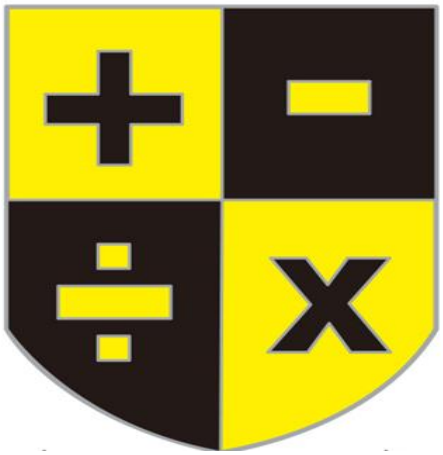
Edmonton County School

Educating our Community for Success

Mathematics Faculty

AS Transition Booklet

MATHS



you and your sixth form

Contents

MATHS FACULTY EXPECTATIONS

The Maths faculty would like to take this opportunity to congratulate you on your GCSE results and welcome you onto the KS5 Maths courses. We trust that you will enjoy the course and work hard to achieve your full potential. Please read through the following points and ensure that you are familiar with them throughout the year as your teacher will regularly refer back to them.

Punctuality

In order to progress well during the course, it is vital that students arrive early to all lessons, attend **ALL** lessons and complete all homework and internal assessments set. The attendance and punctuality of all sixth form students will be monitored and recorded weekly by your teacher and the KS5 Maths Co-ordinator. If you are late more than once to Maths lesson within a week your parents will receive a phone call home. Lateness to lessons causes disruption to teaching and learning of all students and will be taken very seriously.

Attendance

Unless your parents have called in that you are ill or have an appointment, you must e-mail your Maths teacher and cc Mr Alibagi (kS5 Maths Coordinator) explaining why you were absent and requesting the work missed. Your parents may receive a phone call from your teacher asking for more details. All work missed must be completed by the student prior to the next lesson. All internal assessment must be taken by all students. In the unlikely event that you miss an assessment, you will do the exam afterschool at an appointed time.

Assessment

All students are tested regularly and you must record your results on the grade tracking sheet at the front of your folder. You need to have a folder for pure and application unit. Your exercise books and folders are the best resource to help you prepare for assessments and your exams. You will be tested at the end of every half term and term. In year 12 for each unit you will do two mock exams. One of the exams is in December and one is in March (PPE's).

Homework & Independent Study

You are required to allocate **at least 5 hours per week** to do Maths homework. This does not include your independent study time on the subject. Homework must be recorded in your homework diary and must be done in exercise books. Homework will be monitored by your Maths teacher, recorded centrally and will be monitored by the KS5 Maths Co-ordinator/Head of Maths. In the unlikely event that you fail to do the homework on two occasions you will be given an hour detention afterschool with KS5 Maths Co-ordinator and will be required to complete a worksheet on the topic. However, given that you have chosen this course, we expect you to be fully committed to your own development.

Summer Bridging Work

In order to prepare you for the course we expect you to complete the attached practice questions in the summer prior to the start of the course. **You must self-mark these with the answers provided and fill in any gaps that you have. Failure to do this will leave you in a vulnerable position and in the past this has resulted in students being unable to access the start of the course and dropping or being removed from the subject.** To make sure that you don't find the tasks difficult we have provided you with resources below. There is also Hegarty maths, You Tube live lessons, Getting ready for A-Level Maths. These are 30 minutes clips that Mr Hegarty delivers. At the beginning of every task if you are not confident in that topic refer to Mr Hegarty clips and then start on the task.
At the end of the booklets we have put some books that you might find interesting and can read over Summer holiday.
All year 12 students will be sit a gate entry exam first week of the course. This exam will be based on the bridging work booklet and your grade will be the part of the first report that will be shared with the Sixth form leading team when discussing your suitability for the course.

Compulsory Textbooks: There are 2 compulsory textbooks you must purchase

1) **Pearson Edexcel AS and A Level Mathematics Pure Mathematics Year 1 AS Student Book. ISBN: 978-1-292-18339-8**
2) **Pearson Edexcel AS and A Level Mathematics Statistics and Mechanics Year 1 AS Student Book. ISBN: 978-1-292-23253-9**

NB: The textbook listed above must be purchased by all students on this course by 18/09/20

Edexcel AS Mathematics Surds and indices

Indices

Do not use a calculator in this exercise.

1. Find:
   (i) 3^4 (ii) 2^6 (iii) $4^{1/2}$
   (iv) 6^0 (v) 5^{-2} (vi) $64^{1/3}$
   (vii) $16^{-1/2}$ (viii) $8^{5/3}$ (ix) $36^{-3/2}$
   (x) $\left(\frac{1}{2}\right)^{-1}$ (xi) $\left(\frac{25}{9}\right)^{-1/2}$ (xii) $\left(\frac{27}{64}\right)^{-2/3}$

2. Simplify the following:
   (i) $3^{11}\times 3^{-4}\div 3^3$ (ii) $\left(2^5\right)^3\times\left(2^7\right)^{-2}$ (iii) $\frac{5^6}{5^5\times 5^3}$

3. Simplify:
   (i) $2^3\times 16^{\frac{1}{2}}$ (ii) $\frac{3^5\times 5^3}{\sqrt{81\times 25}}$

Surds

Do not use a calculator in this exercise.

1. Write these in terms of the simplest possible surd.
   (i) $\sqrt{8}$ (ii) $\sqrt{50}$ (iii) $\sqrt{48}$
   (iv) $\sqrt{216}$

2. Simplify the following
   (i) $\left(1+\sqrt{2}\right)+\left(3-2\sqrt{2}\right)$ (ii) $\left(5\sqrt{2}-2\sqrt{3}\right)-\left(\sqrt{2}+3\sqrt{3}\right)$
   (iii) $2\left(\sqrt{5}-3\sqrt{3}\right)+3\left(2\sqrt{5}+\sqrt{3}\right)$

3. Multiply out the brackets and simplify as far as possible.
   (i) $\left(1+\sqrt{2}\right)\left(3-\sqrt{2}\right)$ (ii) $\left(2-\sqrt{3}\right)\left(3+2\sqrt{3}\right)$

4. Rationalise the denominators of the following.

(i) $\frac{3}{\sqrt{3}}$ (ii) $\frac{1}{\sqrt{5}}$

(iii) $\frac{1+\sqrt{2}}{\sqrt{2}}$ (iv) $\frac{1}{\sqrt{3}+1}$

(v) $\frac{\sqrt{2}}{2-\sqrt{2}}$

Simultaneous Equations

1. Solve the following simultaneous equations:

(i) $2x+5y=11$, $2x-y=5$ (ii) $x+2y=6$, $4x+3y=4$

(iii) $3a-2b=4$, $5a+4b=3$ (iv) $2p-5q=5$, $3p-2q=-9$

2. Solve the following simultaneous equations:

(i) $x-y=-1$, $3x+2y=7$ (ii) $2x+y=0$, $x-3y=7$

(iii) $y-5x=-8$, $x+3y=0$ (iv) $x=2y-1$, $-x+3y=-1$

The Quadratic Formula

1. Without solving the equation, state how many solutions there are for each of the following quadratic equations:

(i) $3x^2+2x+5=0$ (ii) $2x^2-3x-2=0$

(iii) $5x^2-6=0$ (iv) $4x^2-8x+4=0$

2. Use the quadratic formula to solve these equations. Give your answers in exact form.

(i) $x^2+4x+1=0$ (ii) $x^2-3x-1=0$

(iii) $2x^2+2x-3=0$

Inequalities

1. Solve the following linear inequalities.

(i) $2x+3<10$ (ii) $5x+3\geq 2x-9$

(iii) $3x-1>7-x$ (iv) $4x+1\leq 6x-7$

(v) $5x+2>-7$ (vi) $3x-11\leq 5+4x$

2. (i) Write $x^2 - 11x + 24$ in factorised form.

(ii) Sketch the graph of $y = x^2 - 11x + 24$, labelling the values of x where the graph crosses the x-axis.

(iii) Use your graph to write down the solution of

$$x^2 - 11x + 24 \geq 0$$

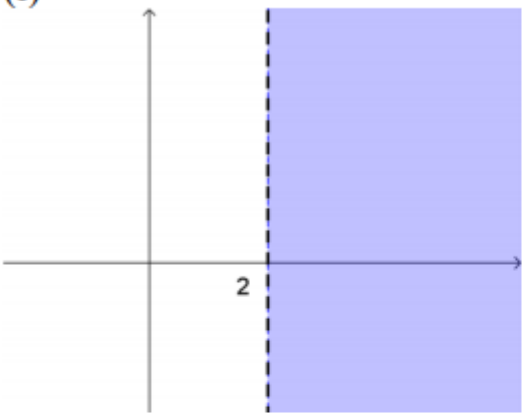
3. Solve the following quadratic inequalities.

(i) $x^2 - 4x - 12 \leq 0$ (ii) $x^2 - 7x + 6 > 0$

(iii) $x^2 + 2x - 15 \geq 0$

4. Write down an inequality to describe the shaded area in each of these diagrams.

(i)



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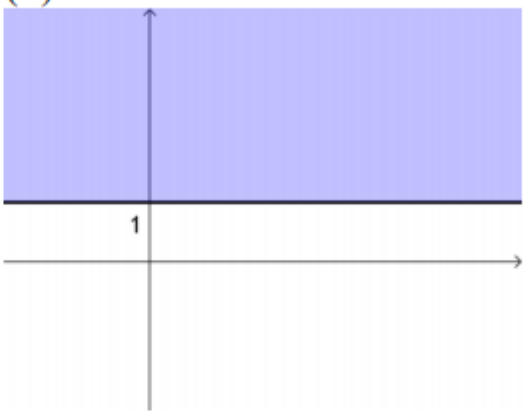

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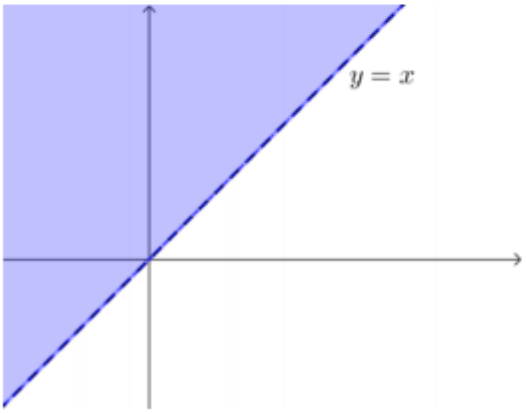

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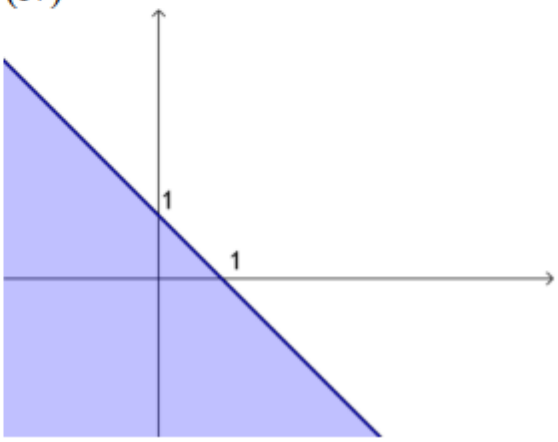


Algebraic Fractions

1. Simplify

(i) $\dfrac{x^2 - 5x}{x - 5}$ (ii) $\dfrac{x^2 + 6x - 16}{(x-2)(x-8)}$

(iii) $\dfrac{x^2 - a^2}{(x-a)^2}$ (iv) $\dfrac{v - 3}{6 - 2v}$

2. Write as a single fraction in its simplest form

(i) $\dfrac{x^2 + 3x - 4}{8} \times \dfrac{2}{3x - 3}$ (ii) $\dfrac{3}{x+2} \times \dfrac{x^2 - 4x - 12}{x^2 - 2x - 24}$

3. Write as a single fraction in its simplest form

(i) $\dfrac{5c+15}{2} \div \dfrac{c^2-9}{4}$ (ii) $\dfrac{x^2-x}{2x+1} \div \dfrac{x^2+2x-3}{2x^2-3x-2}$

4. Express as a single fraction

(i) $\dfrac{x}{2}+\dfrac{3x}{5}$ (ii) $\dfrac{2}{3x}-\dfrac{1}{4x}$

5. Express as a single fraction

(i) $\dfrac{2}{x+3}+\dfrac{1}{x-5}$ (ii) $\dfrac{5}{2x-3}-\dfrac{2}{4x+1}$

6. Express as a single fraction

(i) $\dfrac{1}{2(x+5)}-\dfrac{1}{4(x+1)}$

7. Divide

(i) $3x^3-x^2+2x-4$ by $x+2$
(ii) x^4+2x^2-x-1 by x^2+1
(iii) x^3 by x^2+2
(iv) $6x-2$ by $2x+3$
(v) $3x^2+1$ by x^2-2x-1

The Sine and Cosine Rules

1. Find two possible values of c in triangle ABC given that $a = 16$ cm, $b = 10$ cm, and $B = 30°$.

2. Solve the triangle PQR in which $p = 8$ cm, $q = 9$ cm and $r = 10$ cm.

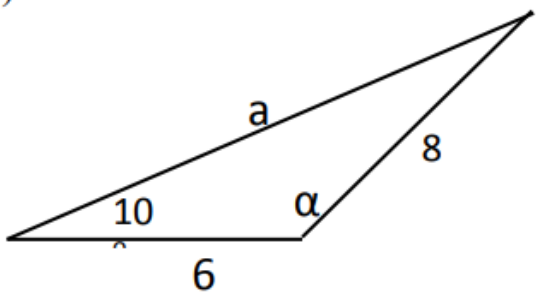
3. In triangle XYZ, $X = 100°$, $Y = 30°$ and $XY = 10$ cm. Calculate the area of the triangle.

4. The area of a triangle is 12 cm^2. Two of the sides are of lengths 6 cm and 7 cm. Calculate possible lengths for the third side.

5. A ship S is 6.8 km from a lighthouse on a bearing of 310°. A second ship T is 8.4 km from the lighthouse on a bearing 075°. Calculate ST and the bearing of T from S correct to the nearest degree.

6. Find all the lettered edges and angles in the figures in the following diagrams:

(i)



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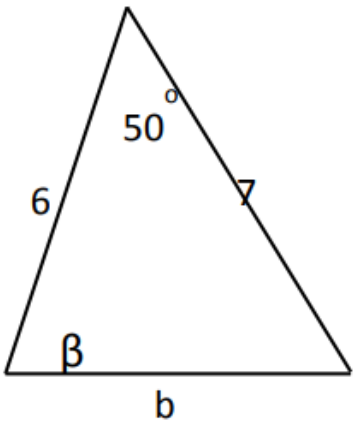


Indices Answers

1. (i) $3^4 = 3\times3\times3\times3 = 81$

(ii) $2^6 = 2\times2\times2\times2\times2\times2 = 64$

(iii) $4^{1/2} = \sqrt{4} = 2$

(iv) $6^0 = 1$

(v) $5^{-2} = \frac{1}{5^2} = \frac{1}{25}$

(vi) $64^{1/3} = \sqrt[3]{64} = 4$

(vii) $16^{-1/2} = \frac{1}{\sqrt{16}} = \frac{1}{4}$

(viii) $8^{5/3} = \left(\sqrt[3]{8}\right)^5 = 2^5 = 32$

(ix) $36^{-3/2} = \frac{1}{\left(\sqrt{36}\right)^3} = \frac{1}{6^3} = \frac{1}{216}$

(x) $\left(\frac{1}{2}\right)^{-1} = \left(2^{-1}\right)^{-1} = 2^1 = 2$

(xi) $\left(\frac{25}{9}\right)^{-1/2} = \left(\frac{9}{25}\right)^{1/2} = \sqrt{\frac{9}{25}} = \frac{3}{5}$

(xii) $\left(\frac{27}{64}\right)^{-2/3} = \left(\frac{64}{27}\right)^{2/3} = \left(\sqrt[3]{\frac{64}{27}}\right)^2 = \left(\frac{4}{3}\right)^2 = \frac{16}{9}$

2. (i) $3^{11}\times3^{-4}\div3^3 = 3^{11-4-3} = 3^4 = 81$

(ii) $\left(2^5\right)^3\times\left(2^7\right)^{-2} = 2^{15}\times2^{-14} = 2^{15-14} = 2^1 = 2$

(iii) $\frac{5^6}{5^5\times5^3} = 5^{6-5-3} = 5^{-2} = \frac{1}{5^2} = \frac{1}{25}$

3. (i) $2^3\times16^{\frac{1}{2}} = 2^3\times\left(2^4\right)^{\frac{1}{2}}$

$= 2^3\times2^2$

$= 2^5\ (=32)$

(ii) $\frac{3^5\times5^3}{\sqrt{81\times25}} = \frac{3^5\times5^3}{\sqrt{3^4\times5^2}}$

$= \frac{3^5\times5^3}{3^2\times5}$

$= 3^3\times5^2\ (=675)$

Surds Answers

1. (i) $\sqrt{8} = \sqrt{4 \times 2} = \sqrt{4} \times \sqrt{2} = 2\sqrt{2}$

(ii) $\sqrt{50} = \sqrt{25 \times 2} = \sqrt{25} \times \sqrt{2} = 5\sqrt{2}$

(iii) $\sqrt{48} = \sqrt{16 \times 3} = \sqrt{16} \times \sqrt{3} = 4\sqrt{3}$

(iv) $\sqrt{216} = \sqrt{36 \times 6} = \sqrt{36} \times \sqrt{6} = 6\sqrt{6}$

2. (i) $(1+\sqrt{2})+(3-2\sqrt{2}) = 1+3+\sqrt{2}-2\sqrt{2}$
$= 4-\sqrt{2}$

(ii) $(5\sqrt{2}-2\sqrt{3})-(\sqrt{2}+3\sqrt{3}) = 5\sqrt{2}-2\sqrt{3}-\sqrt{2}-3\sqrt{3}$
$= 4\sqrt{2}-5\sqrt{3}$

(iii) $2(\sqrt{5}-3\sqrt{3})+3(2\sqrt{5}+\sqrt{3}) = 2\sqrt{5}-6\sqrt{3}+6\sqrt{5}+3\sqrt{3}$
$= 8\sqrt{5}-3\sqrt{3}$

3. (i) $(1+\sqrt{2})(3-\sqrt{2}) = 3-\sqrt{2}+3\sqrt{2}-2$
$= 1+2\sqrt{2}$

(ii) $(2-\sqrt{3})(3+2\sqrt{3}) = 6+4\sqrt{3}-3\sqrt{3}-2\times 3$
$= \sqrt{3}$

4. (i) $\frac{3}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{3\sqrt{3}}{3} = \sqrt{3}$

(ii) $\frac{1}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{\sqrt{5}}{5}$

(iii) $\frac{1+\sqrt{2}}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{(1+\sqrt{2})\sqrt{2}}{2} = \frac{\sqrt{2}+2}{2}$

(iv) $\frac{1}{\sqrt{3}+1} \times \frac{\sqrt{3}-1}{\sqrt{3}-1} = \frac{\sqrt{3}-1}{(\sqrt{3}+1)(\sqrt{3}-1)} = \frac{\sqrt{3}-1}{3-1} = \frac{\sqrt{3}-1}{2}$

(v) $\frac{\sqrt{2}}{2-\sqrt{2}} \times \frac{2+\sqrt{2}}{2+\sqrt{2}} = \frac{\sqrt{2}(2+\sqrt{2})}{(2-\sqrt{2})(2+\sqrt{2})} = \frac{2\sqrt{2}+2}{4-2} = \frac{2\sqrt{2}+2}{2} = \sqrt{2}+1$

Simultaneous Equations Answers

1. (i) $2x+5y=11$ (1)

$2x-y=5$ (2)

Subtracting: $6y=6$

$y=1$

Substituting into (1): $2x+5\times1=11$

$2x=6$

$x=3$

The solution is $x=3, y=1$. Check: $2x+5y=2\times3+5\times1=11$

$2x-y=2\times3-1=5$

(ii) $x+2y=6$ $(1)\times4$ $4x+8y=24$

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

Subtracting: $5y=20$

$y=4$

Substituting into (1): $x+2\times4=6$

$x=-2$

The solution is $x=-2, y=4$. Check: $x+2y=-2+8=6$

$4x+3y=-8+12=4$

(iii) $3a-2b=4$ $(1)\times2$ $6a-4b=8$

$5a+4b=3$ (2) $5a+4b=3$

Adding: $11a=11$

$a=1$

Substituting into (1): $3\times1-2b=4$

$-2b=1$

$b=-\frac{1}{2}$

The solution is $a=1, b=-\frac{1}{2}$. Check: $3a-2b=3+1=4$

$5a+4b=5-2=3$

(iv) $2p-5q=5$ $(1)\times3$ $6p-15q=15$

$3p-2q=-9$ $(2)\times2$ $6p-4q=-18$

Subtracting: $-11q=33$

$q=-3$

Substituting into (1): $2p - 5 \times -3 = 5$

$2p = -10$

$p = -5$

The solution is $p = -5, q = -3$. Check: $2p - 5q = -10 + 15 = 5$

$3p - 2q = -15 + 6 = -9$

2. (i) $x - y = -1$ (A)

$3x + 2y = 7$ (B)

(A) $\Rightarrow 2x - 2y = -2$ (C)

(C) + (B) $\Rightarrow 5x = 5$

$\Rightarrow x = 1, y = 2$

(ii) $2x + y = 0$ (A)

$x - 3y = 7$ (B)

(B) $\Rightarrow 2x - 6y = 14$ (C)

(A) - (C) $\Rightarrow 7y = -14$

$\Rightarrow y = -2, x = 1$

(iii) $y - 5x = -8$ (A)

$x + 3y = 0$ (B)

(B) $\Rightarrow 5x + 15y = 0$ (C)

(A) + (C) $\Rightarrow 16y = -8$

$\Rightarrow y = -\frac{1}{2}, x = \frac{3}{2}$

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

$-x + 3y = -1$ (B)

(A) + (B) $\Rightarrow 3y = 2y - 2$ (C)

$\Rightarrow y = -2, x = -5$

The Quadratic Formula Answers

1. (i) $3x^2+2x+5=0 \Rightarrow$ discriminant $= b^2-4ac$

$= 4-4.3.5 < 0$

so no solutions

(ii) $2x^2-3x-2=0 \Rightarrow$ discriminant $= b^2-4ac$

$= 9-4(2)(-2) > 0$

so two solutions

(iii) $5x^2-6=0 \Rightarrow$ discriminant $= b^2-4ac$

$= 0-4.5(-6) > 0$

so two solutions

(iv) $4x^2-8x+4=0 \Rightarrow$ discriminant $= b^2-4ac$

$= 64-4(4)(4) = 0$

so two (equal) solutions

2. (i) $a=1, b=4, c=1$

$$x = \frac{-4 \pm \sqrt{4^2-4\times1\times1}}{2\times1}$$

$$= \frac{-4 \pm \sqrt{12}}{2}$$

$$= \frac{-4 \pm 2\sqrt{3}}{2}$$

$$= -2 \pm \sqrt{3}$$

(ii) $a=1, b=-3, c=-1$

$$x = \frac{3 \pm \sqrt{3^2-4\times1\times-1}}{2\times1}$$

$$= \frac{3 \pm \sqrt{13}}{2}$$

(iii) $a=2, b=2, c=-3$

$$x = \frac{-2 \pm \sqrt{2^2-4\times2\times-3}}{2\times2}$$

$$= \frac{-2 \pm \sqrt{28}}{4}$$

$$= \frac{-2 \pm 2\sqrt{7}}{4}$$

$$= \frac{-1 \pm \sqrt{7}}{2}$$

Inequalities Answers

1. (i) $2x+3<10$

$2x<7$

$x<\frac{7}{2}$

(ii) $5x+3\geq 2x-9$

$3x+3\geq -9$

$3x\geq -12$

$x\geq -4$

(iii) $3x-1>7-x$

$4x-1>7$

$4x>8$

$x>2$

(iv) $4x+1\leq 6x-7$

$1\leq 2x-7$

$8\leq 2x$

$4\leq x$

$x\geq 4$

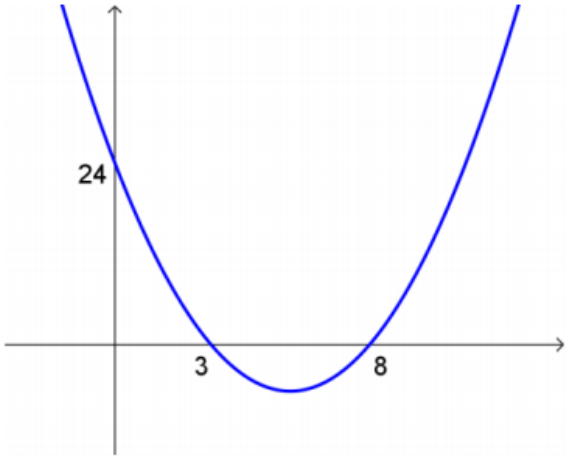
(v) $5x+2>-7$

$5x>-9$

$x>-\frac{9}{5}$

2. (i) $x^2-11x+24=(x-8)(x-3)$

(ii)

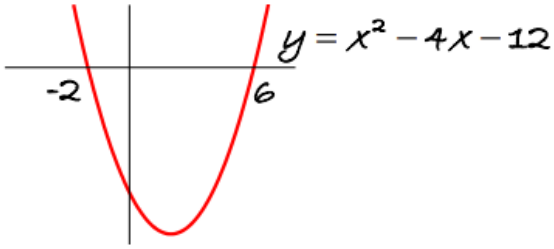


(iii) From the graph, $x^2-11x+24\geq 0 \Rightarrow x\leq 3$ or $x\geq 8$.

3. (i) $x^2-4x-12\le 0$

$(x-6)(x+2)\le 0$

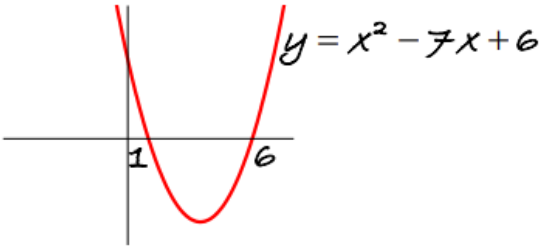
From graph, $-2\le x\le 6$



(ii) $x^2-7x+6>0$

$(x-1)(x-6)>0$

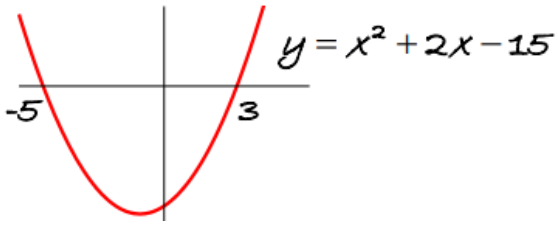
From graph, $x<1$ or $x>6$



(iii) $x^2+2x-15\ge 0$

$(x+5)(x-3)\ge 0$

From graph, $x\le -5$ or $x\ge 3$



4. (i) $x>2$

(ii) $y\ge 1$

(iii) $y>x$

(iv) $y\le x+1$

Since the line is dotted, $x=2$ is not included in the region

Algebraic Fractions Answers

1. (i) $\dfrac{x^2-5x}{x-5}=\dfrac{x(x-5)}{x-5}=x$

(ii) $\dfrac{x^2+6x-16}{(x-2)(x-8)}=\dfrac{(x+8)(x-2)}{(x-2)(x-8)}=\dfrac{x+8}{x-8}$

(iii) $\dfrac{x^2-a^2}{(x-a)^2}=\dfrac{(x+a)(x-a)}{(x-a)^1}=\dfrac{x+a}{x-a}$

(iv) $\dfrac{v-3}{6-2v}=\dfrac{v-3}{2(3-v)}=\dfrac{-(3-v)}{2(3-v)}=-\dfrac{1}{2}$

2. (i) $\dfrac{x^2+3x-4}{8}\times\dfrac{2}{3x-3}=\dfrac{(x+4)(x-1)}{8_4}\times\dfrac{2}{3(x-1)}=\dfrac{x+4}{12}$

(ii) $\frac{3}{x+2} \times \frac{x^2-4x-12}{x^2-2x-24} = \frac{3}{\cancel{x+2}} \times \frac{\cancel{(x-6)}\cancel{(x+2)}}{\cancel{(x-6)}(x+4)} = \frac{3}{x+4}$

3. (i) $\frac{5c+15}{2} \div \frac{c^2-9}{4} = \frac{5c+15}{2} \times \frac{4}{c^2-9}$

$= \frac{5\cancel{(c+3)}}{2} \times \frac{4}{\cancel{(c+3)}(c-3)}$

$= \frac{10}{c-3}$

(ii) $\frac{x^2-x}{2x+1} \div \frac{x^2+2x-3}{2x^2-3x-2} = \frac{x^2-x}{2x+1} \times \frac{2x^2-3x-2}{x^2+2x-3}$

$= \frac{x\cancel{(x-1)}}{\cancel{2x+1}} \times \frac{\cancel{(2x+1)}(x-2)}{(x+3)\cancel{(x-1)}}$

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

4. (i) $\frac{x}{2} + \frac{3x}{5} = \frac{5x}{10} + \frac{6x}{10} = \frac{11x}{10}$

(ii) $\frac{2}{3x} - \frac{1}{4x} = \frac{8}{12x} - \frac{3}{12x} = \frac{5}{12x}$

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

$= \frac{2x-10+x+3}{(x+3)(x-5)}$

$= \frac{3x-7}{(x+3)(x-5)}$

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

$= \frac{20x+5-4x+6}{(2x-3)(4x+1)}$

$= \frac{16x+11}{(2x-3)(4x+1)}$

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

7. (i) Since a cubic is being divided by a linear expression, the quotient is quadratic and the remainder constant.

$$\frac{3x^3-x^2+2x-4}{x+2}=Ax^2+Bx+C+\frac{D}{x+2}$$
$$3x^3-x^2+2x-4=(Ax^2+Bx+C)(x+2)+D$$
$$=Ax^3+(2A+B)x^2+(2B+C)x+2C+D$$

Equating coefficients of x^3: $A=3$

Equating coefficients of x^2: $2A+B=-1 \Rightarrow B=-7$

Equating coefficients of x: $2B+C=2 \Rightarrow C=16$

Equating constant terms: $2C+D=-4 \Rightarrow D=-36$

$$\frac{3x^3-x^2+2x-4}{x+2}=3x^2-7x+16-\frac{36}{x+2}$$

(ii) Since a quartic is being divided by a quadratic, the quotient is quadratic and the remainder linear.

$$\frac{x^4+2x^2-x-1}{x^2+1}=Ax^2+Bx+C+\frac{Dx+E}{x^2+1}$$
$$x^4+2x^2-x-1=(Ax^2+Bx+C)(x^2+1)+Dx+E$$
$$=Ax^4+Bx^3+(A+C)x^2+(B+D)x+C+E$$

Equating coefficients of x^4: $A=1$

Equating coefficients of x^3: $B=0$

Equating coefficients of x^2: $A+C=2 \Rightarrow C=1$

Equating coefficients of x: $B+D=-1 \Rightarrow D=-1$

Equating constant terms: $C+E=-1 \Rightarrow E=-2$

$$\frac{x^4+2x^2-x-1}{x^2+1}=x^2+1+\frac{-x-2}{x^2+1}$$

(iii) Since a cubic is being divided by a quadratic, the quotient is linear and the remainder linear.

$$\frac{x^3}{x^2+2} = Ax + B + \frac{Cx+D}{x^2+2}$$

$$x^3 = (Ax+B)(x^2+2) + Cx + D$$

$$= Ax^3 + Bx^2 + (2A+C)x + 2B + D$$

Equating coefficients of x^3: $A = 1$

Equating coefficients of x^2: $B = 0$

Equating coefficients of x: $2A + C = 0 \Rightarrow C = -2$

Equating constant terms: $2B + D = 0 \Rightarrow D = 0$

$$\frac{x^3}{x^2+2} = x + \frac{-2x}{x^2+2}$$

(iv) Since a linear expression is being divided by a linear expression, the quotient is a constant and the remainder a constant.

$$\frac{6x-2}{2x+3} = A + \frac{}{2x}$$

$$6x-2 = A(2x+$$

$$= 2Ax + 3$$

Comparing coeffi

Comparing const

$$\frac{6x-2}{2x+3} = 3 + \frac{1}{2x}$$

(v) Since a quadratic quadratic expressi remainder linear.

$$\frac{3x^2+1}{x^2-2x-1} = A$$

$$3x^2+1 = A(x^2$$

$$= Ax^2 +$$

Comparing coeffi

Comparing coeffi

Comparing const

$$\frac{3x^2+1}{x^2-2x-1} = 3$$

Using the sine rule: $\frac{\sin A}{a} = \frac{\sin B}{b}$

$$\frac{\sin A}{16} = \frac{\sin 30^\circ}{10}$$

$$\sin A = \frac{16\sin 30^\circ}{10} = 0.8$$

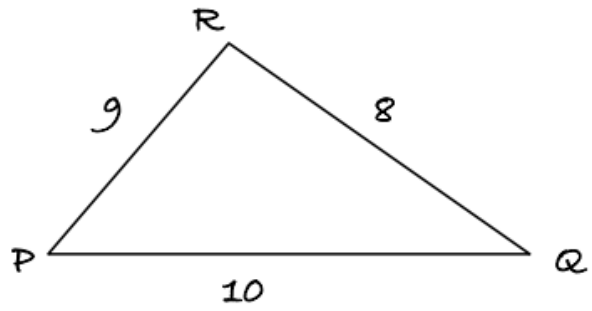
$$A = 53.1^\circ \text{ or } 126.9^\circ$$

$$C = 180^\circ - 30^\circ - A = 96.1^\circ \text{ or } 23.1^\circ$$

1. Using the sine rule: $\frac{c}{\sin C} = \frac{b}{\sin B}$

$$\frac{c}{\sin C} = \frac{10}{\sin 30^\circ}$$

$$c = \frac{10\sin C}{\sin 30^\circ} = 19.9 \text{ cm or } 7.9 \text{ cm}$$



Using the cosine rule: $\cos P = \dfrac{q^2 + r^2 - p^2}{2qr} = \dfrac{9^2 + 10^2 - 8^2}{2 \times 9 \times 10}$

$P = 49.5°$

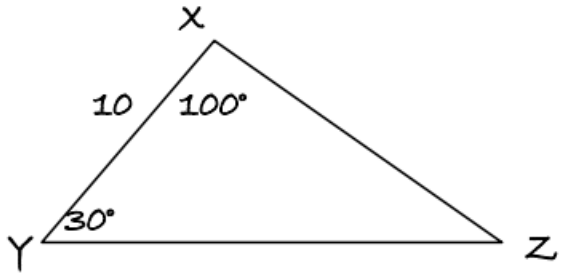
Using the cosine rule: $\cos Q = \dfrac{p^2 + r^2 - q^2}{2pr} = \dfrac{8^2 + 10^2 - 9^2}{2 \times 8 \times 10}$

2.

$Q = 58.8°$

$R = 180° - 49.46° - 58.75° = 71.8°$

3.



Angle $Z = 180° - 100° - 30° = 50°$

Using the sine rule: $\dfrac{x}{\sin X} = \dfrac{z}{\sin z}$

$\dfrac{x}{\sin 100°} = \dfrac{10}{\sin 50°}$

$x = \dfrac{10 \sin 100°}{\sin 50°} = 12.86$

Area of triangle $= \frac{1}{2} xz \sin Y$

$= \frac{1}{2} \times 12.86 \times 10 \sin 30°$

$= 32.1 \text{ cm}^2$

4.

Let $a = 6$ and $b = 7$

Area of triangle $= \frac{1}{2}ab\sin C$

$12 = \frac{1}{2} \times 6 \times 7 \sin C$

$C = 34.85°$ or $145.15°$

Using the cosine rule: $c^2 = a^2 + b^2 - 2ab\cos C$

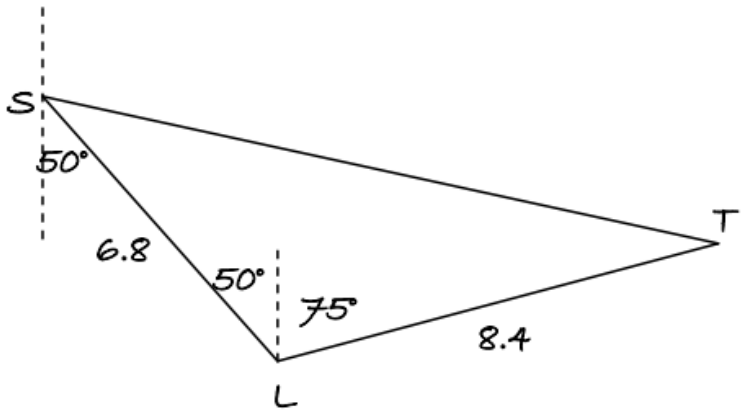
$= 6^2 + 7^2 - 2 \times 6 \times 7 \cos C$

$= 85 - 84\cos C$

If $C = 34.85°$, $c = 4.01$ cm

If $C = 145.14°$, $c = 12.41$ cm

5.



Using cosine rule: $ST^2 = 6.8^2 + 8.4^2 - 2 \times 6.8 \times 8.4 \cos 125°$

$ST = 13.5$ km

Using sine rule: $\frac{\sin S}{8.4} = \frac{\sin 125°}{13.5}$

$\sin S = \frac{8.4 \sin 125°}{13.5}$

$S = 30.6°$

Bearing of T from S = 180° - 50° - 30.6° = 099.4°

6. (i) $\frac{\sin 10}{8} = \frac{\sin \beta}{6}$

$\Rightarrow \sin \beta = 0.13$

$\Rightarrow \beta \approx 7.48^\circ$

$\Rightarrow \alpha = 180^\circ - 10^\circ - 7.48^\circ \approx 162.52^\circ$

$\Rightarrow a^2 = 6^2 + 8^2 - 2(6)(8)\cos 162.52^\circ \approx 191.57$

$\Rightarrow a \approx 13.8$

(ii) $b^2 = 6^2 + 7^2 - 2(6)(7)\cos 50^\circ \approx 31.009$

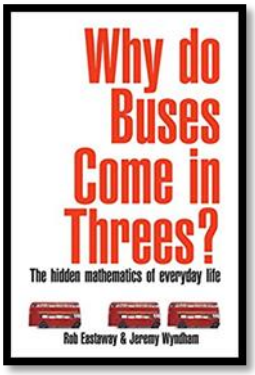
$\Rightarrow b \approx 5.57$

$\frac{\sin \beta}{7} = \frac{\sin 50^\circ}{5.57} \Rightarrow \sin \beta \approx 0.933$

$\Rightarrow \beta \approx 74.3^\circ$

Book Recommendations

Below is a selection of books that should appeal to a mathematician – someone who wants to broaden their understanding of mathematics around them. All are very accessible reads.



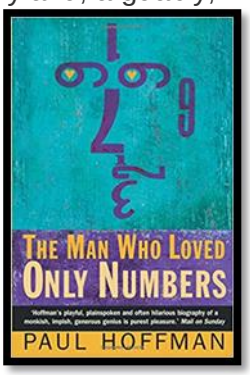
Why do buses come in threes?

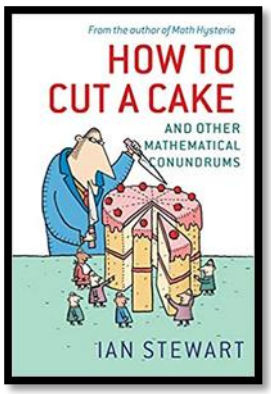
A book to remind yourself that maths is relevant to almost everything! There are chapters on dating, magic tricks and more.

The Man who only loved

The biography of a mathematical genius.

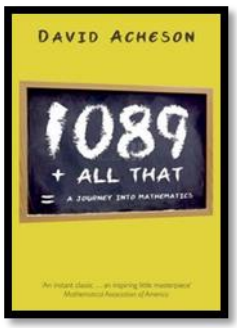
Paul Erdos was the most prolific pure mathematician in history and, arguably, the strangest too.





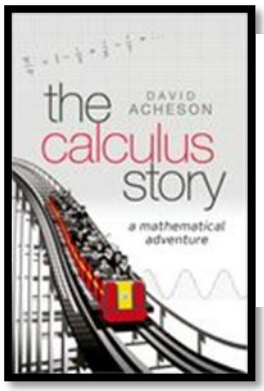
How to cut a cake

This is a strange world of never-ending chess games, empires on the moon, furious fireflies, and, of course, disputes over how best to cut a cake



1089 and All That

Acheson takes us on a thrilling journey to some deep mathematical ideas. On the way, via Kepler and Newton, he explains what calculus really means, gives a brief history of pi, and even takes us to chaos theory and imaginary numbers.

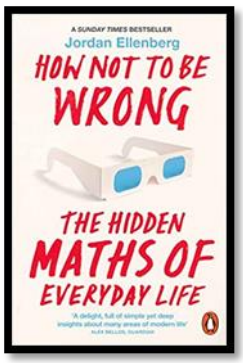


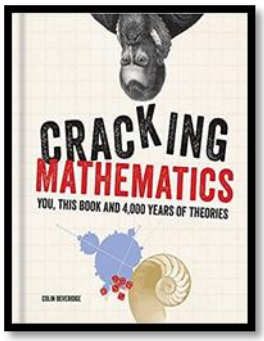
The Calculus Story

Provides an engaging 'big picture' introduction to the nature and applications of calculus

How Not to be Wrong

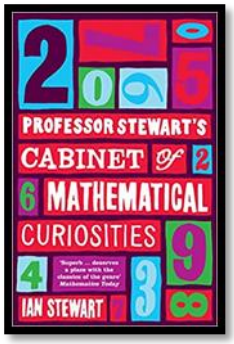
Explores the method of analyzing life, from the everyday to the cosmic, showing us which numbers to defend, which ones to ignore, and when to change the equation entirely.





Cracking Mathematics

Guide covers the history and development of mathematics, from the Ancient Egyptians and Pythagoreans to key figures such as Galileo, Dodgson, Babbage and Lovelace through to contemporary work of the 21st century.



Professor Stewart's Cabinet of Mathematical Curiosities

A collection of the most enlightening, entertaining and vexing 'curiosities' of maths over the years

Movie Recommendations

14 must-see mathematics movies inspired by true events

- **Stand & Deliver**
- **Hidden Figures**
- **The Man Who Knew Infinity**
- **Pi**
- **A Brilliant Young Mind**
- **Good Will Hunting**
- **The Imitation Game**
- **Codebreaker**
- **A Beautiful Mind**
- **A Brief History of Time**
- **Travelling Salesman**
- **Fermat's Room**
- **The Oxford Murders**
- **N is a Number: A Portrait of Paul Erdos**

TV Series Recommendations

- **Numb3rs**

Podcast Recommendations

- **More or Less: Behind the Stats**
  www.bbc.co.uk/programmes/p02nrss1/episodes/downloads

- **Wrong but useful**
  https://www.flyingcoloursmaths.co.uk/wrong-but-useful-episode-1/

- **Relatively Prime**
  http://relprime.com/