DIXONS SIXTH FORM ACADEMY

SUMMER WORK

A LEVEL MATHS

2025

STUDENT NAME:

Contents

About the Summer Work

A-Level Mathematics builds upon the fundamental concepts covered at GCSE. The topics included in this booklet will be assessed upon your arrival in September and only limited time will be allocated to revisiting these foundational principles in lessons.

To ensure a smooth transition into A-Level study, it is essential that you dedicate time over the summer to consolidating your understanding and preparing for the preliminary test, which will take place during the first week of term.

Guidance for Completion

- **Complete all tasks in this booklet** and bring it with you to your first mathematics lesson.
- **Self-mark your work** using green or red pen, carefully reviewing and correcting any errors.
- **Attempt every question**, ensuring that you always show your full working.
- **Spend extra time on challenging topics**, using Corbettmaths videos for additional support where necessary.
- This booklet includes significant additional content. We strongly encourage you to complete all exercises, including the optional ones, to fully prepare for Sixth Form study.
- **Follow the week-by-week schedule** as a guide to manage your workload effectively throughout the summer.

Diligent preparation will help you build confidence and ensure you are ready to engage fully in your A-Level Mathematics journey.

Welcome to Mathematics

A-Level Mathematics: Subject Overview

A-Level Mathematics is one of the most widely studied subjects by students progressing to university. It develops essential analytical skills and problem-solving abilities that are fundamental across numerous disciplines. Students who excel in A-Level Mathematics embrace challenges, enjoy exploring mathematical concepts and recognise the value of consistent practice in mastering a wide range of problem-solving techniques.

Success in this subject requires a commitment to regular independent study. Beyond lessons, students should dedicate time to refining their skills through exercises, past exam questions and various learning resources, including **online retrieval practice**, **textbook-based procedural tasks**, and **exam-style problems**.

The Value of Mathematics in Further Study and Employment

Mathematics has long been regarded as a highly respected A-Level by universities and employers due to its rigorous content and the intellectual discipline required to succeed. It opens doors to a broad spectrum of courses and careers that demand strong numerical reasoning and logical thinking. In today's technology-driven world, mathematics students often demonstrate **innovation and creativity** in problem-solving—key qualities sought after in the modern workforce.

Course Structure

Students will study the **Edexcel Specification** for A-Level Mathematics, culminating in three **2-hour papers** at the end of Year 2:

- **Paper 1 & 2 – Pure Mathematics:** Covers fundamental concepts such as algebra, coordinate geometry, graphs and calculus.
- **Paper 3 – Mechanics and Statistics:** Includes topics such as forces, kinematics and projectiles in mechanics, as well as probability distributions, data analysis, and hypothesis testing in statistics.

By fully engaging with the course and actively developing mathematical fluency, students will build a solid foundation for success in both higher education and future career pathways.

Careers & Higher Education

A-Level Mathematics is a **facilitating subject**, widely recognised as a highly respected qualification that is essential for certain university courses. If you are considering studying **engineering, economics, mathematics, physics, statistics, actuarial science or computer science**, most universities **require** A-Level Mathematics as part of their entry criteria. Additionally, for fields such as **biochemistry, dentistry, business studies, geography and accounting**, mathematics is often listed as a **highly beneficial but not mandatory** subject.

The Value of Mathematics in Career Development

Mathematics-related careers are among the most highly paid professions. Research indicates that students who complete A-Level Mathematics earn, on average, **11% more** over their lifetime compared to those who do not. While some may assume that a degree in mathematics leads to a limited range of career options, this is far from the truth. Mathematics graduates are highly sought after and can pursue diverse career pathways, including **finance, civil service, technology, research and engineering**.

Engineering, in particular, offers a **variety of degree routes**, making it one of the most popular choices for mathematics students entering higher education. The strong analytical and problem-solving skills developed through A-Level Mathematics provide a solid foundation for tackling complex challenges in a wide range of industries.

Actuarial Science: A Leading Mathematical Career

One example of a highly mathematical career is **actuarial science**. Actuaries play a key role in the business and financial sectors, using **mathematical modelling** and **statistical analysis** to assess risk and determine probability. This can involve tasks such as **evaluating pension scheme liabilities** or **pricing commercial insurance policies**. Due to the rigorous examination process required to qualify as an actuary, **salaries in this field are highly competitive**, making it an appealing profession for mathematically skilled individuals.

Links to key information:

qualifications.pearson.com/en/qualifications/edexcel-a-levels/mathematics-2017.html

https://amsp.org.uk/teachers/11-16-maths/transition-to-level-3-maths/where-maths-meets-the-world-of-work/

Summer Work Tasks

Weekly Tasks

There are 10 practice tasks to complete, with examples and answers, that are all revision of key topics from GCSE. These topics are essential to the study of A-Level Mathematics and students need to ensure they fully understand each concept. **Students will be assessed in the first lesson on these topics** to ensure they are starting the course with a grounded understanding of algebra from GCSE. Please see the guidance on the previous page on how to set out your work. Below is a suggested week-by-week schedule to help you organise your time.

Weekly Maths Revision Plan

Week	Exercises
1	1. Rearranging Formulae 2. Indices
2	1. Surds 2. Factorising Quadratics
3	1. Algebra 2. Completing the Square
4	1. Inequalities 2. Straight Line Graphs
5	1. Further Straight Lines 2. Algebraic Fractions and Cancelling
6	**Consolidation:** Redo incorrectly answered questions from previous weeks.

Reading list

Suggested Reading and Viewing Materials

Suggested Reading:

The Codebook by Simon Singh
The Simpsons and Their Mathematical Secrets by Simon Singh
Infinity: The Quest to Think the Unthinkable by Brian Clegg
The Man who knew Infinity by Robert Kanigel
Humble Pi: A Comedy of Maths Errors by Matt Parker

Suggested Viewing:

bbc.co.uk/iplayer/episode/b0074rxx/horizon-19951996-fermat's-last-theore

Rearranging Formulae

Video Examples

Before you dive into the practice questions on the next page, scan the QR code below and watch the video examples to help you understand the topic better.

Rearranging Formulae

Practice Questions

Q1, (Jan 2006, Q5)

Make C the subject of the formula $P = \dfrac{C}{C+4}$. [4]

Q2, (Jun 2006, Q1)

The volume of a cone is given by the formula $V = \frac{1}{3}\pi r^2 h$. Make r the subject of this formula. [3]

Q3, (Jan 2007, Q3)

Make a the subject of the equation

$$2a + 5c = af + 7c.$$ [3]

Q4, (Jun 2007, Q2)

Make t the subject of the formula $s = \frac{1}{2}at^2$. [3]

Q5, (Jan 2008, Q1)

Make v the subject of the formula $E = \frac{1}{2}mv^2$. [3]

Q6, (Jun 2008, Q5)

Make x the subject of the equation $y = \dfrac{x+3}{x-2}$. [4]

Q7, (Jan 2009, Q9)

Rearrange $y + 5 = x(y + 2)$ to make y the subject of the formula. **[4]**

Q8, (Jun 2009, Q2)

Make a the subject of the formula $s = ut + \frac{1}{2}at^2$. **[3]**

Q9, (Jan 2010, Q1)

Rearrange the formula $c = \sqrt{\dfrac{a+b}{2}}$ to make a the subject. **[3]**

Q10, (Jun 2010, Q3)

Make y the subject of the formula $a = \dfrac{\sqrt{y} - 5}{c}$. **[3]**

Q11, (Jan 2011, Q5)

The volume V of a cone with base radius r and slant height l is given by the formula

$$V = \tfrac{1}{3}\pi r^2\sqrt{l^2 - r^2}.$$

Rearrange this formula to make l the subject. **[4]**

Rearranging Formulae

Practice Questions

Q12, (Jun 2011, Q8)

Make x the subject of the formula $y = \dfrac{1-2x}{x+3}$. **[4]**

Q13, (Jan 2012, Q6)

Rearrange the following equation to make h the subject.

$$4h + 5 = 9a - ha^2$$ **[3]**

Q14, (Jun 2012, Q2)

Make b the subject of the following formula.

$$a = \tfrac{2}{3} b^2 c$$ **[3]**

Q15, (Jan 2013, Q3)

A circle has diameter d, circumference C, and area A. Starting with the standard formulae for a circle, show that $Cd = kA$, finding the numerical value of k. **[3]**

Q16, (Jan 2013, Q8)

Rearrange the equation $5c + 9t = a(2c + t)$ to make c the subject. **[4]**

Q17, (Jun 2013, Q4)

Rearrange the following formula to make r the subject, where $r > 0$.

$$V = \frac{1}{3}\pi r^2 (a + b)$$ **[3]**

Q18, (Jun 2014, Q5)

Make a the subject of $3(a+4) = ac + 5f$. **[4]**

Q19, (Jun 2015, Q1)

Make r the subject of the formula $A = \pi r^2 (x+y)$, where $r > 0$. **[2]**

Q20, (Jun 2016, Q4)

You are given that $a = \dfrac{3c+2a}{2c-5}$. Express a in terms of c. **[4]**

Q21, (Jun 2017, Q6)

Rearrange the formula $r = \sqrt{\dfrac{V}{a+b}}$ to make b the subject. **[4]**

Q22, (Jun 2018, Q4)

For the following equation, express x in terms of y.

$$\frac{x}{3y} = \frac{2x+1}{y+2}$$ **[4]**

Rearranging Formulae

Working

Rearranging Formulae

Answers

Scan the QR code below and use a different coloured pen (like red or green) to mark your answers carefully.

Indices

Video Examples

Before you dive into the practice questions on the next page, scan the QR code below and watch the video examples to help you understand the topic better.

Indices

Practice Questions

Q1, (OCR MEI 4751, Jun 2013, Q3)

(i) Evaluate $(0.2)^{-2}$. **[2]**

(ii) Simplify $(16a^{12})^{\frac{3}{4}}$. **[3]**

Q2, (OCR MEI 4751, Jan 2013, Q1)

Find the value of each of the following.

(i) $\left(\frac{5}{3}\right)^{-2}$ **[2]**

(ii) $81^{\frac{3}{4}}$ **[2]**

Q3, (OCR MEI 4751, Jan 2013, Q2)

Simplify $\frac{(4x^5y)^3}{(2xy^2)\times(8x^{10}y^4)}$. **[3]**

Q4 (OCR MEI 4751, Jan 2012, Q2)

(i) Evaluate $9^{-\frac{1}{2}}$. **[2]**

(ii) Simplify $\frac{(4x^4)^3\,y^2}{2x^2y^5}$. **[3]**

Q5, (OCR 4721, Jun 2016, Q5)

Express the following in the form 2^p.

(i) $(2^5\div 2^7)^3$ **[2]**

(ii) $5\times 4^{\frac{2}{3}}+3\times 16^{\frac{1}{3}}$ **[3]**

Q6 (OCR 4721, Jun 2015, Q3)

Express each of the following in the form 5^k.

(i) 25^4 **[1]**

(ii) $\frac{1}{\sqrt[4]{5}}$ **[2]**

(iii) $(5\sqrt{5})^3$ **[2]**

Q7 (OCR 4721, Jan 2013, Q2)

Solve the equations

(i) $3^n = 1$, **[1]**

(ii) $t^{-3} = 64$, **[2]**

(iii) $(8p^6)^{\frac{1}{3}} = 8$. **[3]**

Indices

Practice Questions

Q8 (OCR 4221, Jun 2012, Q2)

Express each of the following in the form 7^k:

(i) $\sqrt[4]{7}$, **[1]**

(ii) $\frac{1}{7\sqrt{7}}$, **[2]**

(iii) $7^4 \times 49^{10}$. **[2]**

Q9, (OCR 4721, Jan 2005, Q1i,ii)

(i) Express 11^{-2} as a fraction. [1]

(ii) Evaluate $100^{\frac{3}{2}}$. [2]

Q10, (OCR 4721, Jun 2005, Q5a,b)

(a) Simplify $2x^{\frac{2}{3}} \times 3x^{-1}$. [2]

(b) Express $2^{40} \times 4^{30}$ in the form 2^n. [2]

Q11, (OCR 4721, Jun 2006, Q2i,ii)

(i) Evaluate $27^{-\frac{2}{3}}$. [2]

(ii) Express $5\sqrt{5}$ in the form 5^n. [1]

Q12, (OCR 4721, Jan 2007, Q2)

Evaluate

(i) 6^0, [1]

(ii) $2^{-1} \times 32^{\frac{4}{5}}$. [3]

Q13, (OCR 4721, Jan 2008, Q3)

Solve the equations

(i) $10^p = 0.1$, [1]

(ii) $(25k^2)^{\frac{1}{2}} = 15$, [3]

(iii) $t^{-\frac{1}{3}} = \frac{1}{2}$. [2]

Q14, (OCR 4721, Jan 2009, Q2)

Simplify

(i) $(\sqrt[3]{x})^6$, **[1]**

(ii) $\frac{3y^4 \times (10y)^3}{2y^5}$. **[3]**

Indices

Working

Indices

Answers

Scan the QR code below and use a different coloured pen (like red or green) to mark your answers carefully.

Surds

Video Examples

Before you dive into the practice questions on the next page, scan the QR code below and watch the video examples to help you understand the topic better.

Surds

Practice Questions

Q1, (Jan 2006, Q8)

(i) Simplify $5\sqrt{8}+4\sqrt{50}$. Express your answer in the form $a\sqrt{b}$, where a and b are integers and b is as small as possible. [2]

(ii) Express $\dfrac{\sqrt{3}}{6-\sqrt{3}}$ in the form $p+q\sqrt{3}$, where p and q are rational. [3]

Q2, (Jun 2006, Q7)

(i) Simplify $6\sqrt{2}\times 5\sqrt{3}-\sqrt{24}$. [2]

(ii) Express $(2-3\sqrt{5})^2$ in the form $a+b\sqrt{5}$, where a and b are integers. [3]

Q3, (Jan 2007, Q7)

You are given that $a=\dfrac{3}{2}$, $b=\dfrac{9-\sqrt{17}}{4}$ and $c=\dfrac{9+\sqrt{17}}{4}$. Show that $a+b+c=abc$. [4]

Q4, (Jun 2007, Q8)

(i) Simplify $\sqrt{98}-\sqrt{50}$. [2]

(ii) Express $\dfrac{6\sqrt{5}}{2+\sqrt{5}}$ in the form $a+b\sqrt{5}$, where a and b are integers. [3]

Q5, (Jan 2008, Q8)

(i) Write $\sqrt{48}+\sqrt{3}$ in the form $a\sqrt{b}$, where a and b are integers and b is as small as possible. [2]

(ii) Simplify $\dfrac{1}{5+\sqrt{2}}+\dfrac{1}{5-\sqrt{2}}$. [3]

Q6, (Jun 2008, Q7)

(i) Express $\dfrac{1}{5+\sqrt{3}}$ in the form $\dfrac{a+b\sqrt{3}}{c}$, where a, b and c are integers. [2]

(ii) Expand and simplify $(3-2\sqrt{7})^2$. [3]

Q7, (Jan 2009, Q10)

(i) Express $\sqrt{75}+\sqrt{48}$ in the form $a\sqrt{3}$. **[2]**

(ii) Express $\dfrac{14}{3-\sqrt{2}}$ in the form $b+c\sqrt{d}$. **[3]**

Q8, (Jun 2009, Q8)

(i) Simplify $\dfrac{\sqrt{48}}{2\sqrt{27}}$. **[2]**

(ii) Expand and simplify $(5-3\sqrt{2})^2$. **[3]**

Surds

Practice Questions

Q9, (Jun 2010, Q5)

(i) Express $\sqrt{48}+\sqrt{27}$ in the form $a\sqrt{3}$. **[2]**

(ii) Simplify $\dfrac{5\sqrt{2}}{3-\sqrt{2}}$. Give your answer in the form $\dfrac{b+c\sqrt{2}}{d}$. **[3]**

Q10, (Jan 2011, Q7)

(i) Express $\dfrac{81}{\sqrt{3}}$ in the form 3^k. **[2]**

(ii) Express $\dfrac{5+\sqrt{3}}{5-\sqrt{3}}$ in the form $\dfrac{a+b\sqrt{3}}{c}$, where a, b and c are integers. **[3]**

Q11, (Jan 2012, Q4)

(i) Expand and simplify $(7+3\sqrt{2})(5-2\sqrt{2})$. **[3]**

(ii) Simplify $\sqrt{54}+\dfrac{12}{\sqrt{6}}$. **[2]**

Q12, (Jun 2012, Q5)

(i) Simplify $\dfrac{10(\sqrt{6})^3}{\sqrt{24}}$. **[3]**

(ii) Simplify $\dfrac{1}{4-\sqrt{5}}+\dfrac{1}{4+\sqrt{5}}$. **[2]**

Q13, (Jan 2013, Q7)

(i) Express $\sqrt{48}+\sqrt{75}$ in the form $a\sqrt{b}$, where a and b are integers. **[2]**

(ii) Simplify $\dfrac{7+2\sqrt{5}}{7+\sqrt{5}}$, expressing your answer in the form $\dfrac{a+b\sqrt{5}}{c}$, where a, b and c are integers. **[3]**

Q14, (Jun 2013, Q7)

(i) Express $125\sqrt{5}$ in the form 5^k. **[2]**

(ii) Simplify $10+7\sqrt{5}+\dfrac{38}{1-2\sqrt{5}}$, giving your answer in the form $a+b\sqrt{5}$. **[3]**

Q15, (Jun 2014, Q4)

(i) Expand and simplify $(7-2\sqrt{3})^2$. **[3]**

(ii) Express $\dfrac{20\sqrt{6}}{\sqrt{50}}$ in the form $a\sqrt{b}$, where a and b are integers and b is as small as possible. **[2]**

Q16, (Jun 2015, Q6)

(i) Expand and simplify $(3+4\sqrt{5})(3-2\sqrt{5})$. **[3]**

(ii) Express $\sqrt{72}+\dfrac{32}{\sqrt{2}}$ in the form $a\sqrt{b}$, where a and b are integers and b is as small as possible. **[2]**

Surds

Working

Surds

Answers

Scan the QR code below and use a different coloured pen (like red or green) to mark your answers carefully.

Factorising Quadratics

Video Examples

Before you dive into the practice questions on the next page, scan the QR code below and watch the video examples to help you understand the topic better.

Factorising Quadratics

Practice Questions

Section 1: Routine Factorisation Practice

Easy

1. $a^2 - 6a + 8$
2. $a^2 + 7a + 10$
3. $a^2 - 3a + 2$
4. $a^2 - 5a + 4$
5. $a^2 + a - 2$
6. $a^2 - 7a + 12$
7. $a^2 + 2a - 8$
8. $a^2 + 8a + 15$
9. $a^2 + 5a + 6$
10. $a^2 + 6a + 9$
11. $a^2 - 2a + 1$
12. $a^2 - 5a + 4$
13. $a^2 - 2a - 3$
14. $a^2 + 6a + 8$
15. $a^2 + a - 20$
16. $a^2 - 9a + 20$
17. $a^2 - a - 12$
18. $a^2 + 9a + 20$
19. $a^2 - 3a - 10$
20. $a^2 - 2a - 8$

Harder

1. $3a^2 + 7a + 4$
2. $4a^2 - 15a + 9$
3. $3a^2 + a - 2$
4. $4a^2 - 17a - 15$
5. $2a^2 - 13a + 20$
6. $4a^2 - 15a + 9$
7. $4a^2 - 15a - 4$
8. $5a^2 + 14a - 3$
9. $3a^2 + 4a - 4$
10. $5a^2 - 6a - 8$
11. $4a^2 - 5a - 6$
12. $2a^2 - 7a + 6$
13. $3a^2 + 4a - 15$
14. $3a^2 + 5a + 2$
15. $3a^2 + 2a - 8$
16. $3a^2 - 2a - 5$
17. $4a^2 - 17a + 4$
18. $3a^2 + 13a - 10$
19. $2a^2 - 9a + 9$
20. $3a^2 - 7a - 6$

Section 2: Problem Solving

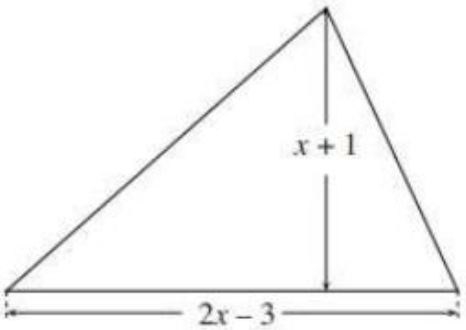
Q1, (Jan 2007, Q9ii)

Factorise $x^2 - 4$ and $x^2 - 5x + 6$.

Hence express $\dfrac{x^2 - 4}{x^2 - 5x + 6}$ as a fraction in its simplest form. [3]

Q2, (Jun 2007, Q10)

The triangle shown in Fig. 10 has height $(x + 1)$ cm and base $(2x - 3)$ cm. Its area is 9 cm^2.



Not to scale

Fig. 10

(i) Show that $2x^2 - x - 21 = 0$. [2]

(ii) By factorising, solve the equation $2x^2 - x - 21 = 0$. Hence find the height and base of the triangle. [3]

Factorising Quadratics

Practice Questions

Q3, (Jan 2008, Q2)

Factorise and hence simplify $\dfrac{3x^2 - 7x + 4}{x^2 - 1}$. [3]

Q4, (Jun 2008, Q3i)

Solve the equation $2x^2 + 3x = 0$. [2]

Q5, (Jun 2008, Q9)

Solve the equation $y^2 - 7y + 12 = 0$.

Hence solve the equation $x^4 - 7x^2 + 12 = 0$. [4]

Q6, (Jun 2010, Q10i, ii)

(i) Solve, by factorising, the equation $2x^2 - x - 3 = 0$. **[3]**

(ii) Sketch the graph of $y = 2x^2 - x - 3$. **[3]**

Q7, (Jan 2011, Q9)

Fig. 9 shows a trapezium ABCD, with the lengths in centimetres of three of its sides.

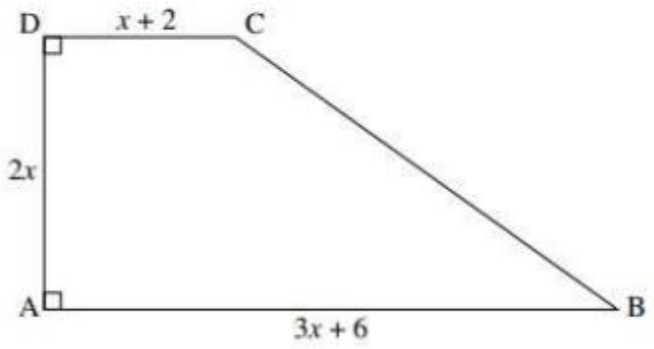


Fig. 9

This trapezium has area $140\,\text{cm}^2$.

(i) Show that $x^2 + 2x - 35 = 0$. **[2]**

(ii) Hence find the length of side AB of the trapezium. **[3]**

Q8, (Jun 2012, Q4)

Factorise and hence simplify the following expression.

$$\frac{x^2 - 9}{x^2 + 5x + 6}$$ **[3]**

Factorising Quadratics

Working

Factorising Quadratics

Answers

Scan the QR code below and use a different coloured pen (like red or green) to mark your answers carefully.

Algebra

Video Examples

Before you dive into the practice questions on the next page, scan the QR code below and watch the video examples to help you understand the topic better.

Algebra

Practice Questions

Q1, (Jan 2006, Q2)

(i) Simplify $(3x+1)^2 - 2(2x-3)^2$. [3]

(ii) Find the coefficient of x^3 in the expansion of

$$(2x^3 - 3x^2 + 4x - 3)(x^2 - 2x + 1).$$ [2]

Q2, (Jun 2006, Q4i)

By expanding the brackets, show that

$$(x-4)(x-3)(x+1) = x^3 - 6x^2 + 5x + 12.$$ [3]

Q3, (Jun 2007, Q1)

Simplify $(2x+5)^2 - (x-3)^2$, giving your answer in the form $ax^2 + bx + c$. [3]

Q4, (Jun 2007, Q5i)

The diagram shows a rectangular enclosure, with a wall forming one side. A rope, of length 20 metres, is used to form the remaining three sides. The width of the enclosure is x metres.

(i) Show that the enclosed area, A m^2, is given by

$$A = 20x - 2x^2.$$ [2]

Q5, (Jun 2008, Q6i)

Expand and simplify $(x-5)(x+2)(x+5)$. [3]

Q6, (Jan 2012, Q3)

Given that

$$5x^2 + px - 8 = q(x-1)^2 + r$$

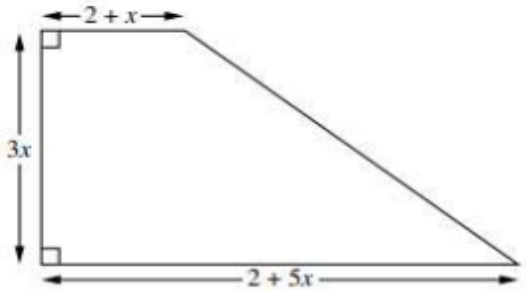
for all values of x, find the values of the constants p, q and r. [4]

Algebra

Practice Questions

Q7, (Jan 2010, Q11i,ii)

A lawn is to be made in the shape shown below. The units are metres.



(i) The perimeter of the lawn is P m. Find P in terms of x. **[2]**

(ii) Show that the area, A m^2, of the lawn is given by $A = 9x^2 + 6x$. **[2]**

Q8, (Jun 2010, Q4i)

Expand $(x-2)^2(x+1)$, simplifying your answer. **[3]**

Q9. (Jan 2011, Q2)

Given that

$$(x-p)(2x^2+9x+10) = (x^2-4)(2x+q)$$

for all values of x, find the constants p and q. **[3]**

Q10, (Jun 2012, Q1)

Simplify $(x-5)(x^2+3)-(x+4)(x-1)$. **[3]**

Q11, (Jan 2013, Q5)

(i) Simplify $(x+4)(5x-3)-3(x-2)^2$. **[3]**

(ii) The coefficient of x^2 in the expansion of

$$(x+3)(x+k)(2x-5)$$

is -3. Find the value of the constant k. **[3]**

Q12, (Jun 2016, Q1)

(i) Simplify $(2x-3)^2-2(3-x)^2$. **[2]**

(ii) Find the coefficient of x^3 in the expansion of $(3x^2-3x+4)(5-2x-x^3)$. **[2]**

Algebra

Working

Algebra

Answers

Scan the QR code below and use a different coloured pen (like red or green) to mark your answers carefully.

Completing the Square

Video Examples

Before you dive into the practice questions on the next page, scan the QR code below and watch the video examples to help you understand the topic better.

Completing the Square

Practice Questions

Section A: GCSE Practice

Write the following expressions in complete square form (i.e. in the form $(x + a)^2 + b$)

1. $x^2 + 2x$
2. $x^2 - 8x$
3. $x^2 + 4x + 3$
4. $x^2 - 6x + 4$
5. $x^2 - 10x - 1$
6. $x^2 + 3x$
7. $x^2 - 7x$
8. $x^2 + 7x - 4$
9. $x^2 - 5x - 5$
10. $x^2 + 7x + \frac{1}{2}$

Section B: Extending on GCSE

Q1 (Jun 2005, Q2)

(i) Express $3x^2 + 12x + 7$ in the form $3(x + a)^2 + b$. [4]

(ii) Hence write down the equation of the line of symmetry of the curve $y = 3x^2 + 12x + 7$. [1]

Q2 (Jun 2006, Q3)

(i) Express $2x^2 + 12x + 13$ in the form $a(x + b)^2 + c$. [4]

(ii) Solve $2x^2 + 12x + 13 = 0$, giving your answers in simplified surd form. [3]

Q3 (Jan 2007, Q6)

(i) Express $2x^2 - 24x + 80$ in the form $a(x - b)^2 + c$. [4]

(ii) State the equation of the line of symmetry of the curve $y = 2x^2 - 24x + 80$. [1]

(iii) State the equation of the tangent to the curve $y = 2x^2 - 24x + 80$ at its minimum point. [1]

Q4 (Jun 2008, Q10) [Modified]

(i) Express $2x^2 - 6x + 11$ in the form $p(x + q)^2 + r$. [4]

(ii) State the coordinates of the vertex of the curve $y = 2x^2 - 6x + 11$. [2]

Q5 (Jan 2009, Q6) [Modified]

(i) Express $5x^2 + 20x - 8$ in the form $p(x + q)^2 + r$. **[4]**

(ii) State the equation of the line of symmetry of the curve $y = 5x^2 + 20x - 8$. **[1]**

Q6 (Jun 2012, Q4)

(i) Express $2x^2 - 20x + 49$ in the form $p(x - q)^2 + r$. **[4]**

(ii) State the coordinates of the vertex of the curve $y = 2x^2 - 20x + 49$. **[2]**

Completing the Square

Working

Completing the Square

Answers

Scan the QR code below and use a different coloured pen (like red or green) to mark your answers carefully.

Inequalities

Video Examples

Before you dive into the practice questions on the next page, scan the QR code below and watch the video examples to help you understand the topic better.

Inequalities

Practice Questions

Section A: Linear Inequalities (From OCR 6993)

Q1, (Jun 2010, Q1)

Solve the inequality $3 - x < 4(x - 1)$. [3]

Q2, (Jun 2013, Q2)

Find the integers that satisfy the inequality $-7 < 3x + 1 < 12$. [4]

Q3, (Jun 2014, Q1)

Solve the following.

$$-6 < 2x - 1 < 7$$ [3]

Q4, (Jun 2016, Q1)

Solve the inequality $1 - 2(x - 3) > 4x$. [3]

Q5, (Jun 2017, Q1)

Solve the inequality $-2 < 3x + 1 < 7$. [3]

Q6, (Jun 2018, Q1)

Solve the inequality $2 - x < 1 + 3(x - 2)$. [3]

Section B: Quadratic Inequalities (From OCR 4751)

Q1 (OCR 4751, Jun 2006, Q6)

Solve the inequality $x^2 + 2x < 3$. [4]

Q2 (OCR 4751. Jun 2009, Q4)

Solve the inequality $x(x - 6) > 0$. [2]

Q3 (OCR 4751, Jan 2013, Q4)

Solve the inequality $5x^2 - 28x - 12 \leqslant 0$. [4]

Q4 (OCR 4751, Jun 2014, Q6)

Solve the inequality $3x^2 + 10x + 3 > 0$. [3]

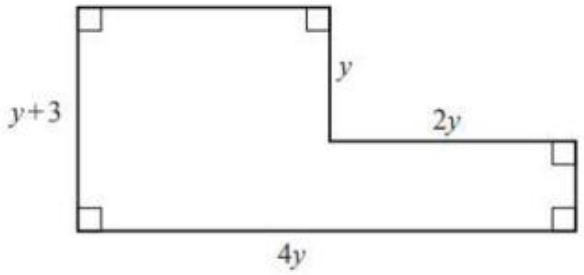
Inequalities

Practice Questions

Q5 (OCR 4721, Jun 2012, Q9)

(i) A rectangular tile has length $4x$ cm and width $(x + 3)$ cm. The area of the rectangle is less than $112\,\text{cm}^2$. By writing down and solving an inequality, determine the set of possible values of x. **[6]**

(ii) A second rectangular tile of length $4y$ cm and width $(y + 3)$ cm has a rectangle of length $2y$ cm and width y cm removed from one corner as shown in the diagram.



Given that the perimeter of this tile is between 20 cm and 54 cm, determine the set of possible values of y. **[5]**

Q6 (OCR 4721, Jan 2005, Q8)

The length of a rectangular children's playground is 10 m more than its width. The width of the playground is x metres.

(i) The perimeter of the playground is greater than 64 m. Write down a linear inequality in x. [1]

(ii) The area of the playground is less than $299\,\text{m}^2$. Show that $(x - 13)(x + 23) < 0$. [2]

(iii) By solving the inequalities in parts **(i)** and **(ii)**, determine the set of possible values of x. [5]

Inequalities

Working

Inequalities

Answers

Scan the QR code below and use a different coloured pen (like red or green) to mark your answers carefully.

Straight Lines

Video Examples

Before you dive into the practice questions on the next page, scan the QR code below and watch the video examples to help you understand the topic better.

Straight Lines

Practice Questions

Q1, (Jun 2005, Q4)

A line has equation $3x + 5y = 12$. Find its gradient and the coordinates of the points where it crosses the axes. [4]

Q2, (Jun 2006, Q3)

Find the coordinates of the point of intersection of the lines $y = 3x + 1$ and $x + 3y = 6$. [3]

Q3, (Jan 2007, Q1)

Find, in the form $y = ax + b$, the equation of the line through $(3, 10)$ which is parallel to $y = 2x + 7$. [3]

Q4, (Jan 2008, Q5)

(i) Find the gradient of the line $4x + 5y = 24$. [2]

(ii) A line parallel to $4x + 5y = 24$ passes through the point $(0, 12)$. Find the coordinates of its point of intersection with the x-axis. [3]

Q5, (Jun 2008, Q2)

(i) Find the points of intersection of the line $2x + 3y = 12$ with the axes. [2]

(ii) Find also the gradient of this line. [2]

Q6, (Jun 2008, Q12i)

Find the equation of the line passing through A $(-1, 1)$ and B $(3, 9)$. [3]

Q7, (Jan 2009, Q2)

Find the equation of the line passing through $(-1, -9)$ and $(3, 11)$. Give your answer in the form $y = mx + c$. **[3]**

Q8, (Jun 2009, Q1)

A line has gradient -4 and passes through the point $(2, 6)$. Find the coordinates of its points of intersection with the axes. **[4]**

Q9, (Jan 2010, Q3)

(i) Find the coordinates of the point where the line $5x + 2y = 20$ intersects the x-axis. **[1]**

(ii) Find the coordinates of the point of intersection of the lines $5x + 2y = 20$ and $y = 5 - x$. **[3]**

Q10, (Jun 2010, Q1)

Find the equation of the line which is parallel to $y = 3x + 1$ and which passes through the point with coordinates $(4, 5)$. **[3]**

Straight Lines

Working

Straight Lines

Answers

Scan the QR code below and use a different coloured pen (like red or green) to mark your answers carefully.

Further Straight Lines

Video Examples

Before you dive into the practice questions on the next page, scan the QR code below and watch the video examples to help you understand the topic better.

Further Straight Lines

Practice Questions

Q1, (Jun 2014, Q2)

A is the point (1, 5) and B is the point (6, −1). M is the midpoint of AB. Determine whether the line with equation $y = 2x - 5$ passes through M. **[3]**

Q2, (Jun 2011, Q9)

A line L is parallel to the line $x + 2y = 6$ and passes through the point (10, 1). Find the area of the region bounded by the line L and the axes. **[5]**

Q3, (Jun 2016, Q10i)

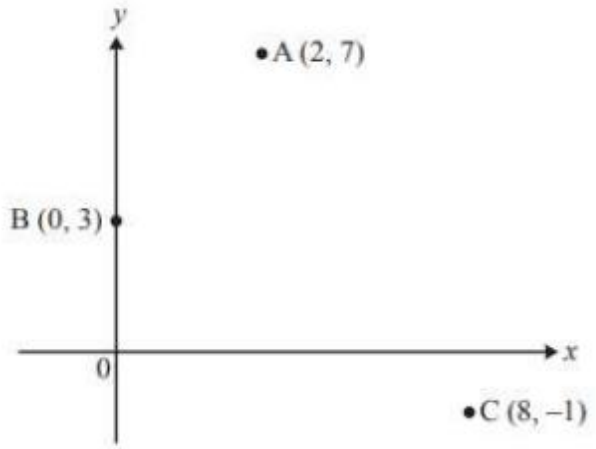
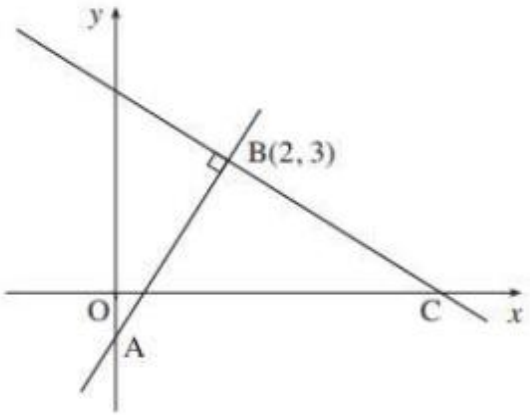


Fig. 10

Prove that angle ABC is 90°. **[3]**

Q4, (Jan 2006, Q7)



Not to scale

Fig. 7

The line AB has equation $y = 4x - 5$ and passes through the point B(2, 3), as shown in Fig. 7. The line BC is perpendicular to AB and cuts the x-axis at C. Find the equation of the line BC and the x-coordinate of C. **[5]**

Further Straight Lines

Practice Questions

Q5, (Jan 2007, Q12)

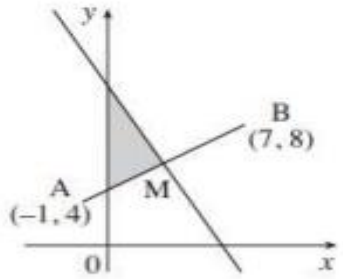
Use coordinate geometry to answer this question. Answers obtained from accurate drawing will receive no marks.

A and B are points with coordinates $(-1, 4)$ and $(7, 8)$ respectively.

(i) Find the coordinates of the midpoint, M, of AB.

Show also that the equation of the perpendicular bisector of AB is $y + 2x = 12$. [6]

(ii) Find the area of the triangle bounded by the perpendicular bisector, the y-axis and the line AM, as sketched in Fig. 12. [6]



Not to scale

Fig. 12

Q6, (Jan 2013, Q10)

(i) Points A and B have coordinates (–2, 1) and (3, 4) respectively. Find the equation of the perpendicular bisector of AB and show that it may be written as $5x + 3y = 10$. **[6]**

(ii) Points C and D have coordinates (–5, 4) and (3, 6) respectively. The line through C and D has equation $4y = x + 21$. The point E is the intersection of CD and the perpendicular bisector of AB. Find the coordinates of point E. **[3]**

Q7, (Jun 2012, Q10)

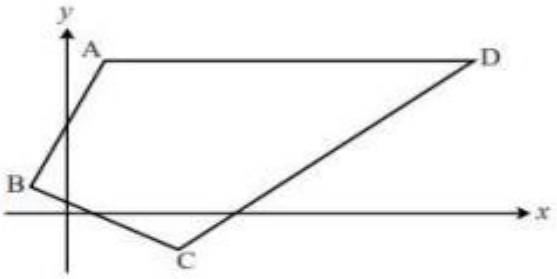


Fig. 10

Fig. 10 is a sketch of quadrilateral ABCD with vertices A (1, 5), B (–1, 1), C (3, –1) and D (11, 5).

(i) Show that AB = BC. **[3]**

(ii) Show that the diagonals AC and BD are perpendicular. **[3]**

(iii) Find the midpoint of AC. Show that BD bisects AC but AC does not bisect BD. **[5]**

Further Straight Lines

Working

Further Straight Lines

Answers

Scan the QR code below and use a different coloured pen (like red or green) to mark your answers carefully.

Algebraic Fractions and Cancelling

Video Examples

Before you dive into the practice questions on the next page, scan the QR code below and watch the video examples to help you understand the topic better.

Algebraic Fractions and Cancelling

Practice Questions

Q1, (Jun 2010, Q1)

Simplify fully

$$\frac{2x^2+9x-5}{x^2+2x-15}$$

(3)

Q2, (Jun 2006, Q1)

(a) Simplify $\frac{3x^2-x-2}{x^2-1}$.

(3)

(b) Hence, or otherwise, express $\frac{3x^2-x-2}{x^2-1}-\frac{1}{x(x+1)}$ as a single fraction in its simplest form.

(3)

Q3, (Jun 2007, Q2)

$$f(x)=\frac{2x+3}{x+2}-\frac{9+2x}{2x^2+3x-2},$$

Show that $f(x)=\frac{4x-6}{2x-1}$.

(7)

Q4, (Jan 2009, Q2)

$$f(x)=\frac{2x+2}{x^2-2x-3}-\frac{x+1}{x-3}$$

Express $f(x)$ as a single fraction in its simplest form.

(4)

Q5, (Jun 2009, Q7)

The function f is defined by

$$f(x) = 1-\frac{2}{(x+4)}+\frac{x-8}{(x-2)(x+4)}$$

Show that $f(x)=\frac{x-3}{x-2}$

(5)

Algebraic Fractions and Cancelling

Practice Questions

Q6, (Jan 2010, Q1)

Express

$$\frac{x+1}{3x^2-3} - \frac{1}{3x+1}$$

as a single fraction in its simplest form.

(4)

Q7, (Jan 2006, Q2)

Express

$$\frac{2x^2+3x}{(2x+3)(x-2)} - \frac{6}{x^2-x-2}$$

as a single fraction in its simplest form.

(7)

Q8, (Jan 2011, Q2)

(a) Express

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

as a single fraction in its simplest form.

(4)

Given that

$$f(x) = \frac{4x-1}{2(x-1)} - \frac{3}{2(x-1)(2x-1)} - 2,$$

(b) show that

$$f(x) = \frac{3}{2x-1}$$

(2)

Q9, (Jun 2011, Q7)

$$f(x) = \frac{4x-5}{(2x+1)(x-3)} - \frac{2x}{x^2-9},$$

Show that

$$f(x) = \frac{5}{(2x+1)(x+3)}$$

(5)

Algebraic Fractions and Cancelling

Working

Algebraic Fractions and Cancelling

Answers

Scan the QR code below and use a different coloured pen (like red or green) to mark your answers carefully.

THE END

Congratulations on completing your Summer Work! 🎉

You've taken an important step towards preparing for A-level Maths and the effort you've put in now will help you build a strong foundation for September.

Before you finish, **make sure all your answers are marked in green/red pen** and that you've used the **QR codes to check your work carefully**. This will ensure you're fully ready to impress your teachers when they review your booklet in September.

Enjoy the rest of your summer and we can't wait to see you at Dixons Sixth Form, ready to take on the exciting challenge of A-level Maths!

See you soon! 🚀