



# MATHS STUDIES

## A LEVEL – SUMMER ASSIGNMENT

### Dear Student,

We know that there has been a lot of disruption in your last two years of learning. This work is aimed to help you prepare you for the beginning of an A level course in mathematics.

These questions are here are mostly non-calculator GCSE Higher Tier and cover the skills necessary for the first few weeks of the course.

Please bring this summer work with you to the first lesson – your teacher will check how much you have completed!

### ADDITIONAL RESOURCES AND SUPPORT

You may need to review some of the work, try the following online resources to help:

<https://www.examsolutions.net/gcse-maths/>

<https://www.mathsgenie.co.uk/gcse.html>  
(look for the grade 7/8/9 material)

<https://www.youtube.com/user/HEGARTYMATHS>

These workbooks have also proved useful to students making the transition from GCSE to A Level:

[Bridging GCSE and A-level Maths Student Book](#)

[New Head Start to A-level Maths](#)

[CIMT Step Up! to A Level Maths](#)

If you would like to do even more extra preparation or you just like a challenge then check out these online courses:

<https://www.futurelearn.com/courses/precalculus>

<https://www.futurelearn.com/courses/maths-puzzles>

<https://www.futurelearn.com/courses/flexagons>

<https://www.futurelearn.com/courses/recreational-math>

<https://www.futurelearn.com/courses/advanced-precalculus>

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**DO NOT USE A CALCULATOR. SHOW WORKING OUT CLEARLY**

### Section 1 – Fractions

a.  $\frac{1}{4} + \frac{3}{8} - \frac{5}{7}$

.....[1]

b.  $\frac{7}{6} \times \frac{24}{35} \div \frac{20}{3}$

.....[1]

c.  $\left(6 \times \frac{3}{7}\right) - \frac{4}{7}$

.....[1]

d.  $\left(6\frac{3}{7}\right) - \frac{4}{7}$

.....[1]

e.  $\frac{x}{7} \times \frac{x+2}{9}$

.....[1]

f.  $\frac{3-x}{7} + \frac{2}{9+x}$

.....[2]

### Section 2 – Surds

a. Rationalise the denominator of  $\frac{2}{\sqrt{5}}$

.....[1]

b. Simplify  $(2 - \sqrt{3})(4 + \sqrt{3})$

.....[2]

c. Write  $\frac{3+\sqrt{2}}{8+\sqrt{2}}$  in the form  $\frac{a+b\sqrt{2}}{c}$  where a, b and c are all integers.

.....[2]

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### Section 3 – Indices Simplify the following:

a. (i)  $27^{\frac{1}{3}}$  (ii)  $27^{\frac{4}{3}}$  (iii)  $3^{-4}$  (iv)  $27^{-\frac{4}{3}}$

..... [4]

b. 
$$\frac{45e^6 \times 2f^8}{5ef^2}$$

..... [1]

c.  $(2xy^2)^5$

..... [1]

d.  $\left(\frac{27}{8}\right)^{\frac{2}{3}}$

..... [1]

e.  $\left(\frac{8}{125}\right)^{-\frac{2}{3}}$

..... [1]

### Section 4 – Algebra

a. Make  $a$  the subject of the equation:  $2(2a - c) = 5c + 1$

..... [4]

b. Make  $x$  the subject of the equation:  $\frac{3x}{x-3} = 2y$

..... [1]

c. Factorise completely:  $8y^2 - 24xy$

..... [4]

d. Expand these brackets:  $(x + 2)^3$

..... [1]

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### Section 5 – Equations Solve to find $x$

a.  $3(2 - x) - 4(3 - 2x) = 14$

.....[1]

b.  $\frac{3x-5}{5} + \frac{x-3}{3} = 6$

.....[2]

c.  $x^2 + 4x - 45 = 0$

.....[2]

d.  $\frac{x}{2} - \frac{2}{x+1} = 1$

.....[2]

e. Solve this equation using three different methods:  $x^2 + 6x + 8 = 0$

(i) By completing the square                      (ii) By using the quadratic formula                      (iii) By factorisation

.....[6]

f. Solve:  $3x^2 + 19x + 28 = 0$

.....[2]

### Section 6 – Simultaneous equations Solve to find $x$ and $y$ :

a.  $3x + 5y = 19$

$4x - 2y = -18$

.....[3]

b.  $x^2 + y^2 = 26$

$y + 6 = x$

.....[3]

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### Section 7 – Straight lines and coordinate geometry

- a.** The equations of five straight lines are
- $$y = x - 2 \qquad y = -x + 3 \qquad y = 3x + 2$$
- $$y = 5x + 2 \qquad y = 3x - 3.$$

Two of the lines go through the point (0, 2).

(i) Write down the equations of these two lines.

Two of the lines are parallel.

(ii) Write down the equations of these two lines.

Two of the lines are perpendicular

(iii) Write down the equations of these two lines.

..... [3]

- b.**  $A(-2,1)$ ,  $B(6,5)$  and  $C(4,k)$  are the vertices of a right-angled triangle  $ABC$ .

Angle  $ABC$  is the right angle.

(i) Find the midpoint of the line segment  $AB$

(ii) Find the gradient of the line segment  $AB$

(iii) Find an equation of the line that passes through  $A$  and  $B$ .

Give your answer in the form  $ay+bx=c$  where  $a$ ,  $b$  and  $c$  are integers.

..... [8]

### Section 8 – Reasoning & Mathematical Proof

- a.** Here are the first 5 terms of an arithmetic sequence.

**3    9    15    21    27**

(i) Find an expression, in terms of  $n$ , for the  $n$ th term of this sequence.

Ben says that 150 is in the sequence.

(ii) Is Ben right?

You must explain your answer.

..... [3]

- b.** Prove that  $(3x + 1)^2 - (3x - 1)^2$  is a multiple of 4, for all positive integers  $x$ .

..... [3]

- c.** For any three consecutive numbers, prove that the difference between the square of the middle number and the product of the smallest and largest is always 1.

..... [3]

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### Section 9 – Trigonometry Solve the equations below in the range $0 < x < 360$

a.  $\sin x = 0.5$   
 .....[2]

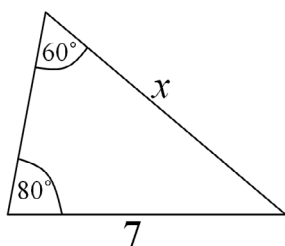
b.  $\cos x = 1$   
 .....[2]

c.  $\tan x = \frac{1}{\sqrt{3}}$   
 .....[3]

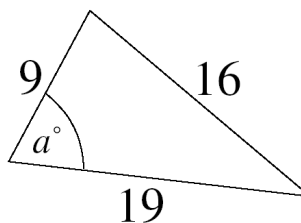
Solve the equations below in the range  $0 < x < 360$ :

Find the missing side or angle in the following triangles

d.



e.



.....[4]

### Section 10 – Calculus

You may need to do some research to complete this question.

These resources may help you: • [examsolutions.net](https://www.examsolutions.net)

<https://www.examsolutions.net/tutorials/gradient-function-dydx/?level=Alevel&board=Edexcel&module=Pure-Maths-A-Level&topic=1256>

<https://www.examsolutions.net/tutorials/differentiation/?level=Alevel&board=Edexcel&module=Pure-Maths-A-Level&topic=1256>

- [khanacademy.org](https://www.khanacademy.org)
- [Wikipedia](https://en.wikipedia.org)
- [wolframalpha.com](https://www.wolframalpha.com)

a. Briefly explain what is meant by differentiation in mathematics.

.....[ ]

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### Section 10 – Calculus

**b.** Differentiate the following:

(i).  $y = 3x^2$

.....[1]

(ii).  $y = 10x^4$

.....[1]

(iii).  $y = \frac{3}{x}$

.....[1]

(iv).  $y = 4x^2 - 2x^6 + 5$

.....[2]

(v).  $y = 2x - \sqrt{x}$

.....[2]

**TOTAL MARKS: 85**