

A Level Mathematics Summer assignment

You will be tested on these skills around 3 weeks into the course

Section A

1 Simplify these expressions.

a $\frac{x^3 \times x^4}{x^2}$ (1 mark)

b $(2x^3)^4$ (1 mark)

c $\frac{9x^{\frac{1}{2}}}{(27x^{-2})^{\frac{2}{3}}}$ (3 marks)

2 Solve $2x^2 \times 4x^4 = 512$ (2 marks)

3 Find the value of x .

$$x^{-\frac{4}{3}} = \frac{1}{256} \quad (2 \text{ marks})$$

1,2,3 <http://www.examsolutions.net/tutorials/summary-of-indices/?level=GCSE&module=gcse&topic=1137>

4 a Write $\sqrt{240}$ in the form $a\sqrt{15}$, where a is an integer. (1 mark)

b Expand and simplify $(2 - \sqrt{3})(5 + 2\sqrt{3})$. (2 marks)

c Simplify $\frac{2 + \sqrt{5}}{3 - \sqrt{5}}$ giving your answer in the form $a + b\sqrt{c}$, where a , b and c are rational numbers. (3 marks)

5 The area of a triangle is given as $(7 + 3\sqrt{3}) \text{ cm}^2$.

The base of the triangle is $(5 - \sqrt{3}) \text{ cm}$, and the perpendicular height is $(p + q\sqrt{3}) \text{ cm}$.

Find the values of p and q . (4 marks)

4,5 <http://www.examsolutions.net/tutorials/exam-questions-surds/?level=A-Level&board=Edexcel&module=C1&topic=1152>

6 Expand and simplify these expressions.

a $3(x - 2y)$ (1 mark)

b $(2x - 3)(3x + 5)$ (2 marks)

c $(x - 2)^2(x + 5)$ (3 marks)

7 Fully factorise these expressions.

a $2xy - 4x$ (1 mark)

b $x^2 + 2x - 3$ (1 mark)

6,7 <http://www.examsolutions.net/tutorials/factorising/?level=GCSE&board&module=gcse&topic=1172>

8 Solve these equations.

a $3x - 7 = 17$ (1 mark)

b $x^2 - 6x + 5 = 0$ (2 marks)

c $2x^2 - 5x + 1 = 0$ (2 marks)

8b,c <http://www.examsolutions.net/tutorials/solve-by-factorising/?level=GCSE&module=gcse&topic=1186>

9 Solve these pairs of simultaneous equations.

a $2x + y = 7$ (3 marks)
 $3x - y = 8$

b $y = 3x - 1$ (3 marks)
 $3y = 6x + 1$

c $2x - y = 9$ (4 marks)
 $x^2 + y^2 = 17$

9a,b <http://www.examsolutions.net/tutorials/elimination-method-for-linear-equations/?level=GCSE&module=gcse&topic=1208>

9b,c <http://www.examsolutions.net/tutorials/substitution-method-for-linear-and-non-linear-equations/?level=GCSE&board&module=gcse&topic=1208>

10 Solve these inequalities.

a $7x - 6 \leq 8$ (1 mark)

b $3x + 2 \geq 7x - 4$ (2 marks)

c $x^2 + 12x - 28 > 0$ (2 marks)

10a,b <http://www.examsolutions.net/tutorials/solving-linear-type/?level=GCSE&board&module=gcse&topic=1212>

10c <http://www.examsolutions.net/tutorials/quadratic-inequalities/?level=GCSE&board&module=gcse&topic=1212>

11 The function f is defined as $f(x) = 5x + 2$

Find the value of $f(-4)$. (1 mark)

11 <http://www.examsolutions.net/tutorials/fx-notation/?level=A-Level&board=Edexcel&module=C1&topic=1160>

Section B

1 Simplify these expressions as far as possible.

a $\frac{x^2 - 2x - 3}{x^2 + 2x + 1}$ (3 marks)

b $\frac{x^2 - 25}{x^2 + 6x + 8} \div \frac{x^2 - 2x - 15}{x^2 - 16}$ (4 marks)

1a <http://www.examsolutions.net/tutorials/simplifying-algebraic-fractions/?level=GCSE&board&module=gcse&topic=1365>

1b <http://www.examsolutions.net/tutorials/division-algebraic-fractions/?level=GCSE&board&module=gcse&topic=1365>

- 2 The line l is a tangent to the circle $x^2 + y^2 = 20$ at the point $P(2, 4)$.
The tangent intersects the y -axis at point A . Find the area of the triangle OPA . (5 marks)
2 <http://www.examsolutions.net/tutorials/equation-circle/?level=A-Level&board=Edexcel&module=C2&topic=1297> (Just a hint)
- 3 Expand and simplify $(\sqrt{p} + 2\sqrt{q})(2\sqrt{p} - \sqrt{q})$ (3 marks)
3 <http://www.examsolutions.net/tutorials/multiplying-surds/?level=GCSE&module=gcse&topic=1152>
- 4 a Write $3x^2 - 12x + 7$ in the form $a(x + b)^2 + c$ (3 marks)
b Hence, or otherwise, write down the coordinates of the turning point of the graph of $y = 3x^2 - 12x + 7$ (1 mark)
4 <http://www.examsolutions.net/tutorials/completing-the-square/?level=GCSE&module=gcse&topic=1182>
- 5 Prove algebraically that the product of three consecutive **odd** numbers is always an odd number. (4 marks)
5 <https://www.youtube.com/watch?v=fGQLSybje38>
- 6 The functions g and f are defined as $g(x) = \frac{2x}{4-x}$ and $f(x) = 3x - 1$
Given that $x \neq 4$, find the value(s) of x such that $g(x) = f(x)$, giving your answer(s) to 2 decimal places. (6 marks)
6 <http://www.examsolutions.net/tutorials/fx-notation/?level=A-Level&board=Edexcel&module=C3&topic=1372>
- 7 The line l_1 has equation $y = -\frac{1}{2}x + 3$ and intersects the x - and y -axes at the points A and B respectively.
a Find the exact length of the line segment AB . (3 marks)
b Find the equation of the line l_2 perpendicular to l_1 which passes through the point $P(-1, -2)$. (2 marks)
The line l_2 intersects l_1 at the point C .
c Find the midpoint of the line segment AC . (4 marks)
7 <http://www.examsolutions.net/tutorials/distance-two-points/?level=A-Level&board=Edexcel&module=C1&topic=1239> (look for more links on this page)
- 8 A triangle ABC has side lengths $AB = 10$ cm, $BC = 15$ cm and $AC = 8$ cm.
a Find the size of the largest angle, giving your answer to 2 decimal places. (3 marks)
b Find the area of the triangle, giving your answer to 2 decimal places. (2 marks)
8a <http://www.examsolutions.net/tutorials/cosine-rule/?level=GCSE&module=gcse&topic=8453>
8b <http://www.examsolutions.net/tutorials/area-triangle-given-two-sides-included-angle/?level=GCSE&module=gcse&topic=8453>
- 9 a Sketch the graph of $y = \cos x$ for $-180 \leq x \leq 360^\circ$, showing the points where the graph cuts the axes. (2 marks)
b Hence find the exact values of x in the interval $-180 \leq x \leq 360^\circ$ for which $\cos x = -\frac{\sqrt{3}}{2}$ (3 marks)
9a <http://www.examsolutions.net/tutorials/trigonometric-graphs/?level=GCSE&module=gcse&topic=1321>
9b <http://www.examsolutions.net/tutorials/trigonometric-ratios/?level=GCSE&module=gcse&topic=1315>

Further Maths Reading List

If you are doing further Maths you should read at least one of these books. Even if you aren't doing further maths it may be fun anyway.

Marcus Du Sautoy The Music of the Primes

Du Sautoy has the ability to explain complex ideas simply. This book, about the building blocks of mathematics and Number Theory, also talks about the tantalising subject of unsolved problems in mathematics.

Marcus Du Sautoy Finding Moonshine

Fantastic! Accessibly written and covering a wide range of topics. Essentially about symmetry and group theory, this book also explains what a mathematician does all day. I wish it had been written 20 years ago.

James Gleick Chaos: Making a New Science

A description of the mysterious world of fractals and their applications to Chaos Theory, an extension of mechanics in which simple and complex causes interact, this book covers the big ideas in the study of chaos and the people behind its development.

G H Hardy A Mathematician's Apology

Refreshingly short. A must-read for anyone serious about mathematics

D G Hofstadter Godel, Escher, Bach: An Eternal Golden Braid

A quirky look at the links between Mathematics, computer programming, logic, music, art. Chapters are interspersed with parodies on the work of Lewis Carroll. A love-it or hate-it book.

Simon Singh Fermat's Last Theorem

Fermat's Last Theorem was one of the most famous mathematical conundrums until in 1993 it was proved by Andrew Wiles. The BBC Horizon film on Wiles' proof was a big talking point at the time. This book, stemming from the film, talks about the history of the problem and gives biographical details of many of the characters involved in its solution.

Novels based on mathematical ideas

Mark Haddon The Curious Incident of the Dog in the Night Time

A bit of light reading, this novel is narrated by an autistic youth who is fascinated by mathematics.

Apostolos Doxiadis Uncle Petros and Goldbach's Conjecture

A novel with mathematics as an underlying theme.

Alternatively you could watch videos from the youtube content creator 'numberphile'.

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

During your further maths lessons you will be expected to give a short presentation on your reading/viewing in September.