Transition work from GCSE to A Level Mathematics

GCSE to A-Level Mathematics Transition

The A Level in mathematics will consist of 3 sections, Pure Maths, Mechanics and Statistics. A Level mathematics uses many of the skills you developed at GCSE. The big difference is that you will be expected to recognise where you use these skills and apply them **quickly** and **efficiently**.

Your success at A Level Mathematics will depend on how willing you are to maintain and perfect these skills. In order to get off to a good start you need to be prepared. This booklet will help you get ready for A Level Mathematics. Read through the advice at the start and by the end of the holidays have answered all of the questions to the best of your ability. You will need to hand in your answers in the first lesson in September.

This work is compulsory for all students.

Skills for success

Be organised – keep your notes and work in clearly labelled folders. Make sure you know where everything is and that you can find it easily.

Make sure your notes are clear and detailed – not everything of use will be written on the board. Listen carefully to what the teacher says and note down any useful hints and tips. Your teacher will model the best way to approach problems or apply skills so you need to make sure your notes clearly show what they were doing. Re-write any notes that are scruffy or not clear. Annotate any handouts that you are given. Read through your notes to check you have everything you need and, if not, talk to your teacher about what you think is missing.

Be precise with your notation – you will probably have developed some bad presentation habits at GCSE level. Look at the way the teacher models each technique and try to do things in the same way. One difference between A level and GCSE is that the way things are set out becomes far more important.

Be accurate with your answers – A level questions often have several joined parts where one answer feeds into the next. You will need to be accurate so that your answers make sense. Feeding a wrong answer in to a calculation often results in something far more difficult to work out. Learn the quick checks that your teacher uses to test the accuracy of calculations.

Plan your time effectively – You will be taught a number of new skills. You will not become fluent in these unless you practise them. It is not enough to just understand what the teacher is telling you about a technique, you must practise it to become confident in it. This is true of all skills based subjects. Make sure you have the time to do all of the homework set for the deadline you are given.

Be prepared to change the way you do things – GCSE methods are not always the quickest or most efficient way of doing things. Skills you previously learned for GCSE often need to be refined. Try not to stubbornly stick to the GCSE way of doing things.

Get help from as many places as possible – it is vitally important that you understand the work as you go along. Be honest with yourself when you don't understand something and seek help. You can get some help from your peers, the text book or your teacher. The important thing is not to allow a technique or skill to pass by without understanding it.

Transition work for Pure Mathematics

(Please complete the Pure, Mechanics & Statistics work on separate sheets of paper)

1. Collecting like terms:

Simplify the following expressions

a) $x^3+2x^2-5x+7x^2+3x-4$ b) $x^4-3x^3-2x^2+2x^3-6x^2-4x$

c) $2ab-a^2+4b^2-2ab$ d) $3x^2+6xy-12x-2xy+6y^2+8y$

2. Indices

Evaluate (i.e. work out)

a) 2^{-3} b) $25^{\frac{1}{2}}$ c) $\left(\frac{1}{3}\right)^{-2}$ d) $\left(\frac{64}{27}\right)^{-\frac{4}{3}}$ e) $\left(6\frac{1}{4}\right)^{\frac{1}{2}}$ f) $49^{\frac{3}{2}}$

3. Laws of Indices

Simplify the following expressions

a) $7^3\times7^4$ b) $\frac{3^4\times3^6}{3^5}$ c) $\left(4^3\right)^8$ d) $\frac{2^5\times2^9}{\left(2^3\right)^5}$ e) $4x^3\times2x^5$ f) $(3a)^3$

g) $\left(-2p^2q^3\right)^4$ h) $\frac{2x^2y^3z\times6x^4yz^3}{\left(9xy^4z^2\right)^2}$

4. Changing the subject of a formula

Make the variable shown in brackets the subject

a) $v=u+at$ (a)

b) $s=\frac{1}{2}(u+v)t$ (v)

c) $A=2\pi r^2+2\pi rh$ (h)

d) $y=\frac{x+1}{x-1}$ (x)

5. Expanding brackets

Multiply out and simplify

a) $6(2x+3)$ b) $-2x(x-5)$ c) $2xy^2(3x-5y)$ d) $5y(4-3x)-2x(3-2y)$

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

6. Factorising expressions

Factorise fully

a) $7x+21$ b) $3ab-12b$ c) $7x^2y+21x^3y^2$ d) $30xy+6x^2-15x$

7. Factorising quadratic expressions

Factorise

a) $x^2+9x+20$ b) $x^2-12x+35$ c) $y^2-2y-63$

d) $a^2-6a-16$ e) $2x^2+3x+1$ f) $2x^2+5xy-3y^2$

g) x^2-9 h) $9x^2-25y^2$ i) $16x^2-3$

8. Solving linear equations

a) $3x+1=10$ b) $7x-13=2$ c) $4x-7=7x+15$

d) $\frac{4}{3x+7}=3$ e) $\frac{5x+2}{3x-4}=2$ f) $\frac{5}{x+1}=\frac{2}{4x+7}$

9. Solving quadratic equations

Solve the following equations

a) $x^2+15x+54=0$ b) $t^2-3t-40=0$ c) $3x^2-x-14=0$

d) $7a-6a^2+20=0$ e) $9x^2+12x+4=0$ f) $x+1=\frac{6}{x}$

10. Solving quadratic equations

Solve the following equations giving your answer in surd form

a) $x^2+12x+20=0$ b) $t^2+9t+4=0$ c) $3x^2-7x=1$

11. Surds

Simplify the following into the form $a\sqrt{b}$,where b is as small as possible

a) $\sqrt{44}$ b) $\sqrt{320}$ c) $\sqrt{75}$ d) $\sqrt{304}$

e) $\sqrt{\frac{32}{25}}$ f) $\sqrt{\frac{27}{16}}$ g) $\sqrt{\frac{50}{9}}$ e) $\sqrt{\frac{496}{304}}$

12. Surds

Write each of the following in its simplest form

a) $4\sqrt{7}-3\sqrt{7}+6\sqrt{7}$ b) $4\sqrt{2}-\sqrt{50}+\sqrt{98}$ c) $\sqrt{3}\left(7+2\sqrt{3}\right)$

d) $\left(\sqrt{7}-\sqrt{3}\right)\left(\sqrt{7}+\sqrt{3}\right)$

13. Surds

Rationalise the following surds

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

14. Solving Simultaneous equations

Solve each of the following pairs of simultaneous equations

a) $\begin{matrix}3x+2y=13\\2x-y=2\end{matrix}$ b) $\begin{matrix}2x+3y=10\\5x+2y=3\end{matrix}$ c) $\begin{matrix}3x+y=7\\2x-3y=23\end{matrix}$ d) $\begin{matrix}8x+4y=5\\6x-8y=1\end{matrix}$

15. Solving Simultaneous equations

Solve each of the following pairs of simultaneous equations

a) $\begin{matrix}y=x^2-x-6\\y=x+2\end{matrix}$ b) $\begin{matrix}y=2x+3\\y(5-x)=20\end{matrix}$

16. Solving Inequalities

Solve each of the following equalities

a) $3x+4\leq 8$ b) $7x-3\geq 4x+10$ c) $x^2+5x-6<0$

Transition work for Statistics

(Please remember to complete this on separate paper to the Core & Mechanics work)

Section 1 - Representing Data

1. The following gives the scores of a cricketer in 40 consecutive innings

6	18	27	19	57	12	28	38	45	66
72	85	25	84	43	31	63	0	26	17
14	75	86	37	20	42	8	42	0	33
21	11	36	11	29	34	55	62	16	82

a) Illustrate the data on a stem and leaf diagram.
b) State an advantage that the diagram has over the data.
c) What information is given by the data that does not appear in the diagram?

2. Certain insects can cause small growths, called 'galls', on the leaves of trees. The numbers of galls found on 60 leaves of an oak tree are given below.

5	19	21	4	17	10	0	61	3	31	15	39
16	27	48	51	69	32	1	25	51	22	28	29
73	14	23	9	2	0	1	37	31	95	10	24
7	89	1	2	50	33	22	0	75	7	23	9
18	39	44	10	33	9	11	51	8	36	44	10

a) Put the data into a grouped frequency table with classes 0-9, 10-19..., 70-99.
b) Draw a histogram of the data
c) Draw a cumulative frequency diagram and use it to estimate the number of leaves with fewer than 34 galls.
d) State an assumption required for your estimate in part (c), and briefly discuss its justification in this case.

3. The traffic noise levels on two city streets were measured one weekday, between 5.30am and 8.30pm. There were 92 measurements on each street, made at equal time intervals, and the results were summarised in the following grouped frequency table.

Noise level dB	<65	65-67	67-69	69-71	71-73	73-75	75-77	77-79	>79
Street 1 freq	4	11	18	23	16	9	5	4	2
Street 2 freq	2	3	7	12	27	16	10	8	7

Compare the noise levels in both streets. Show your working.

4. The number of times each week that a factory machine broke down was noted over a period of 50 consecutive weeks. The results are given in the following table.

No of breakdowns	0	1	2	3	4	5	6
No of weeks	2	12	14	8	8	4	2

a) Find the mean number of breakdowns in this period. Is this an exact value or an estimate?
b) Give the mode and the median of the number of breakdowns.
c) Find the interquartile range of the number of breakdowns in a week

6. The costs, £x, of regional and national phone calls costing over £0.40 made by a household over a period of three months are as follows.

0.92	0.66	0.46	0.42	0.54	0.41	0.49	0.59	0.75	0.52	0.42
0.40	0.49	0.52	0.64	0.48	0.57	0.46	0.49	0.42	0.65	0.73
0.40	1.12	0.94	0.76	0.48	0.85	1.66	0.40	0.50		

a) State why it is advisable to omit 1.66 from a stem and leaf diagram of these data.
b) Draw an ordered stem and leaf diagram, with 1.66 omitted but noted as HI 1.66 next to the diagram. (HI is short for high)
c) For the data obtain the median, mean and mode.
d) Which of the median, mean and mode would be best used to give the average cost of a phone call costing over £0.40? Give a reason for your answer.

5. Find the median, range and interquartile range of each of the following data sets. Hence draw a box plot for each set of data

a)	7	4	14	9	12	2	19	6	15	
b)	7.6	4.8	1.2	6.9	4.8	7.2	8.1	10.3	4.8	6.7

Section 2 – Probability

1. In a class of 30 students, all of them have brothers or sisters or both. 19 have a brother. 16 have a sister.
a) Represent the information on a Venn diagram
b) Find the probability that a student in the class has a brother and a sister.
c) If it is known that a student has a sister, what is the probability that they also have a brother?

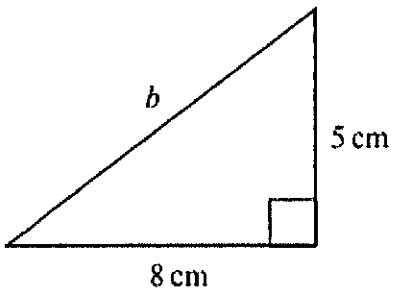
2. Sami asked 50 people which drinks they liked from tea, coffee and milk. All 50 people like at least one of the drinks
19 people like all three drinks.
16 people like tea and coffee but do not like milk.
21 people like coffee and milk.
24 people like tea and milk.
40 people like coffee.
1 person likes only milk.

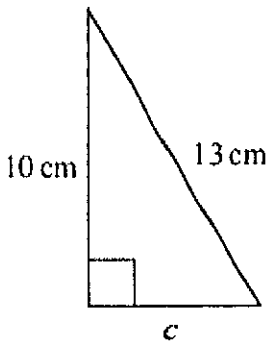
Sami selects at random one of the 50 people.
a) Represent the information on a Venn diagram
b) Work out the probability that this person likes tea

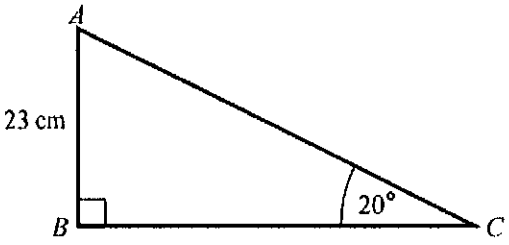
3. There are 5 red pens, 3 blue pens and 2 green pens in a box. Jerry takes at random a pen from the box and gives the pen to his friend. Jerry then takes at random another pen from the box.
a) Draw a tree diagram to represent this information
b) Work out the probability that both pens are the same colour

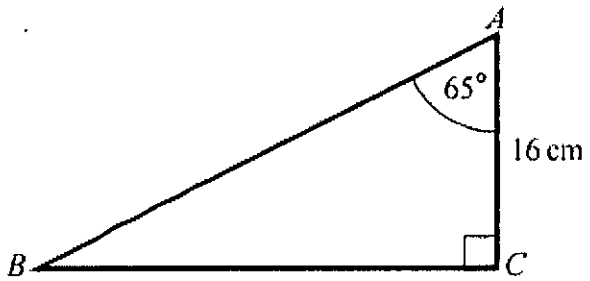
Transition work for Mechanics **(Please remember to complete this on separate paper to the Core & Statistics work)**

1. Calculate the indicated length in each diagram.

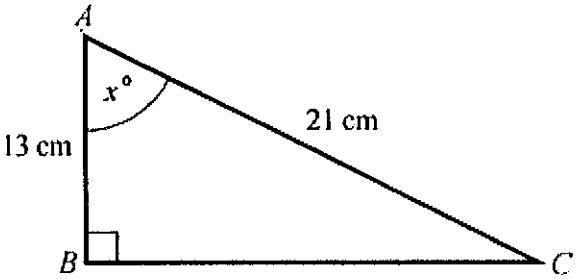


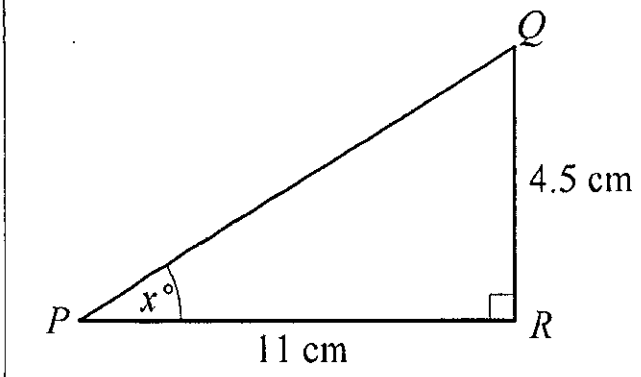






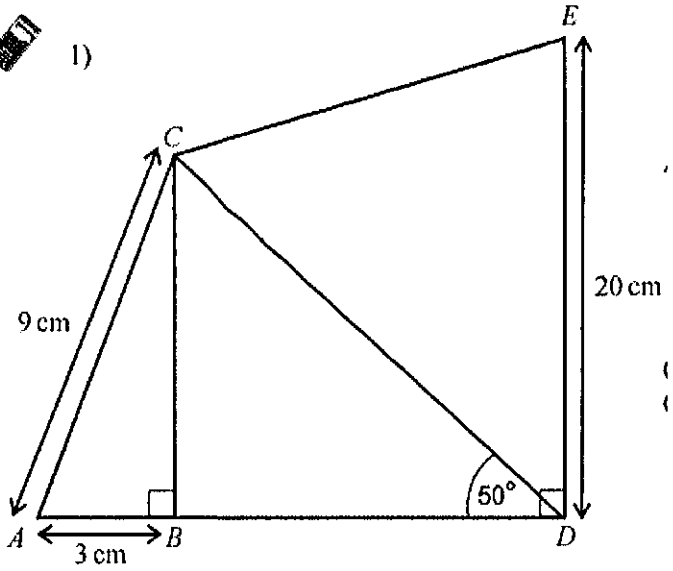
2. Calculate the missing angle





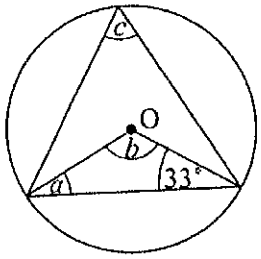
3. Calculate the length CE

1)

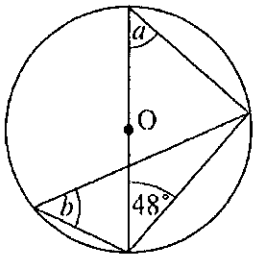


4. Calculate the labelled angles, giving reasons for your answers.

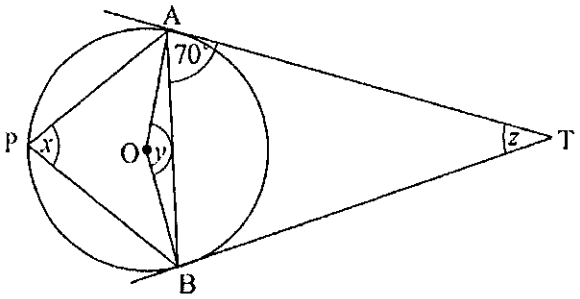
(a)



(b)



ii)



AT, BT are tangents to the circle, which has centre O.

Find the size of the angles marked:

(a) x (b) y (c) z

5.

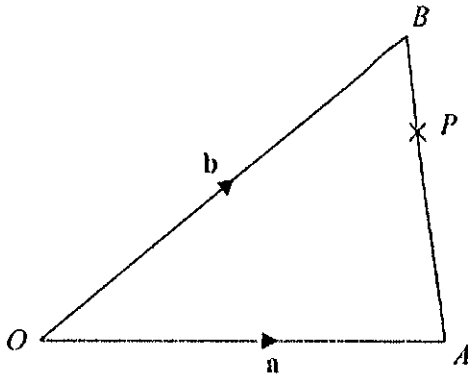


Diagram **NOT** accurately drawn

OAB is a triangle.

$\overrightarrow{OA} = \mathbf{a}$

$\overrightarrow{OB} = \mathbf{b}$

(a) Find $\overrightarrow{AB}$ in terms of **a** and **b**.

.....

(1)

P is the point on AB such that $AP : PB = 3 : 1$

(b) Find $\overrightarrow{OP}$ in terms of **a** and **b**.
Give your answer in its simplest form.