

St Dominic's Sixth Form College

A level Mathematics - Transition Work

Introduction

'I felt so lost. Everyone else in my class had done it before'. There are always some students who feel like this, so we have assembled material which some students feel more familiar with than others. We know you have worked hard for your GCSEs, but we would like you to spend 3 hours sometime between now and September attempting these questions. Use textbooks, online resources, clever friends as much as you like (so long as they don't do it for you!).

If you make a serious attempt at this you will have a much better chance of starting the course on a level playing field.

You must hand this work in at your first Maths lesson.

You will need the following equipment for your Maths lessons:

- Pen, pencil, ruler, eraser
- A4 lined paper
- A4 folder
- CASIO fx-991EX Classwiz calculator or CASIO fx-CG50 Graphical calculator

You will be provided access to Online Textbooks for use outside of lessons.

For more details about the course, please refer to the department handbook on Sharepoint after you have enrolled at the college.

Algebra

A) Solve the following Linear equations:

1. $\frac{x+2}{4} - 3 = 2x - 1$
2. $3(x - 2) + 4x = \frac{x+4}{6}$
3. $\frac{3}{x-2} + 3 = \frac{4x}{x-2}$
4. $\frac{2x}{x+1} + x = 3$
5. $x^3 - 9x = 0$

Example:

$$\begin{aligned} \frac{2x-3}{3x} &= 1 \\ 2x-3 &= 3x \\ -3 &= x \\ x &= -3 \end{aligned}$$

Solve the following linear simultaneous equations:

1. $2x - 4y = 21$ $3x + y = 7$
2. $5x - 19 = 2y$ $2x - \frac{y}{3} = 2$
3. $\frac{x}{3} + \frac{y}{4} = \frac{29}{6}$ $3x - 2 = y$

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

Example

$$(1) \quad 3x - 2y = 10$$

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

$$\text{Rearrange (2)} \quad y = 2 - \frac{x}{3}$$

$$\text{sub(2) into (1)} \quad 3x - 2\left(2 - \frac{x}{3}\right) = 10$$

$$3x + \frac{2x}{3} = 14$$

$$\frac{11x}{3} = 14$$

$$x = \frac{42}{11} \quad y = 2 - \frac{x}{3} = 2 - \frac{42}{33} = \frac{24}{33} = \frac{8}{11}$$

Rearranging formulae

In Mathematics A level, you will often construct equations from information given in the question, and have to solve or rearrange that equation into a particular form. We feel that as students preparing for the start of your A levels, you should be well practiced in both of these skills.

The following equations should be rearranged to make the letter in brackets the subject of the equation.

e.g. $\frac{2a-b}{c} = 20$ (a) $a = \frac{20c+b}{2}$

1. $2x + 3y = 18$ (y)

2. $\frac{x}{3a} - 2b = a$ (x)

3. $a^2 + b^2 = c^2$ (b)

4. $F = G \frac{m_1 m_2}{a^2}$ (d)

5. $E = mc^2$ (m)

6. $ax - \frac{x}{b} + b^2 = a^2$ (x)

7. $2x^2y - 5xy = 3$ (y)

8. $3xy = 24 - 6y$ (y)

9. $\sqrt{\frac{x}{2}} = a^2 + 4$ (x)

10. $\frac{6-x}{-2} = 4 - 3(2 - a^2)$ (x)

11. $\frac{-4-(3-x)}{2-a} = \frac{6-5x}{-a+1}$ (x)

12. $\frac{2x+5}{3} + \frac{x-2}{5} = 2x$ (x)

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

14. $\frac{2y-x}{(x-3)^2} - \frac{3}{(x-1)} = \frac{y-2}{2(4-x^3)}$ (y)

16 a) Find an expression for the time T taken to drive x + y km at 30 km/h

followed by x + z km at 50 km/h

b) Deduce an expression for x in terms of T, y and z

Geometry

A: Check whether the given pair of lines are parallel/perpendicular/intersecting:

e.g. $y = 2x - 1$ and $2y + x = 1$

First rearrange to make y the subject for both equations:

$$y = 2x - 1 \text{ and } y = -\frac{1}{2}x + \frac{1}{2}$$

Now we can see that the gradients are 2 and $-\frac{1}{2}$ respectively so these lines are perpendicular

1. $y = 3x - 5$ and $y = -3x + 7$
2. $5x - y = 1$ and $-10x + 2y = 3$
3. $3x + 2y = 1$ and $x - 3y + 1 = 0$

B: Find the mid points of the following points:

e.g. (7, 2) and (3, -4)

You find the average of the x and y coordinates:

$$\text{So } \left(\frac{7+3}{2}, \frac{2+(-4)}{2} \right) = (5, -1)$$

- 1 (3.2, 7.1) and (-1.6, 3.9)
- 2 $\left(\frac{-1}{2}, \frac{1}{2} \right)$ and $\left(\frac{-5}{2}, \frac{7}{2} \right)$
- 3 $\left(\frac{2}{3}, \frac{4}{5} \right)$ and (-1.5, 2.1)

C: Find the distances in simplest surd form between the following coordinates:

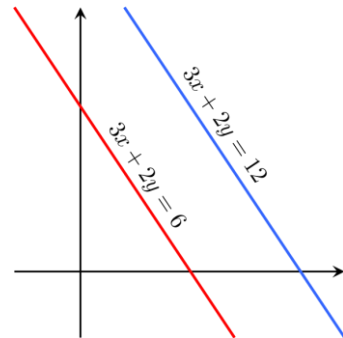
e.g. (4,5) and (-1,4)

$$\sqrt{(-1-4)^2 + (4-5)^2} = \sqrt{26}$$

- 4 (1, 2) and (7,11)
- 5 (-3, 4) and (-7, 10)
- 6 $\left(\frac{2}{3}, \frac{4}{5} \right)$ and (-1.5, 2.1)

7 A phone bill consists of a fixed cost plus a further charge per minute of peak hours talking time

- a) If 200 minutes of peak hours talking time costs £32, and 300 minutes cost £44 find an equation linking the number of minutes of peak hours talking time (x) with the cost (y).



D: Find the equation of the straight line which has the following gradient and passes through the point provided giving your answers in the form $y = mx + c$.

e.g. (2,3) and $m = 4$

Use the equation $y - y_1 = m(x - x_1)$

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

$$y - 3 = 4x - 8$$

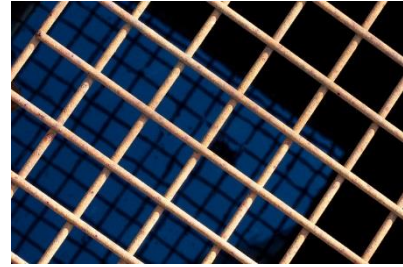
$$y = 4x - 5$$

8 (2, 1) and $m = 1$

9 (3, 0) and $m = 3$

10 (-4, 4) and $m = -2$

11 (1, -6) and $m = -5$



E: Find the equation of the straight line which has the following gradient and passes through the point provided giving your answers in the form $ax + by + c = 0$.

e.g. same as above but give your answer in a different form:

(2,3) and $m = 4$

Use the equation $y - y_1 = m(x - x_1)$

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

$$y - 3 = 4x - 8$$

$$y - 4x + 5 = 0$$

12 (3, -5) and $m = \frac{2}{3}$

13 (2, 3) and $m = -\frac{1}{2}$

14 (-4, 0) and $m = -\frac{4}{5}$

F: Find the equation of the line which passes through the given point and is parallel to the given line:

e.g. (3, -5) and $y = -2x + 1$

The gradient of the given line is -2 so use this in our equation of the line

$$y - (-5) = -2(x - 3)$$

$$y + 5 = -2x + 6$$

$$y = -2x + 1$$

15 (2, 3) and $y = x + 4$

16 (-1, 0) and $y = 3x - 4$

17 (4, -2) and $3x - 2y = 1$



G: Find the equation of the line which passes through the given point and is perpendicular to the given line:

e.g. (-1, -3) and $y = -3x + 3$

Gradient of given line is -3 so gradient of required line will be $\frac{1}{3}$ as the gradients of perpendicular lines multiply to give -1

18 (1, 4) and $y = 3x + 7$

19 (2, 5) and $y = 2x + 4$

20 (-3, 7) and $x - 7y = 4$

H: Find the equation of the line which passes through the given points, give your answers in the form $y = mx + c$:

e.g. (1,1) and (-2, -5)

Firstly, we need to find the gradient:

$$m = \frac{-5 - 1}{-2 - 1}$$

$$= \frac{-6}{-3}$$

$$= 2$$

Then we use the method from above to calculate the equation:

$$y - 1 = 2(x - 1)$$

$$y = 2x - 1$$

21 (3, 7) and (4, 5)

22 (-3, 2) and (-1, 0)

23 (1, 4) and (-2, -1)



I: Find the equation of the straight line which passes through the following points, give your answers in the form, $ax + by + c = 0$:

e.g. Same as above just need to give your answer in a different form:

(1,1) and (-2, -5)

Firstly, we need to find the gradient:

$$\begin{aligned}m &= \frac{-5-1}{-2-1} \\ &= \frac{-6}{-3} \\ &= 2\end{aligned}$$

Then we use the method from above to calculate the equation:

$$\begin{aligned}y-1 &= 2(x-1) \\ y-2x+1 &= 0\end{aligned}$$

24 (3, 4) and (1, 5)

25 (-1, 0) and (0, 3)

26 (2, -2) and (-3, 3)

55 The Watling Street and the Fosse way are both Roman roads, on the same sites as the present day A5 and A429. Because they were Roman roads, they can be modelled as straight lines, with central London as the origin and the x and y axes east and north respectively. Units represent miles. The Watling Street passes through Shrewsbury (-70,60) and Central London. The Fosse Way passes through Cirencester (-55,20) and Lincoln (-5,100)

Find to one decimal place, the co-ordinates of the points where the Watling Street and the Fosse Way intersect.

Answers:

Linear Equation Answers:

1. $x = -\frac{6}{7}$
2. $x = \frac{40}{31}$
3. $x = -3$
4. $x = \pm\sqrt{3}$
5. $x = 0, -3, 3$

Linear Simultaneous equations Answers:

1. $x = 3.5, y = -3.5$
2. $x = -1, y = -12$
3. $x = 4, y = 10$
4. $x = -1, y = -1$

Formulae Rearrangement Answers:

$$y = \frac{18 - 2x}{3}$$

$$x = 3a^2 + 6ab$$

$$b = \pm\sqrt{c^2 - a^2}$$

$$d = \sqrt{\frac{Gm_1m_2}{F}}$$

$$m = \frac{E}{c^2}$$

$$x = \frac{a^2b - b^3}{ab - 1}$$

$$y = \frac{3}{2x^2 - 5x}$$

$$y = \frac{4}{x + 2}$$

$$x = 2(a^2 + 4)^2$$

$$x = \frac{(a - 3)^2}{b^2}$$

$$x = 2 + 6a^2$$

$$x = \frac{13 - 5a}{9 + 6a}$$

$$x = \frac{19}{17}$$

$$y = \frac{(x - 2)(6x^2 - 11x - 1)}{2x - 3}$$

$$y = \frac{6(x - 3)^2(4 - x^3) + 2x(x - 1)(4 - x^3) - 2(x - 3)^2}{4(4 - x^3)(x - 1) - (x - 3)^2}$$

$$\text{or } y = \frac{-8x^5 + 38x^4 - 54x^3 + 30x^2 - 140x + 198}{-4x^4 + 4x^3 - x^2 + 22x - 25}$$

Geometry Section answers:

A:

1. Intersecting
2. Parallel
3. Intersecting
4. Perpendicular
5. Parallel
6. Perpendicular

B:

7. (4, 6.5)
8. (-5, 7)
9. (0.8, 5.5)
10. $\left(\frac{-3}{2}, 2\right)$
11. $\left(\frac{13}{12}, \frac{29}{20}\right)$

C:

12. $3\sqrt{13}$
13. $2\sqrt{13}$
14. $\frac{8\sqrt{13}}{5}$
15. $\sqrt{13}$
16. $\frac{13\sqrt{34}}{30}$

D:

17. $x - y - 1 = 0$
18. $3x - y - 9 = 0$
19. $2x + y + 4 = 0$
20. $5x + y + 1 = 0$
21. $3x + y = 0$
22. $y + 5 = 0$
23. $2x + y - 6 = 0$
24. $6x - y + 24 = 0$

E:

25. $2x - 3y - 21 = 0$
26. $x + 2y - 8 = 0$
27. $4x + 5y + 16 = 0$
28. $2x - 7y + 15 = 0$
29. $x - 6y + 24 = 0$
30. $3x + 4y + 26 = 0$

F:

31. $y = x + 1$
32. $y = 3x + 3$
33. $3x - 2y = 16$

34. $6x - y = 0$
35. $x + y + 3 = 0$
36. $5x + 6y + 57 = 0$

G:

37. $y = -\frac{x}{3} + \frac{13}{3}$
38. $y = -\frac{x}{2} + 6$
39. $7x + y = -14$
40. $4x - 5y = 30$
41. $5x - 2y + 4 = 0$
42. $x + 6y + 11 = 0$

H:

43. $y = -2x + 13$
44. $y = -x - 1$
45. $y = \frac{5}{3}x - \frac{7}{3}$
46. $y = 1$
47. $y = -\frac{11}{3}x + \frac{53}{3}$
48. $y = -x - 8$

I:

49. $x + 2y - 11 = 0$
50. $3x - y + 3 = 0$
51. $x + y = 0$
52. $x - 5 = 0$
53. $x + y + 9 = 0$
54. $y + 3 = 0$
55. $(-43.9, 37.7)$

Bridging the gap for Y11s

- Watch the excellent videos here: <https://sites.google.com/site/tlmaths314/home/gcse-to-a-level-maths-bridging-the-gap>. Pause the clips and try the questions first, before checking the solutions.
- Transition to A level Mathematics resources: Essential Skills: <https://amsp.org.uk/resource/gcse-alevel-transition-resources>
- Bridging GCSE and A-level guide on pdf: <https://padlet.com/av92/n302j2in449j7mid>
- Make sure you have done the harder GCSE past paper questions: <https://www.mathsgenie.co.uk/papers.html>
- For a variety of interesting articles, challenges and puzzles, go to: <https://amsp.org.uk/students/gcse/more-maths>

See next page for more tips and information to help you succeed in your Maths A level...

Advice from 2nd year students

- ✓ Read over topics before lessons
- ✓ Do homework on the day it is given
- ✓ Use online resources for revision and pre-reading
- ✓ Always be prepared for your maths lesson (equipment etc.)
- ✓ Revise your GCSE maths
- ✓ Solomon worksheets are your best friend!
- ✓ Be productive and go to your teachers
- ✓ Don't stress!
- ✓ Keep going over the topics you've already done throughout the year, even when you're not doing it in class
- ✓ Do past papers!
- ✓ Do Solomon papers if you run out of papers to do
- ✓ Make every test and exam count! Your predictions depend on this
- ✓ Start revising early!

Websites

www.TLMaths.com – Excellent **videos**. Click 'A-level Maths 2017'

www.drfrostmaths.com –Excellent **powerpoints** on Pure, Applied & FM including calculator guidance

www.crashmaths.com – **Practice papers** and mark schemes

www.pearsonactivelearn.com – Access to **digital textbooks** (students have personal logins)

www.mathsgenie.co.uk - click 'new A-level' for specimen papers, exam questions on specific topics

www.furthermaths.org.uk/edexcel-revision - excellent revision videos for Further Maths

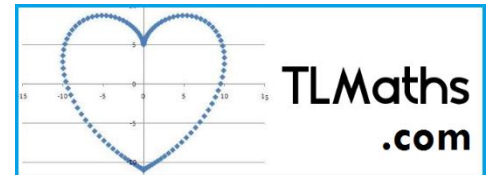
www.desmos.com - free **graph plotting** website

Below are websites relevant to the old modular course but still have useful content:

www.physicsandmathstutor.com - **Past papers** and mark schemes, **Solomon Papers**, revision notes, summary sheets, past paper questions by topic.

www.examsolutions.net - lots of video tutorials and old past paper solutions

Edexcel course specification and sample materials: Google: 'edexcel maths spec'



Podcasts

podcasts.ox.ac.uk/series/secrets-mathematics - The Secrets of Mathematics

www.bbc.co.uk/programmes/b00srz5b/episodes/downloads - A Brief History of Mathematics

soundcloud.com/damien-adams-662584563 - Women in Math

www.numberphile.com/podcast - Numberphile - Excellent podcasts including Matt Parker, Hannah Fry and James Grime



Apps



Desmos – sketch graphs without a graphical calculator

Geogebra – graph sketching and geometrical representations e.g. vectors

Photomath – take a photo of an equation and it will solve it

Enrichment and Further Reading

www.ams.org.uk – resources, university applications, STEP, MAT and TMUA info

www.ukmt.org.uk - Senior Maths Challenge

www.furthermaths.org.uk/competition_materials

Bellos, A	<i>Alex's Adventures In Numberland</i>
Pickover, CA	<i>The Math Book: From Pythagoras to the 57th Dimension</i>
Acheson, D	<i>1089 and All That</i>
Singh, S	<i>Fermat's Last Theorem</i>
Doxiadis, A	<i>Uncle Petros and Goldbach's Conjecture</i>
Maor, E	<i>e: The Story of a Number</i>
Clegg, B	<i>A Brief History of Infinity</i>
Hodges, A	<i>Alan Turing: The Enigma</i>
Stewart, I	<i>Seventeen Equations that Changed the World</i>
Du Sautoy, M	<i>The Creativity Code, The Music of the Primes</i>

