

A LEVEL MATHS COURSE START SUMMER BOOKLET

*REMEMBER: UNDERSTANDING &
COMPLETION. NOT JUST COMPLETION.*

Name:

Are you ready for A Level Maths Test %

Need help completing or understanding anything in this booklet? Watch the videos at the start of each exercise. Need more help? Come to our Maths Support Sessions at 10:00-12:00 on Monday 1st September, Tuesday 2nd September, Friday 5th September. Come to the STEM centre, room S6

Welcome to Varndean Maths. We aim high as a Department, and we want you to be aiming high too! This booklet has been designed to help you to bridge the gap between GCSE Maths and A level Maths. Be sure to complete it all and bring it to your first lesson!

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Read the below carefully before you start this booklet

THE COURSE THAT YOU ARE SIGNING UP FOR IF DOING SINGLE MATHS:

NEW STUDENTS DAY – SINGLE MATHS A LEVEL – WHAT ARE YOU SIGNING UP FOR? (4 MINS)

Ok, before we get into the details of this booklet, let's talk generally about how Maths is going to go for your first year:

- This maths course is going to teach you how to **study (!)**.
- You will be set an assignment every single week, and this assignment *will* take you between 4.5 and 6 hours each week. The assignments are extremely consistent. They will always have 18 questions on them, split into 3 sections A, B, and C. The expectation will be, just like with this booklet, that **every single question is fully complete and correct by deadline day.**
- To achieve this, you will have A2 Doubles students sitting in S6 every lunch time waiting to help you. Your teachers will help you organise your timetables to make sure you know when you are working on each section of the assignment, and that you have planned which help sessions you will access when you get stuck. (note the word **WHEN**)
- You will be given a tracking test every half term. We also have 5 periods secured A2 subject extension across the department to assist with that final year.
- We will finish learning all of the A1 content by February half term, and we will finish all of the A2 content in your second year by February half term. That's 12 weeks to revise for your A2!
- This course is a lot of fun, but it is a serious course where we work hard, we support each other, we plan our time carefully, we ask for help when we need it, we enjoy problem solving and getting stuck 😊

NEW STUDENTS DAY – SINGLE MATHS A LEVEL – WHAT ARE YOU SIGNING UP FOR? (4 MINS) THE BOOKLET

This booklet is projected to take you between 5 – 8 hours. Start it in the last 2 weeks before you enrol here. Remember, we will expect every single question to be fully complete and correct when you arrive for your first lesson. **The purpose of this booklet is for you all to start from the same place, to be ready to begin A level maths.** Some topics you may not have seen before. It doesn't matter, the booklet will teach you how to do them.

- 1) There are help videos at the start of every exercise
- 2) The answers are on pages 5 and 20. We know the answers already. You need to show all of your working to demonstrate you know *how* to get to those answers
- 3) Write your working in the boxes provided and **TICK** the box to confirm you have checked that the answers and your answer match. If they don't, try again, or bring it to a help session
- 4) As detailed on the front of this booklet, we have help sessions running in enrolment week, so **COME TO THEM & GET THE HELP YOU NEED.** No Stress!
- 5) **THIS BOOKLET IS EXTREMELY IMPORTANT. IT CONTAINS ALL OF THE RELEVANT GCSE KNOWLEDGE YOU NEED TO START WITH CONFIDENCE HERE. IN WEEK 2 YOU WILL BE TESTED ON THIS BOOKLET. ALL QUESTIONS ARE DIRECTLY COPIED AND PASTED FROM THE BOOKLET, SO THERE ARE NO SURPRISES. THIS TEST IS IMPORTANT – IT TELLS BOTH YOU AND US IF THIS IS THE RIGHT COURSE FOR YOU.**
- 6) The calculator that we strongly advise you have is the Graphical **Casio CG-50 or Casio CG-100 (SEE NEXT SLIDE).**

IF DOING DOUBLE MATHS:

NEW STUDENTS DAY – DOUBLE MATHS A LEVEL – WHAT ARE YOU SIGNING UP FOR? (4 MINS)

Ok, before we get into the details of this booklet, let's talk generally about how Double Maths is going to go over the two years:

- This maths course is going to teach you how to **study (!)**.
- You will be set two assignments every single week, and each assignment *will* take you between 4.5 and 6 hours each week. The assignments are extremely consistent. They will always have 18 questions on them, split into 3 sections A, B, and C. The expectation will be, just like with this booklet, that **every single question is fully complete and correct by deadline day**.
- You will be given a tracking test every half term.
- You will sit your A2 exams at the end of your first year here. We will finish learning all of the A2 content by February half term, giving you 12 weeks to revise. 1 lesson per week during that revision period will be so we can start the A2 Further Maths material. By the end of your first year, you will have completed your A2 Maths A level, and will have completed all of the material for FS1 and FM1. You will sit all of your A2 Further Maths exams at the end of your second year, which again, we finish teaching by Feb half term.
- This course is a lot of fun, but it is a serious course where we work hard, we support each other, we plan our time carefully, we ask for help when we need it, we enjoy problem solving and getting stuck. Most important of all is that we LOVE maths 😊

NEW STUDENTS DAY – DOUBLE MATHS A LEVEL – WHAT ARE YOU SIGNING UP FOR? (4 MINS) **THE BOOKLET**

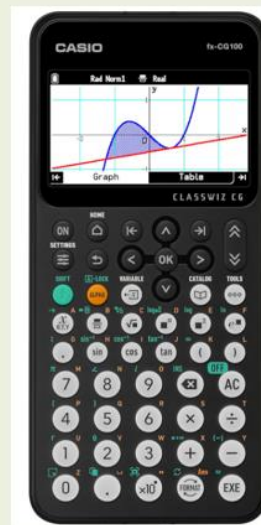
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WHETHER YOU ARE DOING SINGLE OR DOUBLE MATHS, YOU WILL NEED THIS CALCULATOR

CALCULATORS

The calculator that you will need for this course is either a 2nd hand Graphical Casio fx CG-50, or the new Casio fx CG-100. It will cost approx. £89 **THROUGH US**. You can order the CG-100 through us when you first arrive here, so hold off buying anything until you start with us. It is much cheaper buying it through us with our college discount than buying it on Amazon. *We know this is expensive and are sensitive to this fact.*



WHEN (NOT IF) YOU GET STUCK

Studying Maths at Advanced Level is all about Problem Solving. This is a skill that takes work and development. The first stage of solving problems is being stuck. You may get stuck for a short while, or you may find that if you leave the problem for a day or so something clicks and you figure it out (which is a great feeling!). Sometimes you will be stuck to the point that you need help. This is perfectly normal. In fact, it is **expected** that you will get stuck and will need help at some point.

Remember that every single question in this booklet must be fully complete and correct when you arrive to class in your first week. No gaps. All answered checked against the answer pages and ticked off to confirm that they are correct.

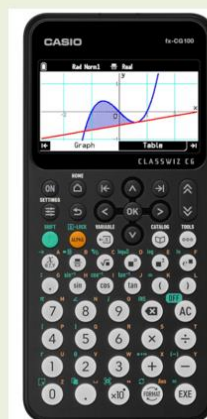
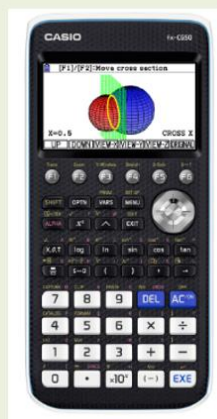
Some of the topics in this booklet may seem unfamiliar to you, but they are all GCSE level topics and you need to be able to perform all of these techniques **before** you begin studying A level here.

So, when you get stuck:

- Watch the 'Need Help?' YouTube videos by scanning the QR codes for more explanation and examples, or type the video titles directly into YouTube to access them
- Look again at the examples in the booklet and work through them to make sure you understand each step they have taken.
- Try looking up the topic in a GCSE higher tier textbook or revision guide (your local library will have one) or look online
- Meet up with a friend if you know they too are studying maths here and work through the problem together
- Attend the help sessions in the days after enrolment as detailed on the front page of this booklet
- If you have any questions about the course you could also e mail Scott (Head of Maths) on sco@varndean.ac.uk

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ANSWERS - SECTIONS 1, 2, 3, 4, & 5

SECTION 1 – INDICES

EX 1A:

1) $\frac{1}{64}$ 2) $\frac{1}{3}$ 3) $\frac{1}{3}$ 4) 32 5) 8 6) $\frac{1}{128}$

EX 1B:

1) $\frac{1}{5}x$ 2) $\frac{3}{2}x^{-\frac{1}{2}}$ 3) $\frac{1}{3}x^{-\frac{3}{2}}$ 4) $2x^{\frac{2}{3}}$ 5) $2x^{-\frac{3}{2}} + 4x^{-2}$

6) $\frac{2}{3}x^{-1} - \frac{4}{3}x^{-2}$ 7) $\frac{1}{4}x^{-3} - x^{-2}$ 8) $x^{-1} - 4x^{-\frac{1}{2}}$ 9) $x^{\frac{3}{2}} - 3x^{-\frac{1}{2}}$

10) $x^{-1} - 2x^{-2}$ 11) $2x^{-\frac{1}{2}} + 1$ 12) $\frac{1}{2} + x^{-1}$ 13) $\frac{1}{3}x^{-\frac{3}{2}} + 2x^{-2}$

14) $2x^{-1} - x^{-2}$

EX 1C:

1) $x = \frac{1}{27}$ 2) $x = \frac{1}{25}$ 3) $x = 32$ 4) $x = 64$ 5) $x = \frac{1}{81}$ 6) $x = \frac{1}{125}$

SECTION 2 – FRACTIONS

EX 2A:

1) $3x$ 2) $\frac{2x+3}{x^2}$ 3) $\frac{3x}{10}$ 4) 2 5) $\frac{27}{8}$ 6) $-\frac{8}{11}$

7) $\frac{3x-4}{2x}$ 8) $\frac{2x^2+25}{5x}$

EX 2B:

1) $x = \frac{10}{33}$ 2) $x = \frac{23}{2}$ 3) $x = \frac{6}{5}$ 4) $x = \frac{5}{9}$ 5) $x = \frac{14}{45}$ 6) $x = \frac{1}{4}$

SECTION 3 – SURDS

EX 3A:

1) $3\sqrt{3}$ 2) $3\sqrt{5}$ 3) $2\sqrt{3}$ 4) $4\sqrt{3}$ 5) $5\sqrt{3}$ 6) $\sqrt{3}$

7) $\sqrt{2}$ 8) 3 9) 3

EX 3B:

1) $17\sqrt{3}$ 2) $\sqrt{2}$ 3) $-4\sqrt{5}$ 4) $-4\sqrt{7} - 14\sqrt{2}$

EX 3C:

1) $\frac{\sqrt{2}}{2}$ 2) $\frac{2\sqrt{7}}{7}$ 3) $-\frac{7\sqrt{5}}{20}$ 4) $\frac{\sqrt{6}}{9}$ 5) $-1 + \sqrt{2}$

6) $10 + 5\sqrt{3}$ 7) $2 + 2\sqrt{3}$ 8) $\frac{-4+6\sqrt{2}}{7}$

SECTION 4 – EXPANDING BRACKETS

EX 4:

1) $2x^3 - 11x^2 - 21x$ 2) $10x^3 - 11x^2y + 20x^2 + 3xy^2 - 12xy$

3) $x^3 - 13x - 12$ 4) $18x^3 - 15x^2 - 4x + 4$

5) $3x^3 - 3xy^2 - 2x^2 + 2y^2$ 6) $8x^3 - 36x^2y + 54xy^2 - 27y^3$

7) $abc + abd + c^2a + cad + b^2c + b^2d + bc^2 + bcd$

SECTION 5 – FACTORISING

EX 5A:

1) $(x + 1)(x - 1)$ 2) $(2x - 3)(2x + 3)$

3) $(7 - 3x)(7 + 3x)$

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

5) $(b^2 - c^4)(b^2 + c^4)$ 6) $(\sqrt{a} - \sqrt{b})(\sqrt{a} + \sqrt{b})$

EX 5B:

1) $x(3x + 4)$ 2) $2y(2y + 5)$ 3) $x(x + y + y^2)$ 4) $2xy(4y + 5x)$

5) $(x + 1)(x + 2)$ 6) $(2x - 3)(x + 1)$ 7) $(5x + 2)(x - 3)$

8) $(1 - x)(6 + x)$ 9) $x(x + 6)(x - 6)$ 10) $x(2x - 3)(x + 5)$

MINI TEST 1 - SECTIONS 1, 2, 3, 4 & 5 ANSWERS

1) a) $\frac{1}{3}$ b) $\frac{1}{128}$

2) a) $\frac{2}{3}x^{-1} - \frac{4}{3}x^{-2}$ b) $x^{\frac{3}{2}} - 3x^{-\frac{1}{2}}$

3) a) $x = \frac{1}{25}$ b) $x = \frac{1}{125}$

4) a) $\frac{2x^2+25}{5x}$ b) 2

5) $x = \frac{1}{4}$

6) $10 + 5\sqrt{3}$

7) $18x^3 - 15x^2 - 4x + 4$

8) a) $2xy(5x + 4y)$ b) $x(x - 6)(x + 6)$

SECTION 1 – INDICES



TICK THE BOXES 'COMPLETED & UNDERSTOOD' IF YOUR ANSWERS MATCH THOSE IN THE ANSWER PAGES. IF YOUR ANSWER DOESN'T MATCH, TRY AGAIN. IF IT'S NOT WORKING, TICK THE 'NEED TO TAKE TO HELP SESSION' AND BRING THIS QUESTION TO ONE OF THE HELP SESSIONS INDICATED ON THE FRONT PAGE.

At Varndean we may use a lot of video learning for students to feel prepared before classes and to access help. Scan the QR codes using your SmartPhone or Tablet and we can get started ☺



EXERCISE 1A – SIMPLIFYING INDICES

Evaluate the following:

1) $2^{-6} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	2) $9^{-\frac{1}{2}} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	3) $81^{-\frac{1}{4}} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
4) $4^{\frac{5}{2}} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	5) $32^{\frac{3}{5}} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	6) $16^{-\frac{7}{4}} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()



EXERCISE 1B

Write these in the form of $ax^n + bx^m$:

1) $\frac{x}{5} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	2) $\frac{3}{2\sqrt{x}} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	3) $\frac{\sqrt{x}}{3x^2} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
4) $\sqrt[3]{8x^2} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	5) $\frac{2\sqrt{x}+4}{x^2} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	6) $\frac{2x-4}{3x^2} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
7) $\frac{1-4x}{4x^3} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	8) $\frac{(1-4\sqrt{x})}{x} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	9) $\frac{(x^2-3)}{\sqrt{x}} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
10) $\frac{x-2}{x^2} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	11) $\frac{(2+\sqrt{x})}{\sqrt{x}} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	12) $\frac{2x+4}{4x} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
13) $\frac{\sqrt{x}+6}{3x^2} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	14) $\frac{2x-1}{x^2} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	



EXERCISE 1C – MANIPULATING INDICES TO SOLVE FOR X

Solve each of the following equations for x . Remember to tick your answers once you have checked you are correct.

1) $x^{-\frac{2}{3}} = 9$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	2) $x^{-\frac{1}{2}} = 5$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	3) $x^{\frac{2}{5}} = 4$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
4) $x^{\frac{2}{3}} = 16$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	5) $x^{\frac{3}{4}} = \frac{1}{27}$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	6) $x^{\frac{2}{3}} = \frac{1}{25}$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()

SECTION 2 – FRACTIONS



Fractions play an extremely important role in mathematics, and being able to manipulate them fluidly will really help you when working with more complicated problems.



EXERCISE 2A – WRITING AS A SINGLE FRACTION

Write the following as a single fraction

<p>1) $\frac{3x}{5} \times 5 =$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>	<p>2) $\frac{2}{x} + \frac{3}{x^2} =$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>
<p>3) $\frac{3x}{2} \div 5 =$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>	<p>4) $\frac{3}{2} \div \frac{1}{4} \div 3 =$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>
<p>5) $\left(\frac{3}{2} \times \frac{1}{4}\right) + 3 =$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>	<p>6) $\left(\frac{12}{11} - \frac{4}{3}\right) \div \frac{1}{3} =$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>
<p>7) $-\frac{2}{x} + \frac{3}{2} =$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>	<p>8) $\frac{5}{x} + \frac{2x}{5} =$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>



EXERCISE 2B – SIMPLIFYING FRACTIONS & SOLVING FOR X

Let's combine everything we have done so far.

Put the following into a single fraction and solve each of the following equations for x .

<p>1) $3 - \frac{x+2}{4} = 8x$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>	<p>2) $\frac{x+1}{3} + \frac{4x}{12} = 8$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>	<p>3) $\frac{2x}{3} - \frac{x-2}{4} = 1$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>
<p>4) $\frac{4-x}{x} - \frac{3-x}{2x} = 4$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>	<p>5) $\frac{\sqrt{16x^2}}{3x^2} - 4 = \frac{2}{7}$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>	<p>6) $3x^{-\frac{1}{2}} - \frac{2\sqrt{x}+4}{5x} = \frac{1}{\sqrt{x}}$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>

SECTION 3 – SURDS



A surd is an example of an irrational number where the $\sqrt{\quad}$ sign remains. An irrational number means that the number cannot be written as a whole number or as a fraction. So $\sqrt{4}$ is not a surd, as $\sqrt{4} = 2$, and 2 is a rational number.

However, $\sqrt{3}$ is a surd because it cannot be broken down any further and the $\sqrt{\quad}$ sign has remained.



EXERCISE 3A – SIMPLIFYING SURDS

Simplify the below into surd form as far as possible, writing your answers as $a\sqrt{b}$
Remember to tick off your answers as you go.

1) $\sqrt{27} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	2) $\sqrt{45} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	3) $\sqrt{12} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
4) $\sqrt{48} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	5) $\sqrt{75} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	6) $\frac{\sqrt{12}}{2} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
7) $\frac{\sqrt{98}}{7} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	8) $\frac{\sqrt{18}}{\sqrt{2}} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	9) $\frac{\sqrt{27}}{\sqrt{3}} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()



EXERCISE 3B – COLLECTING SURD TERMS

Collect the terms and simplify the below into a single surd, broken down as far as possible into the form $a\sqrt{b}$

1) $\sqrt{12} + 3\sqrt{75} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
2) $\sqrt{200} + \sqrt{18} - 2\sqrt{72} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
3) $\sqrt{20} + 2\sqrt{45} - 3\sqrt{80} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
4) $4\sqrt{7} - 2\sqrt{98} - 4\sqrt{28} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()



EXERCISE 3C – RATIONALISING DENOMINATORS

Rationalise the denominators and then simplify to put the following in the form $a\sqrt{b}$ or if appropriate $a + b\sqrt{c}$

1) $\frac{1}{\sqrt{2}} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	2) $\frac{2}{\sqrt{7}} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
3) $\frac{-7}{4\sqrt{5}} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	4) $\frac{\sqrt{2}}{3\sqrt{3}} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
5) $\frac{1}{1+\sqrt{2}} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	6) $\frac{5}{2-\sqrt{3}} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
7) $\frac{4}{\sqrt{3}-1} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	8) $\frac{2\sqrt{2}}{\sqrt{2}+3} =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()

SECTION 4 – EXPANDING BRACKETS



Knowing how to manipulate algebra really quickly is SO important in A level maths. Whether this is through expanding brackets and collecting terms, or through finding common factors and factorising into brackets.



EXERCISE 4 – EXPANDING BRACKETS & COLLECTING TERMS

Expand the following brackets and collect like-terms:

1) $x(2x + 3)(x - 7) =$	COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
2) $x(5x - 3y)(2x - y + 4) =$	COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
3) $(x - 4)(x + 3)(x + 1) =$	COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
4) $(3x - 2)(2x + 1)(3x - 2) =$	COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
5) $(x + y)(x - y)(3x - 2) =$	COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
6) $(2x - 3y)^3 =$	COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
7) $(a + b)(b + c)(c + d) =$	COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()

SECTION 5 – FACTORISING



EXERCISE 5A – FACTORISING USING THE DIFFERENCE OF TWO SQUARES

Factorise the following by splitting these expressions into the difference of two squares – using the rule that $a^2 - b^2 = (a + b)(a - b)$

1) $x^2 - 1 =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	2) $4x^2 - 9 =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
3) $49 - 9x^2 =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	4) $8 - 2x^2 =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
5) $b^4 - c^8 =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	6) $a - b =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()



EXERCISE 5B – FACTORISING EXPRESSIONS

Factorise the following completely:

1) $3x^2 + 4x =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	2) $4y^2 + 10y =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
3) $x^2 + xy + xy^2 =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	4) $8xy^2 + 10x^2y =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
5) $x^2 + 3x + 2 =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	6) $2x^2 - x - 3 =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
7) $5x^2 - 13x - 6 =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	8) $6 - 5x - x^2 =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
9) $x^3 - 36x =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	10) $2x^3 + 7x^2 - 15x =$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()

MINI TEST 1 - SECTIONS 1, 2, 3, 4 & 5



You've completed all the exercises in Sections 1, 2, 3, 4 & 5, well done!

The important question now is whether your brain has really learned the techniques covered so far. To find out, use this mini-test in exam conditions then mark it yourself using the answers at the back of the booklet and give yourself a score. You should aim for 13/13 of course but certainly anything less than 8/13 should be a worry. Go back to the exercises containing the questions you got wrong then try this test again in a few days' time. If you feel you need help, follow the tips on pages 3 and 4 of this booklet, or watch the video help again for more explanation.

Time: 30 minutes. No Calculator allowed. Good Luck!

FROM SECTION 1

1) Evaluate the following:

a) $81^{-\frac{1}{4}}$ b) $16^{-\frac{7}{4}}$

2) Write these in the form of $ax^n + bx^m$:

a) $\frac{2x-4}{3x^2}$ b) $\frac{(x^2-3)}{\sqrt{x}}$

3) Solve each of the following equations for x .

a) $x^{-\frac{1}{2}} = 5$ b) $x^{\frac{2}{3}} = \frac{1}{25}$

FROM SECTION 2

4) Write the following as a single fraction

a) $\frac{5}{x} + \frac{2x}{5}$ b) $\frac{3}{2} \div \frac{1}{4} \div 3$

5) Put the following into a single fraction and solve each of the following equations for x .

$$3x^{-\frac{1}{2}} - \frac{2\sqrt{x} + 4}{5x} = \frac{1}{\sqrt{x}}$$

FROM SECTION 3

6) Rationalise the denominators and then simplify to put the following in the form $a\sqrt{b}$ or $c + a\sqrt{b}$

$$\frac{5}{2 - \sqrt{3}}$$

FROM SECTION 4

7) Expand the following brackets and collect like-terms:

$$(3x - 2)(2x + 1)(3x - 2)$$

FROM SECTION 5

8) Factorise the following completely:

a) $8xy^2 + 10x^2y$ b) $x^3 - 36x$

Out of 13

ANSWERS - SECTIONS 6, 7, & 8

SECTION 6 – QUADRATICS

EX 6A:

- 2) Discriminant = 0, repeated real roots 3) Discriminant = 52, two distinct real roots
4) Discriminant = -36, no real roots 5) Discriminant = 25, two distinct real roots
6) Discriminant = -248, no real roots

EX 6B:

- 1) $x = -1, x = -2$ 2) $x = 5, x = 3$ 3) $x = 0, x = 4$ 4) $x = -\frac{1}{2}, x = -3$
5) $x = \frac{3}{2}, x = -\frac{2}{3}$ 6) $x = \frac{5}{2}, x = \frac{3}{2}$

EX 6C:

- 1) $x = \frac{3+\sqrt{17}}{2}, x = \frac{3-\sqrt{17}}{2}$ 2) $x = -3 + \sqrt{3}, x = -3 - \sqrt{3}$ 3) $x = \frac{-9+\sqrt{101}}{10}, x = \frac{-9-\sqrt{101}}{10}$
4) $x = \frac{3+3\sqrt{17}}{4}, x = \frac{3-3\sqrt{17}}{4}$ 5) $x = \frac{8+2\sqrt{10}}{3}, x = \frac{8-2\sqrt{10}}{3}$ 6) $x = \frac{11+\sqrt{337}}{6}, x = \frac{11-\sqrt{337}}{6}$

EX 6D:

- 1) $\frac{3+\sqrt{17}}{2}, x = \frac{3-\sqrt{17}}{2}$ 2) $x = -3 + \sqrt{3}, x = -3 - \sqrt{3}$ 3) $x = \frac{-9+\sqrt{101}}{10}, x = \frac{-9-\sqrt{101}}{10}$
4) $x = \frac{3+3\sqrt{17}}{4}, x = \frac{3-3\sqrt{17}}{4}$ 5) $x = \frac{8+2\sqrt{10}}{3}, x = \frac{8-2\sqrt{10}}{3}$ 6) $x = \frac{11+\sqrt{337}}{6}, x = \frac{11-\sqrt{337}}{6}$

SECTION 7 – LINE GEOMETRY

EX 7A:

- 1) $m = -\frac{1}{3}$ 2) $m = -2$ 3) $m = \frac{11}{7}$

EX 7B:

- 1) $x - y + 2 = 0$ 2) $4x - y - 23 = 0$ 3) $x - 2y + 2 = 0$ 4) $8x + y + 33 = 0$

SECTION 8 – GCSE STATISTICS REVISION

EX 8A:

- 1) Mode = 9, Mean = 9.5, $Q_1 = 2.5$, $Q_2 = 6$, $Q_3 = 9$
2) Mode = no mode, Mean = 39.3, $Q_1 = 9$, $Q_2 = 44$, $Q_3 = 76$
3) Mode = 86, Mean = 143.8, $Q_1 = 86$, $Q_2 = 87$, $Q_3 = 94$

EX 8B:

- 1) $\bar{x} = 34.5$ 2) $\bar{x} = 345.1$ 3) $\bar{x} = 82.3$

MINI TEST 2 - SECTIONS 6, 7, & 8 ANSWERS

- 1) a) discriminant = 0, repeated real roots b) discriminant = 52, 2 distinct real roots
2) a) $x = -\frac{1}{2}, x = -3$ b) $x = \frac{3}{2}, x = -\frac{2}{3}$
3) a) $x = \frac{3+3\sqrt{17}}{4}, x = \frac{3-3\sqrt{17}}{4}$ b) $x = \frac{8+2\sqrt{10}}{3}, x = \frac{8-2\sqrt{10}}{3}$
4) a) $\frac{3+\sqrt{17}}{2}, x = \frac{3-\sqrt{17}}{2}$ b) $x = -3 + \sqrt{3}, x = -3 - \sqrt{3}$

5) a) $m = -2$

b) $m = \frac{11}{7}$

6) a) $4x - y - 23 = 0$

b) $x - 2y + 2 = 0$

7) $Mode = no\ mode, Mean = 39.3, Q_1 = 9, Q_2 = 44, Q_3 = 76$

8) $\bar{x} = 345.1$

SECTION 6 – QUADRATICS

You should already know what a quadratic is, but in order to start A Level you need to REALLY understand how to manipulate and interpret quadratics. That's why this time, we've made videos for each exercise to help out!



EXERCISE 6A – FINDING THE DISCRIMINANT

Write down the discriminant of each of these quadratics, and state whether each equation has one repeated real root, two distinct real roots, or no real roots

Quadratic	Discriminant	Number of roots (circle)
1) EXAMPLE $x^2 + 8x + 7 = 0$	$(8)^2 - 4(1)(7) = 36$ > 0	Repeated real roots Two distinct real roots No real roots
2) $4x + 2x^2 + 2 = 0$		Repeated real roots Two distinct real roots No real roots
3) $4x - 3x^2 = -3$		Repeated real roots Two distinct real roots No real roots
4) $2x = 2x^2 + 5$		Repeated real roots Two distinct real roots No real roots
5) $-5x + 4x^2 = 0$		Repeated real roots Two distinct real roots No real roots
6) $-2x + 9x^2 = -7$		Repeated real roots Two distinct real roots No real roots

**EXERCISE 6B – SOLVING QUADRATICS THROUGH FACTORISING**Solve the following quadratics **by factorising**

1) $x^2 + 3x + 2 = 0$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	2) $x^2 - 8x + 15 = 0$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
3) $x^2 = 4x$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	4) $2x^2 + 7x + 3 = 0$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
5) $6x^2 - 5x - 6 = 0$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	6) $4x^2 - 16x + 15 = 0$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()

**EXERCISE 6C – SOLVING QUADRATICS BY COMPLETING THE SQUARE**Solve the following quadratics **by Completing the Square** i.e. writing the quadratic in $(x + p)^2 + q = 0$ form and solving for x

1) $x^2 - 3x - 2 = 0$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	2) $x^2 + 6x + 6 = 0$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
3) $5x^2 + 9x - 1 = 0$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	4) $2x^2 - 3x - 18 = 0$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
5) $3x^2 + 8 = 16x$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()	6) $2x^2 + 11x = 5x^2 - 18$ COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()



EXERCISE 6D – SOLVING QUADRATICS USING THE QUADRATIC FORMULA

Solve the same quadratics as in EX 6C, but this time using **the quadratic formula** $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

<p>1) $x^2 - 3x - 2 = 0$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>	<p>2) $x^2 + 6x + 6 = 0$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>
<p>3) $5x^2 + 9x - 1 = 0$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>	<p>4) $2x^2 - 3x - 18 = 0$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>
<p>5) $3x^2 + 8 = 16x$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>	<p>6) $2x^2 + 11x = 5x^2 - 18$</p> <p>COMPLETED & UNDERSTOOD? ()</p> <p>NEED TO TAKE TO HELP SESSION? ()</p>



SECTION 7 – LINE GEOMETRY

We know that you will have seen a straight line equation being represented as $y = mx + c$. We are going to expand on this knowledge and generate a new formula $y - y_1 = m(x - x_1)$.

EXERCISE 7A – THE GRADIENT BETWEEN POINTS

Work out the gradient of the line joining the following points:

1) $(-2,7)$ and $(4,5)$	2) $(2,-5)$ and $(3,-7)$	3) $(-3,-1)$ and $(4,10)$
$m =$	$m =$	$m =$
COMPLETED & UNDERSTOOD? ()	COMPLETED & UNDERSTOOD? ()	COMPLETED & UNDERSTOOD? ()
NEED TO TAKE TO HELP SESSION? ()	NEED TO TAKE TO HELP SESSION? ()	NEED TO TAKE TO HELP SESSION? ()



EXERCISE 7B – LINE EQUATIONS

Using the formula $y - y_1 = m(x - x_1)$, write the following line equations passing through the two given points in the form $ax + by + c = 0$ where a, b , and c are integers

1) $(0,2)$ and $(3,5)$	COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
2) $(5,-3)$ and $(7,5)$	COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
3) $(-4,-1)$ and $(6,4)$	COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()
4) $(-4,-1)$ and $(-3,-9)$	COMPLETED & UNDERSTOOD? () NEED TO TAKE TO HELP SESSION? ()

SECTION 8 – GCSE STATISTICS REVISION

The New A Level requires you to learn both Statistics and Mechanics. To get you back into the swing of Stats, we will revise some work on averages here.



EXERCISE 8A – FINDING AVERAGES OF DISCRETE DATA

By listing the following numbers in ascending order, write down the mean, median (Q_2) and upper and lower quartiles (Q_1 and Q_3), and the mode.

1) 3, 7, 1, 40, 5, 9, 2, 9

Mode =

Mean =

Q_2 =

Q_1 =

Q_3 =

COMPLETED & UNDERSTOOD? ()

NEED TO TAKE TO HELP SESSION? ()

2) 76, 56, 44, 77, 12, 1, 9

Mode =

Mean =

Q_2 =

Q_1 =

Q_3 =

COMPLETED & UNDERSTOOD? ()

NEED TO TAKE TO HELP SESSION? ()

3) 101, 90, 91, 87, 86, 86, 86, 94, 104, 1000, 3, 20, 21

Mode =

Mean =

Q_2 =

Q_1 =

Q_3 =

COMPLETED & UNDERSTOOD? ()

NEED TO TAKE TO HELP SESSION? ()



EXERCISE 8B – FINDING THE MEAN OF GROUPED DATA

Find the mean of the following grouped data:

1)

Length of Pine Cone (mm)	Frequency (f)	Mid value (x)	xf
30 – 31	2		
32 – 33	25		
34 – 36	30		
37 - 39	13		

Mean \bar{x} =

COMPLETED & UNDERSTOOD? ()

NEED TO TAKE TO HELP SESSION? ()

2)

Weekly wage (£)	Frequency (f)	Mid value (x)	xf
175 – 225	4		
226 – 300	8		
301 – 350	18		
351 - 400	28		
401 - 500	7		

Mean \bar{x} =

COMPLETED & UNDERSTOOD? ()

NEED TO TAKE TO HELP SESSION? ()

3)

Noise (decibels)	Frequency (f)	Mid value (x)	xf
65 – 69	1		
70 – 74	4		
75 – 79	6		
80 – 84	6		
85 - 89	8		
90 – 94	4		
95 - 99	1		

Mean \bar{x} =

COMPLETED & UNDERSTOOD? ()

NEED TO TAKE TO HELP SESSION? ()

MINI TEST 2 - SECTIONS 6, 7, & 8



You've completed all the exercises in Sections 6, 7, & 8, well done!

The important question now is whether your brain has really learned the techniques covered so far. To find out, use this mini-test in exam conditions then mark it yourself using the answers at the back of the booklet and give yourself a score. You should aim for 14/14 of course but certainly anything less than 9/14 should be a worry. Go back to the exercises containing the questions you got wrong then try this test again in a few days' time. If you feel you need help, follow the tips on pages 3 and 4 of this booklet, or watch the video help again for more explanation.

Time: 30 minutes. You do not need a calculator for this test (but we'll let you off on Q8). Good Luck!

FROM SECTION 6

- 1) Write down the discriminant of each of these quadratics, and state whether each equation has one repeated real root, two distinct real roots, or no real roots

a) $4x + 2x^2 + 2 = 0$ b) $4x - 3x^2 = -3$

- 2) Solve the following quadratics **by factorising**

a) $2x^2 + 7x + 3 = 0$ b) $6x^2 - 5x - 6 = 0$

- 3) Solve the following quadratics **by Completing the Square**

a) $2x^2 - 3x - 18 = 0$ b) $3x^2 + 8 = 16x$

- 4) Solve the following quadratics **using the quadratic formula**

a) $x^2 - 3x - 2 = 0$ b) $x^2 + 6x + 6 = 0$

FROM SECTION 7

- 5) Work out the gradient of the line joining the following points:

a) $(2, -5)$ and $(3, -7)$ b) $(-3, -1)$ and $(4, 10)$

- 6) Using the formula $y - y_1 = m(x - x_1)$, write the following line equations passing through the two given points in the form $ax + by + c = 0$ where a, b , and c are integers

a) $(5, -3)$ and $(7, 5)$ b) $(-4, -1)$ and $(6, 4)$

FROM SECTION 8

- 7) By listing the following numbers in ascending order, write down the mean, median (Q_2) and upper and lower quartiles (Q_1 and Q_3), and the mode.

76, 56, 44, 77, 12, 1, 9

- 8) Find the mean of the following grouped data:

Weekly wage (£)	Frequency (f)	Mid value (x)	xf
175 – 225	4		
226 – 300	8		
301 – 350	18		
351 – 400	28		
401 – 500	7		

Out of 14

ARE YOU READY FOR A LEVEL MATHS TEST?

This is your last task of the Maths A level Booklet. In order to be confident starting A level maths you need to be confident with the techniques in this booklet. When you start the course we will give you a test like this one to check that you are ready to start A level. Do this test in exam conditions, write your answers on file paper, then mark it using the answers at the back of the booklet; record your result on the front cover sheet. You should aim for over 80% (at least 15 answers completely correct) but certainly anything less than 60% should be a worry and you should go back to the exercises containing the questions you got wrong then try this test again in a few days' time. In addition, attend the drop in help sessions detailed on the front of this booklet if you need help.

Time: 1 hour. No Calculator Allowed.

1) Evaluate the following:

a) $\left(\frac{1}{27}\right)^{-\frac{1}{3}}$ b) $\left(\frac{64}{25}\right)^{\frac{3}{2}}$

2) Write these in the form of $ax^n + bx^m$:

a) $\frac{\sqrt{16x^2} - \sqrt[3]{27x^2}}{\sqrt{x}}$ b) $\frac{5x^3 + \sqrt[4]{81x^2}}{3x}$

3) Solve the following equation for x :

$$2x^{-\frac{3}{2}} = 54$$

4) Write the following as a simplified, single fraction

a) $\frac{4}{x-2} - \frac{2x}{x+1}$ b) $\frac{x}{x^2-1} + \frac{3}{x+1}$

5) By rationalising the denominator, write the below in the form $c + a\sqrt{b}$:

$$\frac{2}{\sqrt{3} + 1}$$

6) Expand the following brackets and collect like-terms:

$$(2x + 3)(3x - 1)(x + 2)$$

7) Fully factorise the following:

a) $(36 - 4x^2)$ b) $3x^3 + 27x^2 + 60x$

8) Consider the quadratic $x^2 - 4x - 12 = 0$:

a) Write the value of the discriminant. What does this tell you about the number of solutions you should expect?

b) Solve the equation, finding values of x using:

i) Completing the square ii) Factorisation iii) The quadratic formula

9) Consider the points $A(9, -1)$ and $B(-2, -3)$

a) Write down the gradient m of the line passing through these two points

b) Hence, find the equation of the line passing through A and B in the form $ax + by + c = 0$ where a, b , and c are integers

10) Find the mean, mode, median and upper and lower quartiles of:

4, 7, 1, 0, 13, 15, 90, 12, 7

11) Find the mean of the following:

Length of oak leaves (mm)	Frequency (f)
20 – 22	4
23 – 26	20
27 – 30	23
31 – 50	5

Out of 19

ANSWERS – ARE YOU READY FOR A LEVEL MATHS TEST?

1) a) 3

b) $\frac{512}{125}$

2) a) $4x^{\frac{1}{2}} - 3x^{\frac{1}{6}}$

b) $\frac{5}{3}x^2 + x^{-\frac{1}{2}}$

3) $x = \frac{1}{9}$

4) a) $\frac{-2x^2+8x+4}{(x+1)(x-2)}$

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

5) $-1 + \sqrt{3}$

6) $6x^3 + 19x^2 + 11x - 6$

7) a) $(6 - 2x)(6 + 2x)$

b) $3x(x + 5)(x + 4)$

8) a) $b^2 - 4ac = 64$, 2 *distinct real solutions*

b) all 3 versions should give $x = 6$, $x = -2$

9) a) $m = \frac{2}{11}$

b) $2x - 11y - 29 = 0$

10) $mode = 7, mean = 16.6, Q_1 = 4, Q_2 = 7, Q_3 = 13$

11) $\bar{x} = 27.5$