocal graphs.	1071			
Simultaneous equations 2 Solving simultaneous equations using the elimination method, including multiplying one equation.	1175			
Simultaneous equations 3 Solving simultaneous equations using the elimination method, including multiplying both equations.	1174			
Simultaneous equations 1 Setting up simultaneous equations and learning how to solve them.	1176			
Substitution 2 Substituting into formulae with more than one variable. Includes squares and cubes.	1186			

Expanding three brackets Expanding and simplifying expressions such as $(3x+2)(2x+5)(x-1)$.	1285			
Cancelling algebraic fractions Using the same principles as with numbers, we can cancel algebraic fractions.	1151			
Adding algebraic fractions Using the same principles as with numbers, we can add algebraic fractions.	1149			
Multiplying algebraic fractions Using the same principles as with numbers, we can multiply and divide algebraic fractions.	1164			
Factorising quadratics 1 Factorising simple quadratics. Difference of two squares. $(a=1)$	1157			
Factorising quadratics 2 Factorising harder quadratics. $(a \neq 1)$	1156			
Completing the square Completing the square. Using this to solve quadratic equations.	1185			
Quadratic formula Using the quadratic formula to solve quadratic equations.	1160			
Shading inequalities Representing inequalities by drawing and shading graphs.	1189			
Functions 1 Considering functions as equations with inputs and outputs, graphs of functions from tables and introduction to function notation.	1940			
Functions 2 Finding and using composite functions and inverses of linear functions.	1941			

Geometry and measures

Topics	Clip Number	R	A	G
Bearings Measuring three-figure bearings. Using two bearings to locate an object.	1086			
Interior exterior angles Internal and external angles of polygons.	1100			
Sum of angles in a polygon Understand and use the formula for the sum of the interior angles of a polygon with n sides.	1320			
Arcs, sectors and segments Knowing the parts of a circle: sector, arc, chord and segment. Finding and using arc length and area for a sector of a circle. Finding the area of a segment.	1118			
Pythagoras' theorem Finding missing sides in right angled triangles. Includes finding the distance between 2 points.	1112			
Trig missing sides Finding missing sides in right angled triangles using trigonometry.	1133			
Trig missing angles Finding missing angles in right angled triangles. This introduction to trigonometry takes you through the idea of \sin , \cos and \tan .	1131			
Trig area of a triangle Area of a scalene triangle when we know the base but not the height.	1144			
Sine rule Area of a scalene triangle when we know the base but not the height.	1120			
Cosine rule side Using the cosine rule to find missing sides in triangles.	1095			
Cosine rule angles Using the cosine rule to find missing angles in triangles.	1094			
Vectors 1 Plotting, multiplying, adding and subtracting vectors.	1134			
Vectors 2 Expressing journeys in terms of vectors. Using vectors to prove that lines are parallel, and points are co-linear.	1135			
Vectors 3 Finding the magnitude of a vector and understanding position vectors.	1332			

Probability

Topics	Clip Number	R	A	G
Experimental probability Expected frequencies and the comparison of expected and observed frequencies.	1264			
Independent probability Drawing a tree diagram to show the probabilities of independent events. Using the AND rule.	1208			
The OR rule Exhaustive and mutually exclusive events. Using the OR Rule.	1262			
Conditional probability 2 Understanding how probabilities change in experiments without replacement. Using tree diagrams without replacement.	1334			
Venn diagrams 1 Interpreting data given in a Venn diagram and finding simple probabilities. Introducing the language and notation of sets, including union, intersection and complement.	1921			
Venn diagrams 2 Constructing Venn diagrams from given data. Using set notation with probabilities.	1922			

Statistics

Topics	Clip Number	R	A	G
Types of data Qualitative and quantitative, discrete and continuous data.	7008			
Sampling 1 Populations and censuses. Types of sampling.	7009			
Sampling 2 Simple random sampling and stratified sampling. Pros and cons of each method.	7010			
Questionnaires Designing questionnaires, and problems including bias and missing data.	7011			
Time series Interpreting time series data in tables and graphs, including trend lines.	1939			
Scatter graphs Scatter graphs and correlation. An excellent way to show whether or not two sets of data are linked in some way or correlated.	1213			
Quartiles and interquartile range Finding the interquartile range, outliers, and interquartile ranges.	7056			
Mean from frequency tables Find the mean from a frequency table.	1254			
Mean of grouped data 1	1201			

Finding the mean from data placed in a grouped data table.				
Mean of grouped data 2 More on estimating the mean of grouped data. Types of skew.	1255			
All averages Use the three types of average to compare two data sets. Advantages and disadvantages of different averages.	1192			
Cumulative frequency 1 Plotting cumulative frequency graphs. Finding the median and the interquartile range.	1195			
Cumulative frequency 2 Cumulative frequency graphs for grouped data. Using the graph to find the median and the modal class.	1333			
Box and whisker plots Box and whisker plots allow you to summarise the important statistics from a cumulative frequency graph. Comparing two or more data sets.	1194			
Frequency polygons Representing and comparing grouped data using frequency polygons.	1936			
Histograms Understanding the difference between a histogram and a bar chart. Calculating the frequency and frequency density.	1197			

Once you have completed the work booklet and worked through the red topics from the MyMaths checklist above you can take advantage of this additional transition period to work on the resources available online using the links below.

<https://www.mathedup.co.uk/transition-takeaway/>