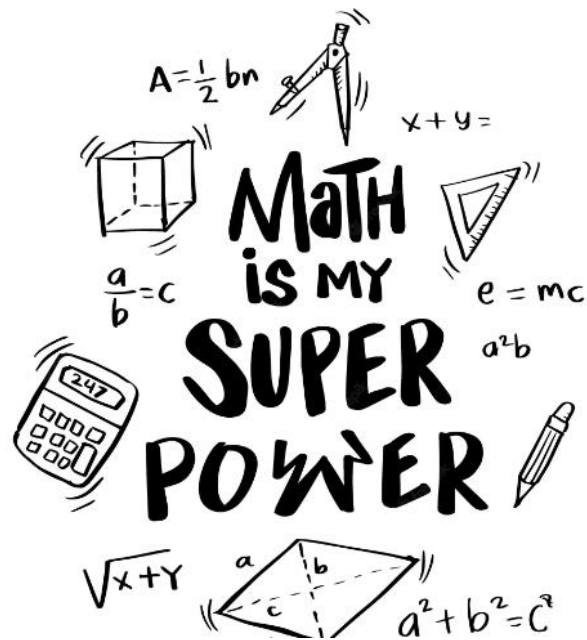


Myton School
Mathematics A-Level Induction Pack
2024



Name:

Overview

Thank you for choosing to study Mathematics in the sixth form at Myton School. The Mathematics Department is committed to ensuring that you make good progress throughout your A-Level course. In order that you make the best possible start to the course, we have prepared this booklet.

Examinations:

Myton students follow the Edexcel exam board specification. Examinations happen at the end of Year 13 and cover all material covered.

This booklet takes you through all of the key information needed to prepare yourself for the course. It is crucial that you are familiar and confident with all the skills listed in this booklet.

You will have an induction test in September to check you understand the induction material.

Equipment:

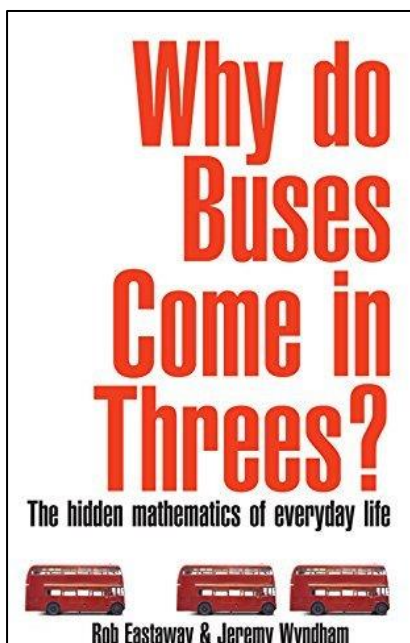
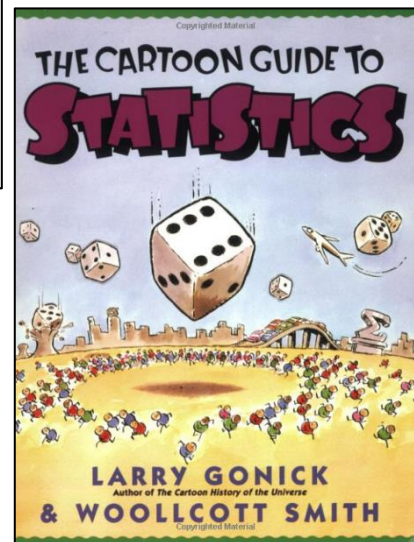
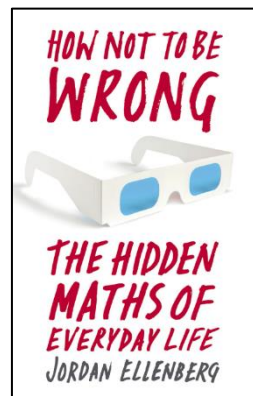
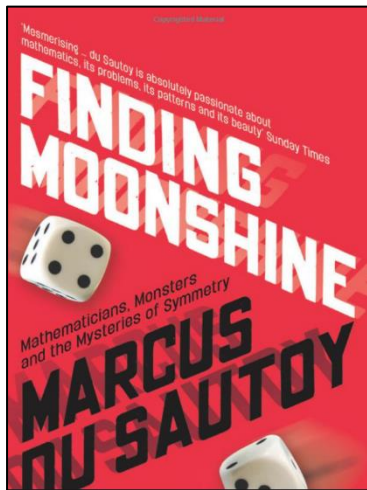
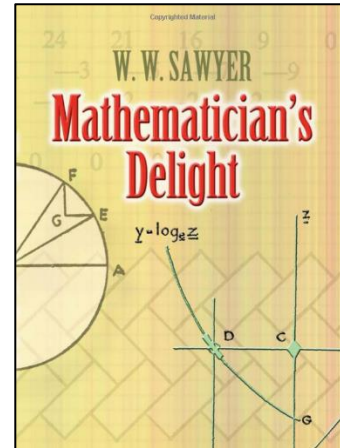
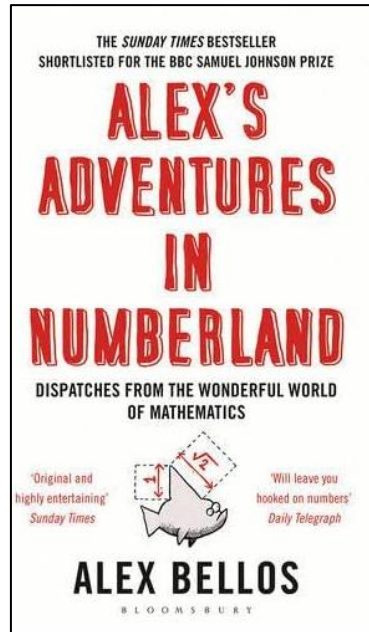
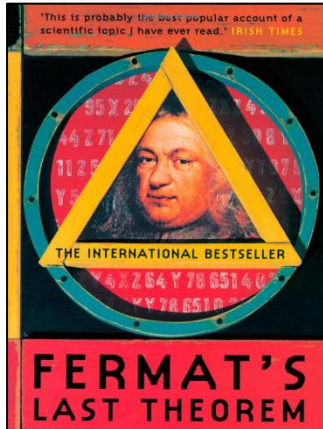
You will need a calculator for all of your lessons. We recommend the Casio fx-991 EX. This has all of the functions required for A Level.

You are permitted in examinations to use the fx-CG50, a complex graphical calculator. This device has additional functions but is significantly more expensive and can be cumbersome to use.

Alpha A a	Beta B β	Gamma Γ γ	Delta Δ δ
Epsilon Ε ε	Zeta Ζ ζ	Eta Η η	Theta Θ θ
Iota Ι ι	Kappa Κ κ	Lambda Λ λ	Mu Μ μ
Nu Ν ν	Xi Ξ ξ	Omicron Ο ο	Pi Π π
Rho Ρ ρ	Sigma Σ σ	Tau Τ τ	Upsilon Υ υ
Phi Φ φ	Chi Χ χ	Psi Ψ ψ	Omega Ω ω

Recommended wider reading

More available at <https://rich.maths.org/books>



bringing mathematics to life

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Maths In A Minute

Want facts and want them fast? Our *Maths in a minute* series explores key mathematical concepts in just a few words. From symmetry to Euclid's axioms, and from binary numbers to the prosecutor's fallacy, learn some maths without too much effort.

<p>Maths in a minute: Thermodynamics</p> <p>Tea gone cold? Don't worry, you can cheer yourself up with the theory of thermodynamics.</p>	<p>Maths in a minute: Numerical weather prediction</p> <p>How does your phone know what the weather's going to be like?</p>	<p>Maths in a minute: Correlation versus causation</p> <p>Wet cats don't cause umbrellas and umbrellas don't cause wet cats.</p>
<p>Maths in a minute: Percentage error</p> <p>How good is your estimate?</p>	<p>Maths in a minute: Dispersion</p> <p>If you've ever marvelled at a rainbow, you have witnessed dispersion in action!</p>	<p>Maths in a minute: Combinatorics</p> <p>Whether you want to understand viruses, win at lotto or solve a rubik's cube – you'll need some help from combinatorics.</p>

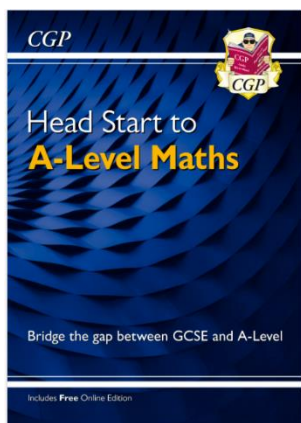
Pre course reading/homework

As you may be aware, two thirds of the A-Level course is comprised of Pure Maths and a heavy reliance is placed on your understanding of algebra and manipulation of numbers. To give you the maximum amount of lesson time on new topics, the following topics covered at GCSE are assumed knowledge and therefore not re-taught in depth in Year 12.

- Index Laws
- Expanding Brackets
- Factorising linear and quadratic expressions
- Surd manipulation
- Rationalising the denominator
- Solving quadratics using factorising or the quadratic formula
- Completing the square
- Solving simultaneous equations
- Linear Inequalities

Your homework will be to revise these topics in detail before September. There is a transition workbook of questions for you to complete in addition to any individual work you undertake.

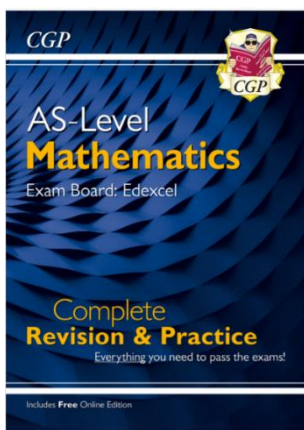
You may wish to purchase one of the following workbooks to help you, but this is not essential.



Head Start to A-Level Maths

ISBN: 9781782947929

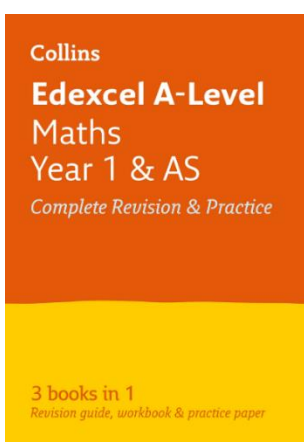
RRP: £5.95



AS-Level Maths Edexcel Complete Revision and Practice

ISBN: 9781782948049

RRP: £11.99



Edexcel Maths A Level Year 1 All-in-one Complete Revision and Practice

ISBN: 9780008268510

RRP: £12.99

Expectations

You will be expected to keep your lesson notes, examples and homework/tests organised in a folder with dividers.

You are expected to practise techniques learnt in class. As a rule of thumb, you should expect to do **at least** one hour of work out of class for every hour in class.

Recommended Resources for the A-Level Course

The following are free online resources which you may find helpful alongside studying the course from September.

- Maths Genie
- Physics and Maths Tutor
- Dr Frost Maths
- AMSP (Advanced Mathematics Support Programme) website
- Bicen Maths (YouTube)

Summer Learning

Here are some practice resources. You must be familiar with all of the following skills. Complete a selection of questions and mark using the answers at the back of the booklet. You do not have to complete every question.

Simplifying expressions

1 Simplify these expressions:

a $x^3 \times x^4$

b $2x^3 \times 3x^2$

c $\frac{k^3}{k^2}$

d $\frac{4p^3}{2p}$

e $\frac{3x^3}{3x^2}$

f $(y^2)^5$

g $10x^5 \div 2x^3$

h $(p^3)^2 \div p^4$

i $(2a^3)^2 \div 2a^3$

j $8p^4 \div 4p^3$

k $2a^4 \times 3a^5$

l $\frac{21a^3b^7}{7ab^4}$

m $9x^2 \times 3(x^2)^3$

n $3x^3 \times 2x^2 \times 4x^6$

o $7a^4 \times (3a^4)^2$

p $(4y^3)^3 \div 2y^3$

q $2a^3 \div 3a^2 \times 6a^5$

r $3a^4 \times 2a^5 \times a^3$

2 Expand and simplify if possible:

a $9(x - 2)$

b $x(x + 9)$

c $-3y(4 - 3y)$

d $x(y + 5)$

e $-x(3x + 5)$

f $-5x(4x + 1)$

g $(4x + 5)x$

h $-3y(5 - 2y^2)$

i $-2x(5x - 4)$

j $(3x - 5)x^2$

k $3(x + 2) + (x - 7)$

l $5x - 6 - (3x - 2)$

m $4(c + 3d^2) - 3(2c + d^2)$

n $(r^2 + 3t^2 + 9) - (2r^2 + 3t^2 - 4)$

o $x(3x^2 - 2x + 5)$

p $7y^2(2 - 5y + 3y^2)$

q $-2y^2(5 - 7y + 3y^2)$

r $7(x - 2) + 3(x + 4) - 6(x - 2)$

s $5x - 3(4 - 2x) + 6$

t $3x^2 - x(3 - 4x) + 7$

u $4x(x + 3) - 2x(3x - 7)$

v $3x^2(2x + 1) - 5x^2(3x - 4)$

3 Simplify these fractions:

a $\frac{6x^4 + 10x^6}{2x}$

b $\frac{3x^5 - x^7}{x}$

c $\frac{2x^4 - 4x^2}{4x}$

d $\frac{8x^3 + 5x}{2x}$

e $\frac{7x^7 + 5x^2}{5x}$

f $\frac{9x^5 - 5x^3}{3x}$

Expanding Brackets

1 Expand and simplify if possible:

a $(x + 4)(x + 7)$

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

c $(x - 2)^2$

d $(x - y)(2x + 3)$

e $(x + 3y)(4x - y)$

f $(2x - 4y)(3x + y)$

g $(2x - 3)(x - 4)$

h $(3x + 2y)^2$

i $(2x + 8y)(2x + 3)$

j $(x + 5)(2x + 3y - 5)$

k $(x - 1)(3x - 4y - 5)$

l $(x - 4y)(2x + y + 5)$

m $(x + 2y - 1)(x + 3)$

n $(2x + 2y + 3)(x + 6)$

o $(4 - y)(4y - x + 3)$

p $(4y + 5)(3x - y + 2)$

q $(5y - 2x + 3)(x - 4)$

r $(4y - x - 2)(5 - y)$

2 Expand and simplify if possible:

a $5(x + 1)(x - 4)$

b $7(x - 2)(2x + 5)$

c $3(x - 3)(x - 3)$

d $x(x - y)(x + y)$

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

f $y(x - 5)(x + 1)$

g $y(3x - 2y)(4x + 2)$

h $y(7 - x)(2x - 5)$

i $x(2x + y)(5x - 2)$

Factorising

1 Factorise these expressions completely:

a $4x + 8$

b $6x - 24$

c $20x + 15$

d $2x^2 + 4$

e $4x^2 + 20$

f $6x^2 - 18x$

g $x^2 - 7x$

h $2x^2 + 4x$

i $3x^2 - x$

j $6x^2 - 2x$

k $10y^2 - 5y$

l $35x^2 - 28x$

m $x^2 + 2x$

n $3y^2 + 2y$

o $4x^2 + 12x$

p $5y^2 - 20y$

q $9xy^2 + 12x^2y$

r $6ab - 2ab^2$

s $5x^2 - 25xy$

t $12x^2y + 8xy^2$

u $15y - 20yz^2$

v $12x^2 - 30$

w $xy^2 - x^2y$

x $12y^2 - 4yx$

2 Factorise:

a $x^2 + 4x$

b $2x^2 + 6x$

c $x^2 + 11x + 24$

d $x^2 + 8x + 12$

e $x^2 + 3x - 40$

f $x^2 - 8x + 12$

g $x^2 + 5x + 6$

h $x^2 - 2x - 24$

i $x^2 - 3x - 10$

j $x^2 + x - 20$

k $2x^2 + 5x + 2$

l $3x^2 + 10x - 8$

m $5x^2 - 16x + 3$

n $6x^2 - 8x - 8$

o $2x^2 + 7x - 15$

p $2x^4 + 14x^2 + 24$

q $x^2 - 4$

r $x^2 - 49$

s $4x^2 - 25$

t $9x^2 - 25y^2$

u $36x^2 - 4$

v $2x^2 - 50$

w $6x^2 - 10x + 4$

x $15x^2 + 42x - 9$

Indices

1 Simplify:

a $x^3 \div x^{-2}$

b $x^5 \div x^7$

c $x^{\frac{3}{2}} \times x^{\frac{5}{2}}$

d $(x^2)^{\frac{3}{2}}$

e $(x^3)^{\frac{5}{3}}$

f $3x^{0.5} \times 4x^{-0.5}$

g $9x^{\frac{2}{3}} \div 3x^{\frac{1}{6}}$

h $5x^{\frac{7}{3}} \div x^{\frac{2}{3}}$

i $3x^4 \times 2x^{-5}$

j $\sqrt{x} \times \sqrt[3]{x}$

k $(\sqrt{x})^3 \times (\sqrt[3]{x})^4$

l $\frac{(\sqrt[3]{x})^2}{\sqrt{x}}$

2 Evaluate:

a $25^{\frac{1}{2}}$

b $81^{\frac{2}{3}}$

c $27^{\frac{1}{3}}$

d 4^{-2}

e $9^{-\frac{1}{2}}$

f $(-5)^{-3}$

g $(\frac{3}{4})^0$

h $1296^{\frac{3}{4}}$

i $(\frac{25}{16})^{\frac{3}{2}}$

j $(\frac{27}{8})^{\frac{2}{3}}$

k $(\frac{6}{5})^{-1}$

l $(\frac{343}{512})^{-\frac{2}{3}}$

Surds

1 Do not use your calculator for this exercise. Simplify:

a $\sqrt{28}$

b $\sqrt{72}$

c $\sqrt{50}$

d $\sqrt{32}$

e $\sqrt{90}$

f $\frac{\sqrt{12}}{2}$

g $\frac{\sqrt{27}}{3}$

h $\sqrt{20} + \sqrt{80}$

i $\sqrt{200} + \sqrt{18} - \sqrt{72}$

j $\sqrt{175} + \sqrt{63} + 2\sqrt{28}$

k $\sqrt{28} - 2\sqrt{63} + \sqrt{7}$

l $\sqrt{80} - 2\sqrt{20} + 3\sqrt{45}$

m $3\sqrt{80} - 2\sqrt{20} + 5\sqrt{45}$

n $\frac{\sqrt{44}}{\sqrt{11}}$

o $\sqrt{12} + 3\sqrt{48} + \sqrt{75}$

2 Expand and simplify if possible:

a $\sqrt{3}(2 + \sqrt{3})$

b $\sqrt{5}(3 - \sqrt{3})$

c $\sqrt{2}(4 - \sqrt{5})$

d $(2 - \sqrt{2})(3 + \sqrt{5})$

e $(2 - \sqrt{3})(3 - \sqrt{7})$

f $(4 + \sqrt{5})(2 + \sqrt{5})$

g $(5 - \sqrt{3})(1 - \sqrt{3})$

h $(4 + \sqrt{3})(2 - \sqrt{3})$

i $(7 - \sqrt{11})(2 + \sqrt{11})$

1 Simplify:

a $\frac{1}{\sqrt{5}}$

b $\frac{1}{\sqrt{11}}$

c $\frac{1}{\sqrt{2}}$

d $\frac{\sqrt{3}}{\sqrt{15}}$

e $\frac{\sqrt{12}}{\sqrt{48}}$

f $\frac{\sqrt{5}}{\sqrt{80}}$

g $\frac{\sqrt{12}}{\sqrt{156}}$

h $\frac{\sqrt{7}}{\sqrt{63}}$

2 Rationalise the denominators and simplify:

a $\frac{1}{1 + \sqrt{3}}$

b $\frac{1}{2 + \sqrt{5}}$

c $\frac{1}{3 - \sqrt{7}}$

d $\frac{4}{3 - \sqrt{5}}$

e $\frac{1}{\sqrt{5} - \sqrt{3}}$

f $\frac{3 - \sqrt{2}}{4 - \sqrt{5}}$

g $\frac{5}{2 + \sqrt{5}}$

h $\frac{5\sqrt{2}}{\sqrt{8} - \sqrt{7}}$

i $\frac{11}{3 + \sqrt{11}}$

j $\frac{\sqrt{3} - \sqrt{7}}{\sqrt{3} + \sqrt{7}}$

k $\frac{\sqrt{17} - \sqrt{11}}{\sqrt{17} + \sqrt{11}}$

l $\frac{\sqrt{41} + \sqrt{29}}{\sqrt{41} - \sqrt{29}}$

m $\frac{\sqrt{2} - \sqrt{3}}{\sqrt{3} - \sqrt{2}}$

Factorising

1 Solve the following equations using factorisation:

a $x^2 + 3x + 2 = 0$

b $x^2 + 5x + 4 = 0$

c $x^2 + 7x + 10 = 0$

d $x^2 - x - 6 = 0$

e $x^2 - 8x + 15 = 0$

f $x^2 - 9x + 20 = 0$

g $x^2 - 5x - 6 = 0$

h $x^2 - 4x - 12 = 0$

2 Solve the following equations using factorisation:

a $x^2 = 4x$

b $x^2 = 25x$

c $3x^2 = 6x$

d $5x^2 = 30x$

e $2x^2 + 7x + 3 = 0$

f $6x^2 - 7x - 3 = 0$

g $6x^2 - 5x - 6 = 0$

h $4x^2 - 16x + 15 = 0$

Solving quadratics

1 Solve the following equations using the quadratic formula.

Give your answers exactly, leaving them in surd form where necessary.

a $x^2 + 3x + 1 = 0$

b $x^2 - 3x - 2 = 0$

c $x^2 + 6x + 6 = 0$

d $x^2 - 5x - 2 = 0$

e $3x^2 + 10x - 2 = 0$

f $4x^2 - 4x - 1 = 0$

g $4x^2 - 7x = 2$

h $11x^2 + 2x - 7 = 0$

Solving simultaneous equations

1 Solve these simultaneous equations by elimination:

a $2x - y = 6$
 $4x + 3y = 22$

b $7x + 3y = 16$
 $2x + 9y = 29$

c $5x + 2y = 6$
 $3x - 10y = 26$

d $2x - y = 12$
 $6x + 2y = 21$

e $3x - 2y = -6$
 $6x + 3y = 2$

f $3x + 8y = 33$
 $6x = 3 + 5y$

2 Solve these simultaneous equations by substitution:

a $x + 3y = 11$
 $4x - 7y = 6$

b $4x - 3y = 40$
 $2x + y = 5$

c $3x - y = 7$
 $10x + 3y = -2$

d $2y = 2x - 3$
 $3y = x - 1$

1 Solve the simultaneous equations:

a $x + y = 11$
 $xy = 30$

b $2x + y = 1$
 $x^2 + y^2 = 1$

c $y = 3x$
 $2y^2 - xy = 15$

2 Solve the simultaneous equations:

a $2x + 2y = 7$
 $x^2 - 4y^2 = 8$

b $x + y = 9$
 $x^2 - 3xy + 2y^2 = 0$

c $5y - 4x = 1$
 $x^2 - y^2 + 5x = 41$

Gradient

1 Work out the gradients of the lines joining these pairs of points:

a $(4, 2), (6, 3)$

b $(-1, 3), (5, 4)$

c $(-4, 5), (1, 2)$

d $(2, -3), (6, 5)$

e $(-3, 4), (7, -6)$

f $(-12, 3), (-2, 8)$

g $(-2, -4), (10, 2)$

h $(\frac{1}{2}, 2), (\frac{3}{4}, 4)$

i $(\frac{1}{4}, \frac{1}{2}), (\frac{1}{2}, \frac{2}{3})$

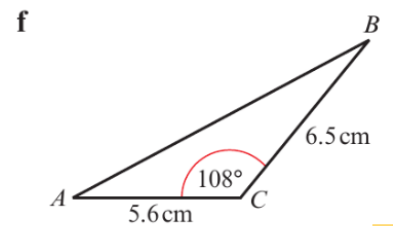
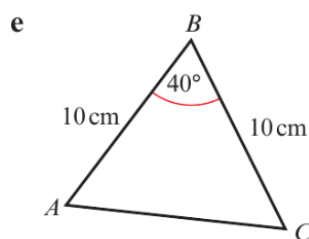
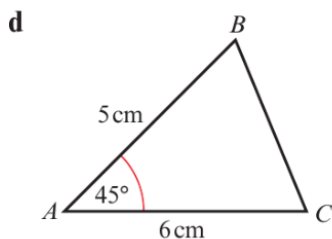
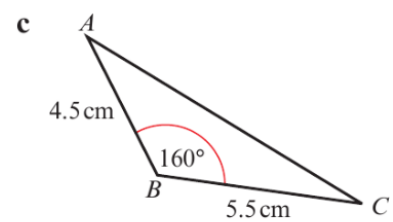
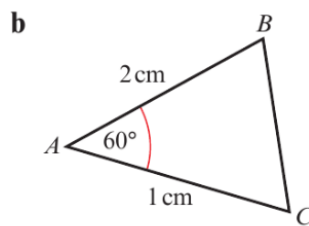
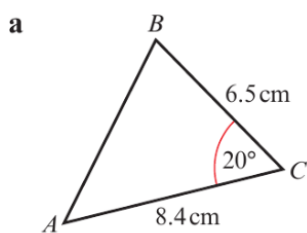
j $(-2.4, 9.6), (0, 0)$

k $(1.3, -2.2), (8.8, -4.7)$

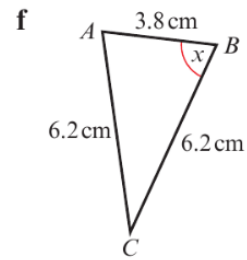
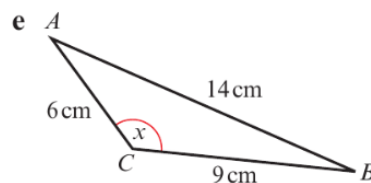
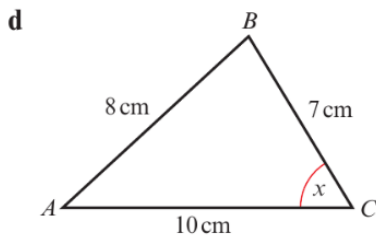
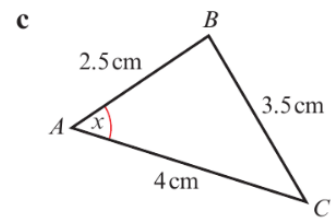
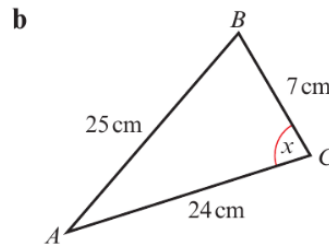
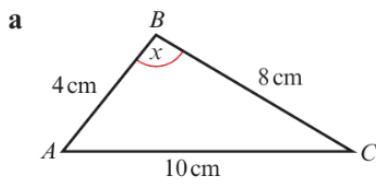
l $(0, 5a), (10a, 0)$

Cosine Rule

1 In each of the following triangles calculate the length of the missing side.

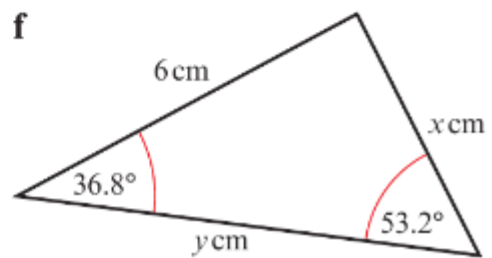
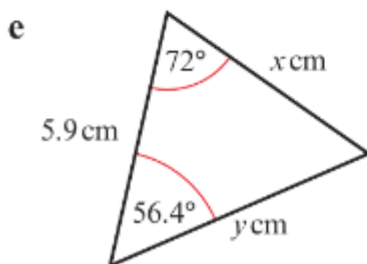
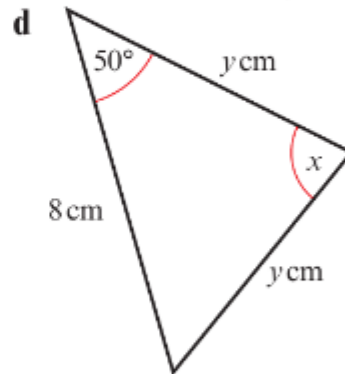
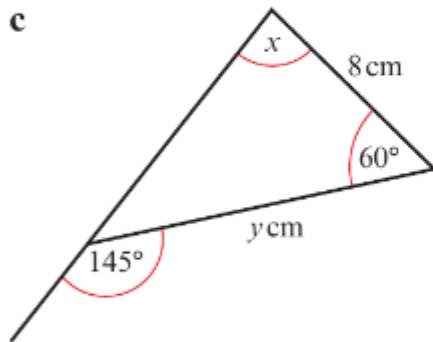
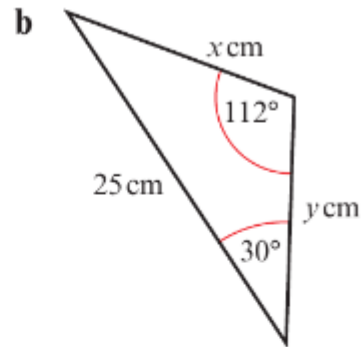
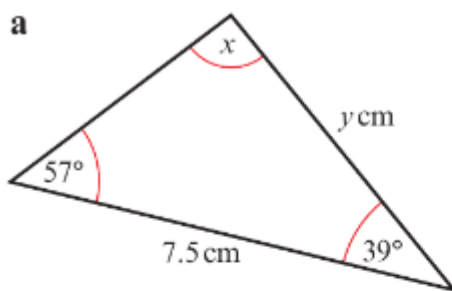


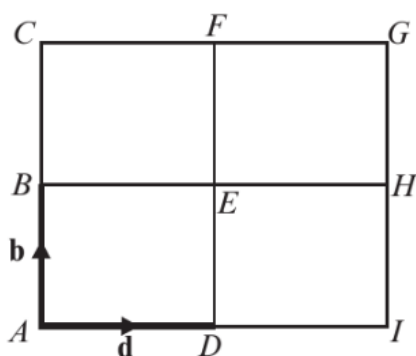
2 In the following triangles calculate the size of the angle marked x :



Sine Rule

2 In each of the following triangles calculate the values of x and y .

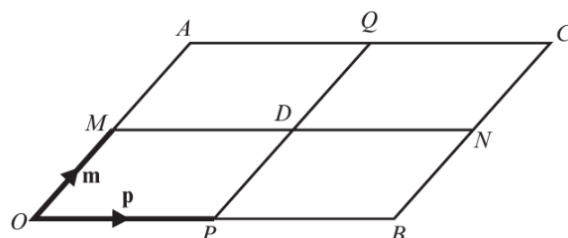




- 2 $ACGI$ is a square, B is the midpoint of AC , F is the midpoint of CG , H is the midpoint of GI , D is the midpoint of AI .

$\vec{AB} = \mathbf{b}$ and $\vec{AD} = \mathbf{d}$. Find, in terms of \mathbf{b} and \mathbf{d} :

- | | | | |
|--------------|--------------|--------------|--------------|
| a \vec{AC} | b \vec{BE} | c \vec{HG} | d \vec{DF} |
| e \vec{AE} | f \vec{DH} | g \vec{HB} | h \vec{FE} |
| i \vec{AH} | j \vec{BI} | k \vec{EI} | l \vec{FB} |



- 3 $OACB$ is a parallelogram. M , Q , N and P are the midpoints of OA , AC , BC and OB respectively.

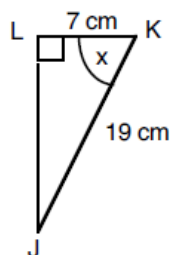
Vectors \mathbf{p} and \mathbf{m} are equal to \vec{OP} and \vec{OM} respectively. Express in terms of \mathbf{p} and \mathbf{m} .

- | | | | |
|--------------|--------------|--------------|--------------|
| a \vec{OA} | b \vec{OB} | c \vec{BN} | d \vec{DQ} |
| e \vec{OD} | f \vec{MQ} | g \vec{OQ} | h \vec{AD} |
| i \vec{CD} | j \vec{AP} | k \vec{BM} | l \vec{NO} |

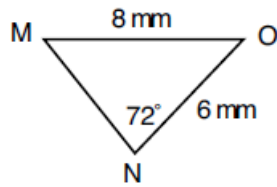
MOCK ASSESSMENT

You will sit a paper similar to this when you start year 12 which requires a 70% result to pass.

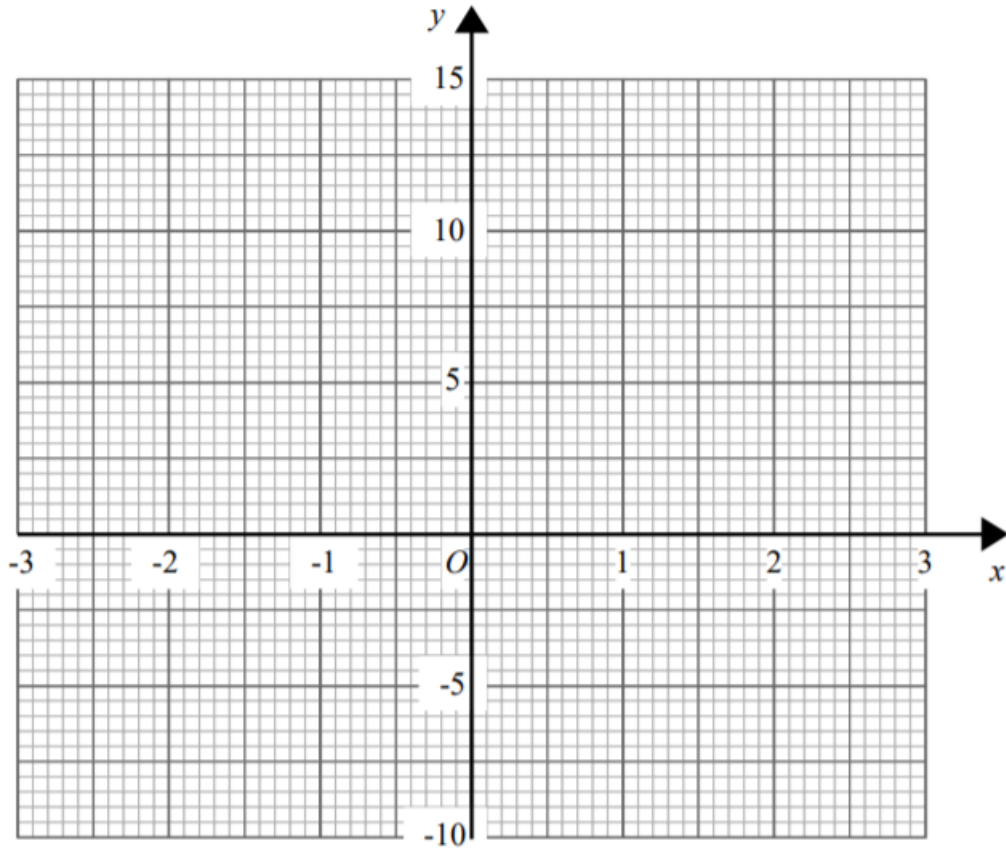
1. Expand and Simplify $(2x + 3)(x - 4)$
2. Factorise $6t^2 - 13t + 5$
3. Factorise Fully $200 - 8y^2$
4. Show that $x^2 + 10x + 13$ can be written as $(x + p)^2 + q$, where p and q are integers to be found.
5. Simplify $\frac{4x^3y}{8x^2y^3}$
6. Write $\frac{3x + 2}{3} + \frac{4x - 1}{6}$ as a single fraction in its simplest form
7. Solve $\frac{h-1}{4} + \frac{3h}{5} = 4$
8. Simplify $(3x^{\frac{2}{3}}y)^3$
9. Put these numbers in order of size. Start with the smallest number. 2^{-1} , 0.2 , -2 , 2^0
10. Find the value of 6^{-2}
11. Find the value of $16^{\frac{3}{2}}$
12. Solve the simultaneous equations
$$\begin{aligned} 3x - 5y &= -11 \\ 5x - 2y &= 7 \end{aligned}$$
13. Make s the subject of the formula. $v^2 = u^2 + 2as$
14. Make x the subject of $y = \frac{x+2}{x+1}$
15. $f(x) = x^2 - 12x + 15$ It can be shown that $f(x) = (x - 6)^2 - 21$
Hence, or otherwise, find the exact solutions to the equation $x^2 - 12x + 15 = 0$
16. Calculate the missing value of x . Leave your answer to 3 significant figures



17. Find the angle NMO



18. On the grid below, draw the graph of $y = 3 - 2x$ for values of x from -3 to 3 .



19. Line **A** has equation $2x - 5y = 5$

Line **B** goes through the points $(10, -1)$ and $(-5, 5)$

Are Lines A and B parallel?

You must show workings to explain your answer.

Answers to the MOCK ASSESSMENT

Please ensure you mark your work carefully and go back and revise any topic relevant topics

1. $2x^2 - 5x - 12$

2. $(3t - 5)(2t - 1)$

3. $(10 - 2y)(10 + 2y)$

4. $(x + 5)^2 - 12$

5. $\frac{x}{2y^2}$

6. $\frac{10x + 3}{6}$

7. $h = 5$

8. $27x^2y^3$

9. $-2, 0.2, 2^{-1}, 2^0$

10. $\frac{1}{36}$

11. 64

12. $x = 3, y = 4$

13. $x = \frac{v^2 - u^2}{2a}$

14. $x = \frac{2 - y}{y - 1}$

15. $6 \pm \sqrt{21}$

16. $x = 68.4^\circ$

17. $x = 45.5^\circ$

18.

x	-3	-2	-1	0	1	2	3
y	9	7	5	3	1	-1	-3

19. Line A: $y = \frac{2}{5}x - 1$

Line B: gradient = $\frac{5-1}{-5-10} = -\frac{2}{5}$

They are not parallel because their gradients are not equal

Anything you got wrong – please go back and revise it again – use videos online to support if needed!

Summer Learning Solutions

Simplifying expressions

- | | | | |
|------------------|---------------------|---------------------|--------------------|
| 1 a x^7 | b $6x^5$ | c k | d $2p^2$ |
| e x | f y^{10} | g $5x^2$ | h p^2 |
| i $2a^3$ | j $2p$ | k $6a^9$ | l $3a^2b^3$ |
| m $27x^8$ | n $24x^{11}$ | o $63a^{12}$ | p $32y^6$ |
| q $4a^6$ | r $6a^{12}$ | | |

- | | |
|----------------------------------|----------------------------------|
| 2 a $9x - 18$ | b $x^2 + 9x$ |
| c $-12y + 9y^2$ | d $xy + 5x$ |
| e $-3x^2 - 5x$ | f $-20x^2 - 5x$ |
| g $4x^2 + 5x$ | h $-15y + 6y^3$ |
| i $-10x^2 + 8x$ | j $3x^3 - 5x^2$ |
| k $4x - 1$ | l $2x - 4$ |
| m $9d^2 - 2c$ | n $13 - r^2$ |
| o $3x^3 - 2x^2 + 5x$ | p $14y^2 - 35y^3 + 21y^4$ |
| q $-10y^2 + 14y^3 - 6y^4$ | r $4x + 10$ |
| s $11x - 6$ | t $7x^2 - 3x + 7$ |
| u $-2x^2 + 26x$ | v $-9x^3 + 23x^2$ |

- | | | |
|-------------------------------|-------------------------------|----------------------------------|
| 3 a $3x^3 + 5x^5$ | b $3x^4 - x^6$ | c $\frac{x^3}{2} - x$ |
| d $4x^2 + \frac{5}{2}$ | e $\frac{7x^6}{5} + x$ | f $3x^4 - \frac{5x^2}{3}$ |

Expanding Brackets

- | | |
|---|--|
| 1 a $x^2 + 11x + 28$ | 2 a $5x^2 - 15x - 20$ |
| b $x^2 - x - 6$ | b $14x^2 + 7x - 70$ |
| c $x^2 - 4x + 4$ | c $3x^2 - 18x + 27$ |
| d $2x^2 + 3x - 2xy - 3y$ | d $x^3 - xy^2$ |
| e $4x^2 + 11xy - 3y^2$ | e $6x^3 + 8x^2 + 3x^2y + 4xy$ |
| f $6x^2 - 10xy - 4y^2$ | f $x^2y - 4xy - 5y$ |
| g $2x^2 - 11x + 12$ | g $12x^2y + 6xy - 8xy^2 - 4y^2$ |
| h $9x^2 + 12xy + 4y^2$ | h $19xy - 35y - 2x^2y$ |
| i $4x^2 + 6x + 16xy + 24y$ | i $10x^3 - 4x^2 + 5x^2y - 2xy$ |
| j $2x^2 + 3xy + 5x + 15y - 25$ | |
| k $3x^2 - 4xy - 8x + 4y + 5$ | |
| l $2x^2 + 5x - 7xy - 4y^2 - 20y$ | |
| m $x^2 + 2x + 2xy + 6y - 3$ | |
| n $2x^2 + 15x + 2xy + 12y + 18$ | |
| o $13y - 4x + 12 - 4y^2 + xy$ | |
| p $12xy - 4y^2 + 3y + 15x + 10$ | |
| q $5xy - 20y - 2x^2 + 11x - 12$ | |
| r $22y - 4y^2 - 5x + xy - 10$ | |

Factorising

- | | | |
|----------|-------------------------|-------------------------|
| 1 | a $4(x + 2)$ | b $6(x - 4)$ |
| | c $5(4x + 3)$ | d $2(x^2 + 2)$ |
| | e $4(x^2 + 5)$ | f $6x(x - 3)$ |
| | g $x(x - 7)$ | h $2x(x + 2)$ |
| | i $x(3x - 1)$ | j $2x(3x - 1)$ |
| | k $5y(2y - 1)$ | l $7x(5x - 4)$ |
| | m $x(x + 2)$ | n $y(3y + 2)$ |
| | o $4x(x + 3)$ | p $5y(y - 4)$ |
| | q $3xy(3y + 4x)$ | r $2ab(3 - b)$ |
| | s $5x(x - 5y)$ | t $4xy(3x + 2y)$ |
| | u $5y(3 - 4z^2)$ | v $6(2x^2 - 5)$ |
| | w $xy(y - x)$ | x $4y(3y - x)$ |

- | | | |
|----------|------------------------------|--------------------------------|
| 2 | a $x(x + 4)$ | b $2x(x + 3)$ |
| | c $(x + 8)(x + 3)$ | d $(x + 6)(x + 2)$ |
| | e $(x + 8)(x - 5)$ | f $(x - 6)(x - 2)$ |
| | g $(x + 2)(x + 3)$ | h $(x - 6)(x + 4)$ |
| | i $(x - 5)(x + 2)$ | j $(x + 5)(x - 4)$ |
| | k $(2x + 1)(x + 2)$ | l $(3x - 2)(x + 4)$ |
| | m $(5x - 1)(x - 3)$ | n $2(3x + 2)(x - 2)$ |
| | o $(2x - 3)(x + 5)$ | p $2(x^2 + 3)(x^2 + 4)$ |
| | q $(x + 2)(x - 2)$ | r $(x + 7)(x - 7)$ |
| | s $(2x + 5)(2x - 5)$ | t $(3x + 5y)(3x - 5y)$ |
| | u $4(3x + 1)(3x - 1)$ | v $2(x + 5)(x - 5)$ |
| | w $2(3x - 2)(x - 1)$ | x $3(5x - 1)(x + 3)$ |

Indices

- | | | | | |
|----------|--------------------|----------------------------|-----------------------------|----------------------------|
| 1 | a x^5 | b x^{-2} | c x^4 | d x^3 |
| | e x^5 | f $12x^0 = 12$ | g $3x^{\frac{1}{2}}$ | h $5x$ |
| | i $6x^{-1}$ | j $x^{\frac{5}{6}}$ | k $x^{\frac{17}{6}}$ | l $x^{\frac{1}{6}}$ |
-
- | | | | | |
|----------|---------------------------|---------------------------|------------------------|--------------------------|
| 2 | a 5 | b 729 | c 3 | d $\frac{1}{16}$ |
| | e $\frac{1}{3}$ | f $\frac{-1}{125}$ | g 1 | h 216 |
| | i $\frac{125}{64}$ | j $\frac{9}{4}$ | k $\frac{5}{6}$ | l $\frac{64}{49}$ |

Surds

1 **a** $2\sqrt{7}$ **b** $6\sqrt{2}$ **c** $5\sqrt{2}$ **d** $4\sqrt{2}$
 e $3\sqrt{10}$ **f** $\sqrt{3}$ **g** $\sqrt{3}$ **h** $6\sqrt{5}$
 i $7\sqrt{2}$ **j** $12\sqrt{7}$ **k** $-3\sqrt{7}$ **l** $9\sqrt{5}$
 m $23\sqrt{5}$ **n** 2 **o** $19\sqrt{3}$

2 **a** $2\sqrt{3} + 3$ **b** $3\sqrt{5} - \sqrt{15}$
 c $4\sqrt{2} - \sqrt{10}$ **d** $6 + 2\sqrt{5} - 3\sqrt{2} - \sqrt{10}$
 e $6 - 2\sqrt{7} - 3\sqrt{3} + \sqrt{21}$ **f** $13 + 6\sqrt{5}$
 g $8 - 6\sqrt{3}$ **h** $5 - 2\sqrt{3}$
 i $3 + 5\sqrt{11}$

1 **a** $\frac{\sqrt{5}}{5}$ **b** $\frac{\sqrt{11}}{11}$ **c** $\frac{\sqrt{2}}{2}$ **d** $\frac{\sqrt{5}}{5}$
 e $\frac{1}{2}$ **f** $\frac{1}{4}$ **g** $\frac{\sqrt{13}}{13}$ **h** $\frac{1}{3}$

2 **a** $\frac{1 - \sqrt{3}}{-2}$ **b** $\sqrt{5} - 2$ **c** $\frac{3 + \sqrt{7}}{2}$
 d $3 + \sqrt{5}$ **e** $\frac{\sqrt{5} + \sqrt{3}}{2}$ **f** $\frac{(3 - \sqrt{2})(4 + \sqrt{5})}{11}$
 g $5(\sqrt{5} - 2)$ **h** $5(4 + \sqrt{14})$ **i** $\frac{11(3 - \sqrt{11})}{-2}$
 j $\frac{5 - \sqrt{21}}{-2}$ **k** $\frac{14 - \sqrt{187}}{3}$ **l** $\frac{35 + \sqrt{1189}}{6}$
 m -1

Factorising

1 **a** $x = -1$ or $x = -2$ **b** $x = -1$ or $x = -4$
 c $x = -5$ or $x = -2$ **d** $x = 3$ or $x = -2$
 e $x = 3$ or $x = 5$ **f** $x = 4$ or $x = 5$
 g $x = 6$ or $x = -1$ **h** $x = 6$ or $x = -2$

2 **a** $x = 0$ or $x = 4$
 c $x = 0$ or $x = 2$
 e $x = -\frac{1}{2}$ or $x = -3$
 g $x = -\frac{2}{3}$ or $x = \frac{3}{2}$

b $x = 0$ or $x = 25$
d $x = 0$ or $x = 6$
f $x = -\frac{1}{3}$ or $x = \frac{3}{2}$
h $x = \frac{3}{2}$ or $x = \frac{5}{2}$

Solving quadratics

1 **a** $x = \frac{1}{2}(-3 \pm \sqrt{5})$
 c $x = -3 \pm \sqrt{3}$
 e $x = \frac{1}{3}(-5 \pm \sqrt{31})$
 g $x = 2$ or $x = -\frac{1}{4}$

b $x = \frac{1}{2}(3 \pm \sqrt{17})$
d $x = \frac{1}{2}(5 \pm \sqrt{33})$
f $x = \frac{1}{2}(1 \pm \sqrt{2})$
h $x = \frac{1}{11}(-1 \pm \sqrt{78})$

Solving simultaneous equations

1 **a** $x = 4, y = 2$
 c $x = 2, y = -2$
 e $x = -\frac{2}{3}, y = 2$

b $x = 1, y = 3$
d $x = 4\frac{1}{2}, y = -3$
f $x = 3, y = 3$

2 **a** $x = 5, y = 2$
 c $x = 1, y = -4$

b $x = 5\frac{1}{2}, y = -6$
d $x = 1\frac{3}{4}, y = \frac{1}{4}$

1 **a** $x = 5, y = 6$ or $x = 6, y = 5$
 b $x = 0, y = 1$ or $x = \frac{4}{5}, y = -\frac{3}{5}$
 c $x = -1, y = -3$ or $x = 1, y = 3$

2 **a** $x = 3, y = \frac{1}{2}$ or $x = 6\frac{1}{3}, y = -2\frac{5}{6}$
 b $x = 4\frac{1}{2}, y = 4\frac{1}{2}$ or $x = 6, y = 3$
 c $x = -19, y = -15$ or $x = 6, y = 5$

Gradient

- | | | | | |
|----------|------------------------|--|-------------------------|-------------------------|
| 1 | a $\frac{1}{2}$ | b $\frac{1}{6}$ | c $-\frac{3}{5}$ | d 2 |
| | e -1 | f $\frac{1}{2}$ | g $\frac{1}{2}$ | h 8 |
| | i $\frac{2}{3}$ | j -4 | k $-\frac{1}{3}$ | l $-\frac{1}{2}$ |
| | m 1 | n $\frac{q^2 - p^2}{q - p} = q + p$ | | |

Cosine Rule

- | | | | |
|----------|---------------------------|-----------------------------------|------------------------|
| 1 | a 3.19 cm | b 1.73 cm ($\sqrt{3}$ cm) | c 9.85 cm |
| | d 4.31 cm | e 6.84 cm | f 9.80 cm |
| 2 | a 108(.2) $^\circ$ | b 90 $^\circ$ | c 60 $^\circ$ |
| | d 52.6 $^\circ$ | e 137 $^\circ$ | f 72.2 $^\circ$ |

Sine Rule

- 2**
- | | |
|----------|---|
| a | $x = 84^\circ, y = 6.32$ |
| b | $x = 13.5, y = 16.6$ |
| c | $x = 85^\circ, y = 13.9$ |
| d | $x = 80^\circ, y = 6.22$ (isosceles triangle) |
| e | $x = 6.27, y = 7.16$ |
| f | $x = 4.49, y = 7.49$ (right-angled) |

Vectors

- | | | | |
|----------|----------------------------------|---------------------------------|----------------------------------|
| 2 | a 2 b | b d | c b |
| | d 2 b | e d + b | f d + b |
| | g -2 d | h - b | i 2 d + b |
| | j - b + 2 d | k - b + d | l - d - b |
| 3 | a 2 m | b 2 p | c m |
| | d m | e p + m | f p + m |
| | g p + 2 m | h p - m | i - m - p |
| | j -2 m + p | k -2 p + m | l - m - 2 p |