Year 11-12 Transition Work

Subject: Maths

St Peter's SIXTH FORM
Discover your potential

We're looking forward to welcoming you in September! Please note that this document has been created by staff to help you prepare to start your studies at sixth form. The work you produce from this will form the basis of a discussion in your first lessons with your teachers.

At the end of this document, there is a review grid for you to complete every time you engage with some preparatory reading this summer.

List of key topics you will study in Year 12:

Pure 1

Algebraic expressions & methods

Coordinate geometry

Binomial expansion

Trigonometric identities

Vectors

Calculus

Exponentials & logarithms

Statistics

Data collection

Correlation

Probability

Statistical distributions

Hypothesis testing

Mechanics

Constant & variable acceleration

Forces & motion

Recommended research list:

The Number Devil – Hans Magnus Enzenberger
Designed as a fairy story for children but actually a really nice introduction into Number Theory and Proof. Easy to read!

Why do Buses Come in Threes – Rob Eastaway and Jeremy Wyndham
Many real-life problems that use maths to solve them.

How to Dunk a Doughnut – Len Fisher
Like *Why do Buses Come in Threes*, a bit less accessible for everyone, helps if you have a scientific or mathematical background.

Eurekas and Euphorias – Walter Gratzer
Fun and interesting scientific and mathematical anecdotes – good to dip in and out of.

Isaac Newton – James Gleick
A concise biography of the scientist – interesting details on his life and mathematical work.

The Book of Nothing – John D. Barrow
A philosophical book about the concept of nothing – links together our simple ideas about "zero" with more advanced concepts and even some Shakespeare thrown in.

Infinity – Brian Clegg
A very mathematical look into the idea of infinity. Helps with the mind-bogglingness of the concept!

The Crest of the Peacock – George Gheverghese Joseph
An eloquently written and fascinating account of how maths evolved in the non-western world. My favourite on this list!

Things to Make and Do in the Fourth Dimension – Matt Parker
Very funny and easy to access with a GCSE maths knowledge.

Dr. Riemann's Zeros – Karl Sabbagh
I haven't actually read this (it's next on my list!) but apparently an interesting account into "modern professional mathematics". Perhaps a good insight into what mathematicians actually do now!

How Not to be Wrong – Jordan Ellenburg
The most recently written book on the list – I also haven't read this yet but comes highly recommended.

Some other suggestions…

Apps: Sumaze! Flow, Two Dots, 2048, Fill

Twitter: Hannah Fry, Catriona Shearer, MoMath, Rob Eastaway, Matt Parker

Websites: Nrich; UKMT; and explore the Integral and AMSP websites for puzzles, challenges and pre uni work (they have the logins for Integral) (use this link and scroll all the way to the bottom https://2017.integralmaths.org/course/view.php?id=160)

Youtube: Watch Hannah Fry's BBC programmes and Christmas Lectures; subscribe to Numberphile.

Tasks

The following work in this booklet is designed to prepare you to make the transition from GCSE Mathematics to A level Mathematics.

All of the areas in this booklet are covered at GCSE at grades 7, 8 and 9. By assessing your knowledge on these key areas we will be able to support your transition more successfully and where necessary give further tuition to make your foundation knowledge more secure.

You should aim to complete the work over your summer break. It will be marked, in class, during your second week of lessons (w/c 8th September 2025).

Please complete all the questions, working on lined paper and showing all necessary steps in your calculations.

You may also wish to pick one of the books from the list above and make notes in a review grid.

If you have any further questions regarding this work then please contact me by e-mail at jgregg@st-peters.surrey.sch.uk

Section 1- Surds (17 marks)

1. Evaluate
   a. $\sqrt{49}$
   b. $\sqrt[3]{8}$
2. Simplify
   a. $\sqrt{7} \times \sqrt{7}$
   b. $\left(\sqrt{2}\right)^5$
   c. $\frac{\sqrt{32}}{\sqrt{2}}$
3. Express in the form $k\sqrt{2}$
   a. $\sqrt{18}$
4. Simplify
   a. $\sqrt{12}$
   b. $\sqrt{45}$
   c. $\sqrt{216}$
5. Simplify
   a. $\sqrt{18} + \sqrt{50}$
   b. $\sqrt{360} - 2\sqrt{40}$
6. Express in the form $a + b\sqrt{3}$
   a. $\sqrt{3}(2 + \sqrt{3})$
   b. $(4 + \sqrt{3})(1 + 2\sqrt{3})$
7. Simplify
   a. $\left(\sqrt{5} + 1\right)\left(2\sqrt{5} + 3\right)$
   b. $(3\sqrt{2} - 1)(2\sqrt{2} + 5)$
8. Rationalise the denominator
   a. $\frac{1}{\sqrt{5}}$
   b. $\frac{1}{3\sqrt{7}}$

Section 2 – Indices (19 marks)

1. Evaluate
   a. 8^2
   b. $\left(\frac{2}{3}\right)^3$
2. Write in the form 2^n
   a. $2^5 \times 2^3$
3. Simplify
   a. $2p^2 \times 4p^5$
   b. $(2b)^3 \div 4b^2$
   c. $6x^5 \div 3x^2y$
4. Evaluate
   a. 3^{-2}
   b. $16^{\frac{1}{4}}$
   c. $81^{-\frac{1}{4}}$
5. Evaluate
   a. $4^{\frac{3}{2}}$
   b. $36^{-\frac{3}{2}}$
   c. $(0.04)^{\frac{1}{2}}$
6. Work out
   a. $4^{\frac{1}{2}} \times 27^{\frac{1}{3}}$
   b. $\left(\frac{1}{3}\right)^{-2} - (-8)^{\frac{1}{3}}$
   c. $\left(\frac{1}{9}\right)^{-\frac{1}{2}} \times (-32)^{\frac{3}{5}}$
7. Simplify
   a. $x^8 \times x^{-6}$
   b. $y^3 \times y^{-\frac{1}{2}}$
   c. $p^{\frac{1}{4}} \div p^{-\frac{1}{5}}$
   d. $\frac{b^2 \times b^{\frac{1}{4}}}{b^{\frac{1}{2}}}$

Section 3 – Factorising (16 marks)

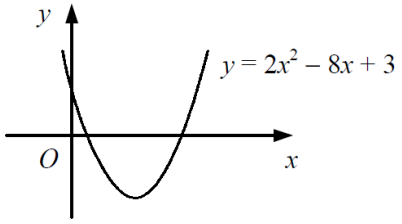
1. Using factorisation, solve
   a. $x^2 - 4x + 3 = 0$
   b. $x^2 - 25 = 0$
   c. $60 - 4x - x^2 = 0$
   d. $3x^2 + 11x = 4$
   e. $4x^2 + 4x + 1 = 0$
2. Factorise fully
   a. $2y^2 - 10y + 12$
   b. $a^4 + 4a^2 + 3$
   c. $6x^3 - 26x^2 + 8x$
3. Sketch each curve showing all intersection points
   a. $y = x^2 - 3x + 2$
   b. $y = x^2 - 2x$
   c. $y = -x^2 + 5x - 4$
   d. $y = 2x^2 + 13x + 6$
   e. $y = 5x^2 - 17x + 6$
4. Solve
   a. $x - 5 + \frac{4}{x} = 0$
   b. $\frac{5}{x^2} + \frac{4}{x} - 1 = 0$
   c. $4x^4 + 7x^2 = 2$

Section 4 – Completing the square (9 marks)

1. Express in the form $(x + a)^2 + b$
   a. $x^2 + 2x + 4$
   b. $x^2 + 4x + 8$
   c. $x^2 + 6x - 9$
   d. $x^2 - 18x + 100$
   e. $5 - 3x + x^2$
2. Solve, in surd form by completing the square
   a. $y^2 - 4y + 2 = 0$
   b. $x^2 - 2x = 11$
   c. $u^2 + 7u = 44$
   d. $-m^2 + m + 1 = 0$

Section 5 – The Quadratic Formula (5 marks)

1. Use the quadratic formula to solve, leave your answers as surds
   a. $x^2 + 4x + 1 = 0$
   b. $6 + 18a + a^2 = 0$
   c. $5 - y - y^2 = 0$
   d. $0.1r^2 + 1.4r = 0.9$
2. The diagram shows the curve with equation $y = 2x^2 - 8x + 3$. Find and simplify the exact coordinates of the points where the curve crosses the x axis



Section 6 – Simultaneous Equations (3 marks)

1. Solve
   a. $y = 3x$
      $y = 2x + 1$
   b. $x + y - 3 = 0$
      $x + 2y + 1 = 0$
2. Find the coordinates of the points of intersection
   $y = x + 2$
   $y = x^2 - 4$

Section 7 – Inequalities (12 marks)

1. Find the set of values of x
   a. $2x + 1 < 7$
   b. $5x + 17 \geq 2$
   c. $18 - x > 4$
2. Solve
   a. $2y - 3 > y + 4$
   b. $a + 11 \geq 15 - a$
   c. $4x + 23 < x + 5$
   d. $5(r - 2) > 30$
   e. $7(y + 3) - 2(3y - 1) < 0$
3. Find the set of values of x
   a. $x^2 - 4x + 3 < 0$
   b. $x^2 - 6x + 5 > 0$
   c. $63 - 2x - x^2 \leq 0$
4. Find the set of values of x in terms of surd
   a. $x^2 + 2x - 1 < 0$

Section 8 – Algebraic Fractions (19 marks)

1. Simplify
   a. $\frac{m}{16} \div \frac{5m}{12}$
   b. $\frac{3m}{8} \div \frac{15m}{20}$
   c. $\frac{6x+3}{8} \div \frac{2x+1}{12}$
   d. $\frac{9xy}{7} \div \frac{6x}{3}$
   e. $\frac{6pq}{5} \div \frac{12p}{7}$
   f. $\frac{3(x+1)}{8} \div \frac{5(x+1)}{16}$
2. Simplify
   a. $\frac{x}{3} + \frac{x}{4}$
   b. $\frac{2}{2xy} + \frac{4}{xy^3}$
   c. $\frac{3x+1}{2} - (6x + 5)$
   d. $\frac{3}{b-1} - \frac{4}{b-2}$
   e. $\frac{\frac{2x+2}{y}}{\frac{x+1}{xy}}$

3. Simplify

a. $\frac{4(x+1)}{3} - \frac{5(x-2)}{2}$

b. $\frac{x^2+3x}{x+4} \times \frac{2x+8}{5x}$

c. $\frac{8x-24}{4} \div \frac{x+7}{12}$

4. Solve

a. $\frac{x+8}{5} - \frac{x-2}{3} = 4$

b. $\frac{x+1}{3} + \frac{x-4}{2} = 5$

c. $\frac{3(x-2)}{4} - \frac{2(x+1)}{5} = \frac{1}{10}$

d. $\frac{4}{x+1} + \frac{3}{x-4} = \frac{2}{x+1}$

e. $\frac{5}{x+3} + \frac{2}{2x+6} = 4$

Section 9 – Graphs (16 marks)

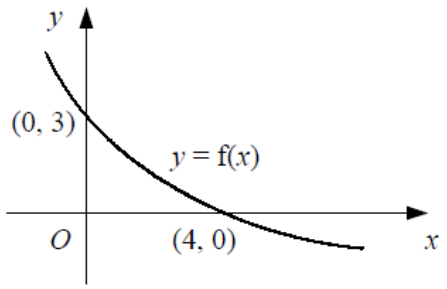
1.

Describe how the graph of $y = f(x)$ is transformed to give the graph of

a $y = f(x - 1)$ **b** $y = f(x) - 3$ **c** $y = 2f(x)$ **d** $y = f(4x)$

e $y = -f(x)$ **f** $y = \frac{1}{5} f(x)$ **g** $y = f(-x)$ **h** $y = f(\frac{2}{3}x)$

2.



The diagram shows the curve with equation $y = f(x)$ which crosses the coordinate axes at the points (0, 3) and (4, 0).

Showing the coordinates of any points of intersection with the axes, sketch on separate diagrams the graphs of

a $y = 3f(x)$ **b** $y = f(x + 4)$ **c** $y = -f(x)$ **d** $y = f(\frac{1}{2}x)$

3.

Find and simplify an equation of the graph obtained when

a the graph of $y = 2x + 5$ is translated by 1 unit in the positive y-direction,

b the graph of $y = 1 - 4x$ is stretched by a factor of 3 in the y-direction, about the x-axis,

c the graph of $y = 3x + 1$ is translated by 4 units in the negative x-direction,

d the graph of $y = 4x - 7$ is reflected in the x-axis.

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