Welcome to AS level Mathematics – Devizes sixth form induction for year 12

Maths is an extremely useful, well respected and rewarding A-level. However, it is also very demanding. Students often find the transition from GCSE to A-level maths extremely difficult as the course relies on them fully understanding all of the work covered at GCSE, and working much more independently compared to GCSE.

Some basic requirements:

- **Equipment:** alongside pens, pencils, ruler, **Casio fx-991EX** calculator etc. you will be expected to bring lined paper and a ring binder folder (in order to keep your work organised!)
  You will also need to buy textbooks. The first one to buy is:
  Edexcel AS and A level Mathematics, Pure Mathematics. Year 1/AS   (ISBN 978-1-292-18339-8)

- **Out of school learning:** approximately FIVE hours EVERY week will be the normal amount of time you should expect to commit to self-study at home (one of which should be spent with us after school on Wednesdays, where we provide a support session every week), this time is used to complete set home learning tasks, review work previously studied and preparation time needed between each lesson (reading through worked examples etc): It equates to about the same amount of time outside of the classroom as you spend in school doing mathematics!

To help ensure that all students are prepared for the course, we expect you to complete work over the summer so that you can cope with the content of the A-level course. You have been set questions on the next pages to complete. Some of the topics will be easy for you, others more challenging, whilst a few may be new to some of you that have not been in a top-set in year 11. All need to be *mastered* by the start of September. You should then have no trouble coping with the start of the course, these tasks are NOT a test of your current knowledge, but rather part of the learning process for A-level mathematics. Therefore, we expect you all to complete **all** the questions, writing **full solutions** (*on lined paper*) which show the stages that you went through to get your answers as required. Unlike many GCSE questions, A-level mathematics predominately award marks for method, so from the offset you need to get used to doing so!

You **must bring the fully completed written work to your first mathematics lesson**, to show that you have met this REQUIREMENT. You will get feedback on it, and you will then file it in your folder. We provide support for this work through access to the website: **https://corbettmaths.com/contents/**

Email support (over the summer I will try to answer within 3 days!): **ggaynor@devizes.wilts.sch.uk**

These are the topics you need to master.
Help can be found on the Corbett maths website by finding the 'video number' (in brackets).

Indices – (17 , 172 - 175)
Surds – simplifying surds, rationalising the denominator (305 - 308)
Basic Algebra – Forming, simplifying expressions, expanding brackets, factorising single brackets (9, 11, 13 - 18)
Quadratics – factorise and solve (118, 119, 226), 'using the formula' (267), completing the square (10, 267a), difference of two squares (120)
Simultaneous equations – solving **linear** equations with two unknowns (graphically 297, use algebra 295, 296).
Rearranging formulae – changing the subject of a formula (7, 8)
Coordinate Geometry – finding the distance between two points (88), finding the gradient of a line between two points, equations of straight lines, equations of perpendicular lines, finding mid points. (189 - 198)

To test your ability in these key areas you will be given a test during your first lesson of year 12. Make sure you come to the lesson fully prepared for this! If you do not pass, you will be required to complete extra work (with us during compulsory afterschool sessions), and then a resit test on the same topics to ensure that you are suitable for the course.

(To be completed on lined paper: write the question first and show <u>full method</u> as required).

Indices

Calculate the following:

(a) $4^{\frac{1}{2}}$ (b) $8^{\frac{1}{3}}$ (c) $125^{\frac{1}{3}}$

(d) $64^{\frac{1}{6}}$ (e) $81^{\frac{1}{4}}$ (f) $27^{-\frac{1}{3}}$

(g) $32^{-\frac{1}{5}}$ (h) $64^{-\frac{1}{2}}$ (i) $169^{-\frac{1}{2}}$

Calculate the following:

(a) $9^{\frac{1}{2}}$ (b) $64^{\frac{1}{3}}$ (c) $81^{\frac{1}{2}}$

(d) $10000^{\frac{1}{4}}$ (e) $32^{\frac{1}{5}}$ (f) $121^{\frac{1}{2}}$

(g) $144^{-\frac{1}{2}}$ (h) $49^{-\frac{1}{2}}$ (i) $125^{-\frac{1}{3}}$

(j) $\left(\dfrac{4}{9}\right)^{\frac{1}{2}}$ (k) $\left(\dfrac{1}{27}\right)^{\frac{1}{3}}$ (l) $\left(\dfrac{125}{64}\right)^{-\frac{1}{3}}$

Express the following as powers of 2:
(a) $4^3 \times 8^2$

(b) $\dfrac{16 \times 32^2}{8^3}$

(c) $16\sqrt{2}$

Surds

Simplify the following as far as possible:

(a) $\sqrt{18}$ (b) $\sqrt{8}$ (c) $\sqrt{12}$

(d) $\sqrt{50}$ (e) $\sqrt{45}$ (f) $\sqrt{44}$

(g) $\sqrt{75}$ (h) $\sqrt{63}$ (i) $\sqrt{72}$

Write the following, in the simplest possible form (in the form $a\sqrt{b}$):

(a) $\dfrac{6}{\sqrt{2}}$ (b) $\dfrac{3}{\sqrt{3}}$ (c) $\dfrac{10}{\sqrt{5}}$

(d) $\dfrac{21}{\sqrt{7}}$ (e) $\dfrac{15}{\sqrt{5}}$ (f) $\dfrac{33}{\sqrt{11}}$

Simplify the following by rationalising the denominators

21). $\dfrac{1}{\sqrt{5}+\sqrt{2}}$ 22). $\dfrac{1}{\sqrt{3}-\sqrt{2}}$ 23). $\dfrac{4}{\sqrt{7}+\sqrt{5}}$ 24). $\dfrac{6}{\sqrt{13}-\sqrt{7}}$ 25). $\dfrac{4}{\sqrt{5}+\sqrt{3}}$

26). $\dfrac{7}{\sqrt{3}+2}$ 27). $\dfrac{4}{\sqrt{11}-3}$ 28). $\dfrac{12}{\sqrt{7}+3}$ 29). $\dfrac{6}{\sqrt{13}-2}$ 30). $\dfrac{6}{\sqrt{24}-\sqrt{6}}$

Quadratics

Factorise the following

(a) $x^2 + 8x + 15$ (b) $x^2 + 6x + 8$

(c) $2x^2 + 9x + 9$ (d) $3x^2 - 10x - 8$

(e) $5x^2 - 9x + 4$ (f) $6x^2 - 7x - 3$

Solve the following (without using the formula):

(a) $x^2 + 7x + 12 = 0$ (b) $x^2 - 5x - 14 = 0$

(c) $3x^2 + 7x + 2 = 0$ (d) $4x^2 - 9 = 0$

(e) $2x^2 - 7x = 0$ (f) $8x^2 - 15x - 2 = 0$

Completing the square

Write the following in the form $(x + p)^2 + r$ where p and r are numbers to be determined:

(a) $x^2 + 8x + 7$ (b) $x^2 + 12x + 25$

(c) $x^2 + 18x + 75$ (d) $x^2 + 6x + 5$

(e) $x^2 + 10x + 7$ (f) $x^2 + 12x + 3$

(g) $x^2 + 2x - 1$ (h) $x^2 + 8x - 3$

(i) $x^2 + 4x + 1$ (j) $x^2 + 14x + 40$

Write the following in the form $(x + p)^2 + r$ where p and r are numbers to be determined:

(a) $x^2 - 8x + 11$ (b) $x^2 - 12x + 13$

(c) $x^2 - 18x + 60$ (d) $x^2 + 6x + 6$

(e) $x^2 - 10x - 15$ (f) $x^2 + 12x + 29$

(g) $x^2 - 2x + 3$ (h) $x^2 + 8x + 13$

(i) $x^2 - 4x - 10$ (j) $x^2 + 14x - 3$

Solve the following equations by completing the square (leaving square roots in your answers):

(a) $x^2 + 2x - 1 = 0$ (b) $x^2 - 4x - 3 = 0$

(c) $x^2 + 12x + 36 = 0$ (d) $x^2 + 20x + 5 = 0$

(e) $x^2 + 8x - 9 = 0$ (f) $x^2 - 2x - 7 = 0$

Linear simultaneous equations

Solve the following simultaneous equations:

(a) $5x + 3y = 5$ (b) $3p - 2q = 3$
    $7x + 2y = 18$ $11p + 5q = 122$

(c) $b = 3a + 1$ (d) $2s = 5r - 3$
    $3a + 7b = 79$ $9r + 4s = 89$

Rearranging Formulae

Make x the subject of the following formulae:

(a) $ax + b = cx$ (b) $\dfrac{mx + n}{r} = x$

(c) $\dfrac{px + q}{s} = x$ (d) $\dfrac{c + bx}{t} = x + q$

(e) $\dfrac{ax + b}{cx + d} = e$ (f) $\dfrac{rx + v}{dx - e} = p$

Geometry

Find the distance between the following points:
(a)   (7, 9) and (11, 12)   (b)   (-2, 3) and (4, -5)
(c)   (-1, -2) and (-6, 10)   (d)   (1, 14) and (9, -1)

Write the following exactly in the form $y = mx + c$ where m and c are fractions or integers:
(a) $3y - 4x = 9$

(b) $5y + 4x = -10$

(c) $3x - 2y = 4$

(d) $12x = 9 - 4y$

Write the following as equations involving only integers (e.g. $2x + 3y = 6$):
(a) $y = \frac{4}{3}x - 2$

(b) $y - \frac{1}{2}x = 4$

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

(d) $3y = \frac{3}{5}x + 2$

Find the gradients of the straight lines which pass through the following pairs of points:
(a)   (1, 12) and (3, 8)
(b)   (2, 7) and (5, 13)
(c)   (-4, 8) and (2, -10)
(d)   (-2, -11) and (13, 4)
(e)   (-3, 7) and (-1, 11)

Now write the equation (in the form y = mx + c) of **each line** in the questions above.

Finally write the equation of the straight line that is PERPENDICULAR to **each line** in the questions above that passes through the mid-point of the coordinates given. (Remember to show full method!!)