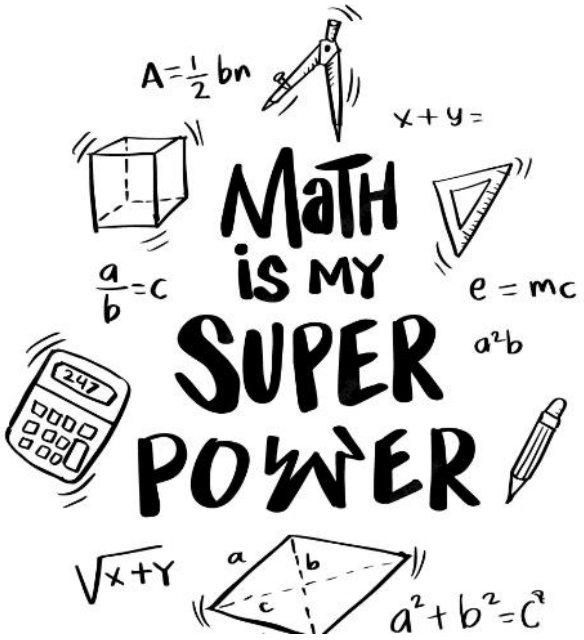
Myton School

Mathematics A-Level Induction Pack



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:

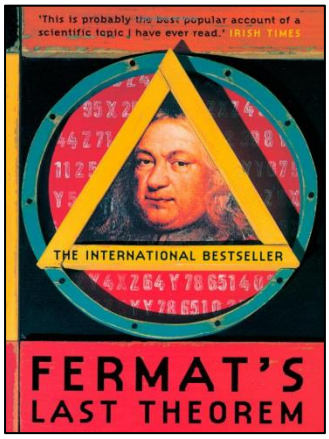
You will need a calculator for all of your lessons. We recommend the Casio fx-991 EX. This has all of the functions required for A Level.

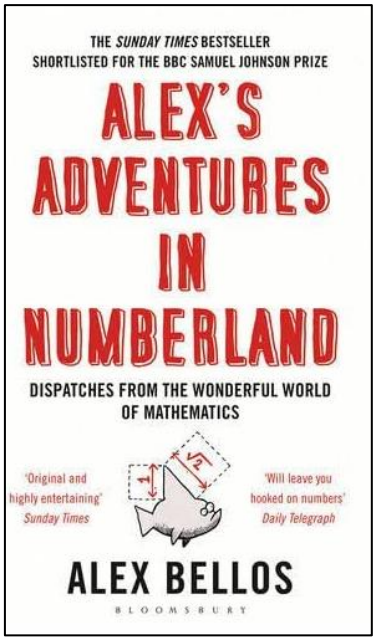
You are permitted in examinations to use the fx-CG50, a complex graphical calculator. This device has additional functions but is significantly more expensive and can be cumbersome to use.

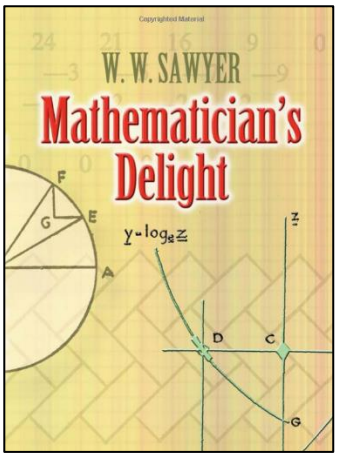
Alpha A α	Beta B β	Gamma Γ γ	Delta Δ δ
Epsilon E ε	Zeta Z ζ	Eta H η	Theta Θ θ
Iota I ι	Kappa K κ	Lambda Λ λ	Mu M μ
Nu N ν	Xi Ξ ξ	Omicron O ο	Pi Π π
Rho P ρ	Sigma Σ σ	Tau T τ	Upsilon Y υ
Phi Φ φ	Chi X χ	Psi Ψ ψ	Omega Ω ω

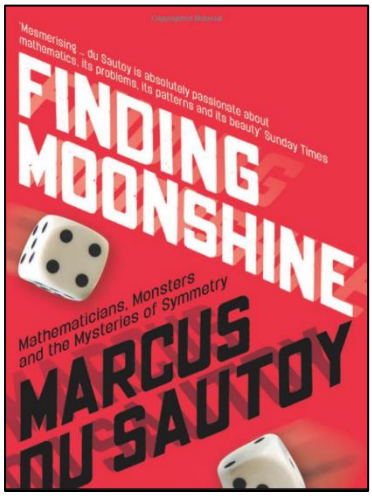
Recommended wider reading

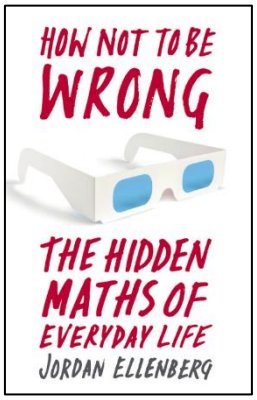
More available at https://nrich.maths.org/books

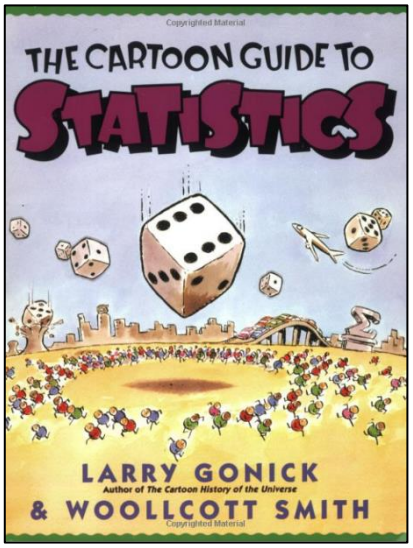


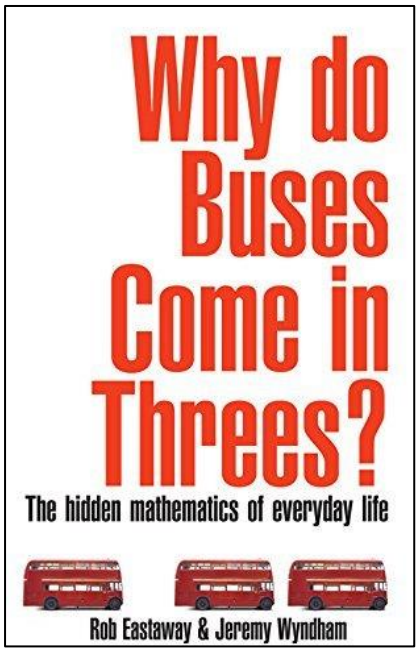


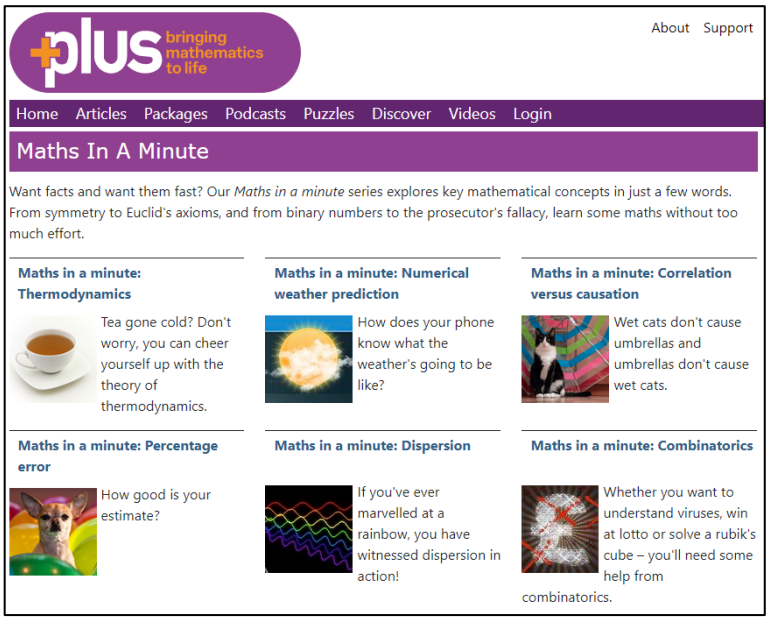












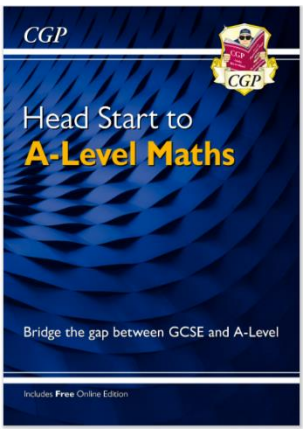
Pre course reading/homework

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 the 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.

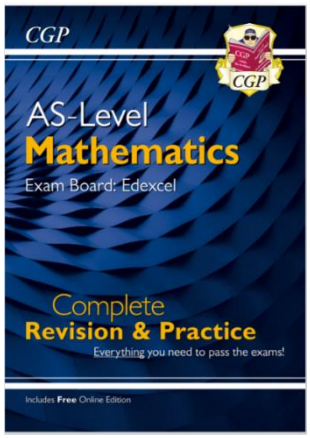
You may wish to purchase one of the following workbooks to help you, but this is not essential.



Head Start to A-Level Maths

ISBN: *9781782947929*

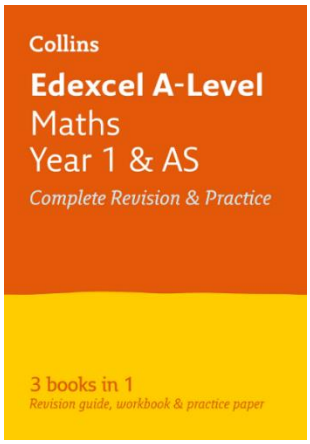
RRP: £5.95



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** $5x^{\frac{7}{5}} \div x^{\frac{2}{5}}$ **i** $3x^4 \times 2x^{-5}$

j $\sqrt{x} \times \sqrt[3]{x}$ **k** $(\sqrt{x})^3 \times (\sqrt[3]{x})^4$ **l** $\dfrac{(\sqrt[3]{x})^2}{\sqrt{x}}$

2 Evaluate:

a $25^{\frac{1}{2}}$ **b** $81^{\frac{3}{2}}$ **c** $27^{\frac{1}{3}}$

d 4^{-2} **e** $9^{-\frac{1}{2}}$ **f** $(-5)^{-3}$

g $\left(\frac{3}{4}\right)^0$ **h** $1296^{\frac{3}{4}}$ **i** $\left(\frac{25}{16}\right)^{\frac{3}{2}}$

j $\left(\frac{27}{8}\right)^{\frac{2}{3}}$ **k** $\left(\frac{6}{5}\right)^{-1}$ **l** $\left(\frac{343}{512}\right)^{-\frac{2}{3}}$

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** $\dfrac{\sqrt{12}}{2}$

g $\dfrac{\sqrt{27}}{3}$ **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** $\dfrac{\sqrt{44}}{\sqrt{11}}$ **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 $\dfrac{1}{\sqrt{5}}$ **b** $\dfrac{1}{\sqrt{11}}$ **c** $\dfrac{1}{\sqrt{2}}$ **d** $\dfrac{\sqrt{3}}{\sqrt{15}}$

e $\dfrac{\sqrt{12}}{\sqrt{48}}$ **f** $\dfrac{\sqrt{5}}{\sqrt{80}}$ **g** $\dfrac{\sqrt{12}}{\sqrt{156}}$ **h** $\dfrac{\sqrt{7}}{\sqrt{63}}$

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

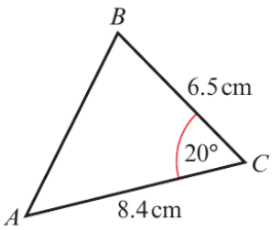
1 Work out the gradients of the lines joining these pairs of points:

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.

a



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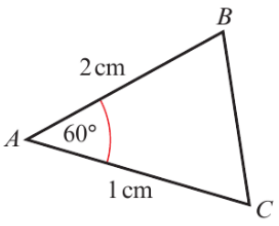

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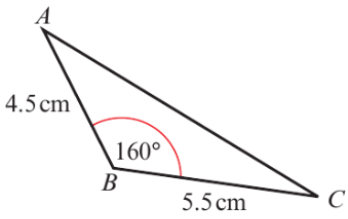

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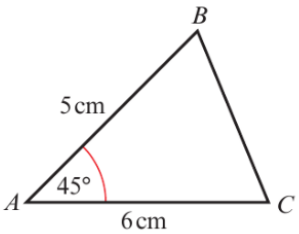

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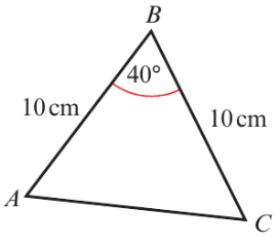

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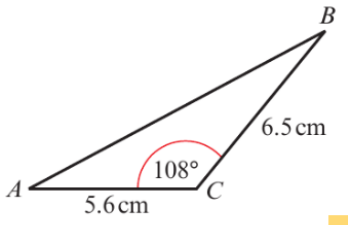
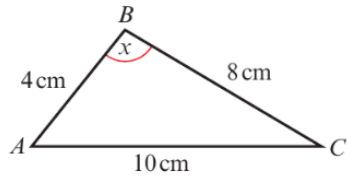


2 In the following triangles calculate the size of the angle marked x:

a



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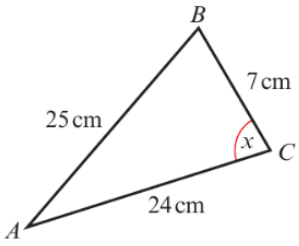

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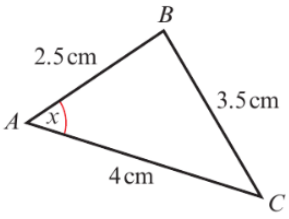

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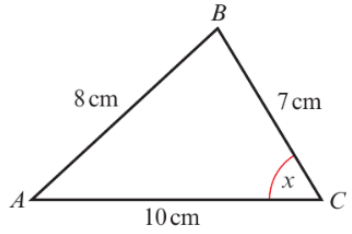

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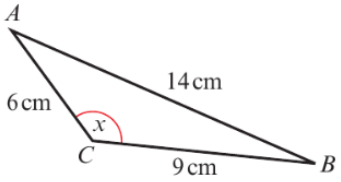
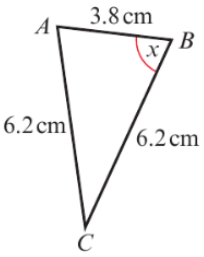


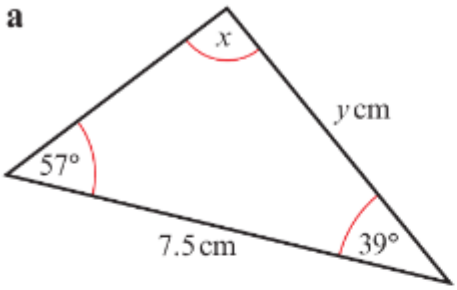
f



Sine Rule

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

a



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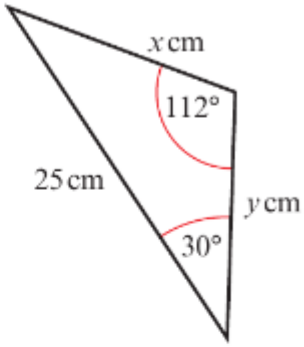
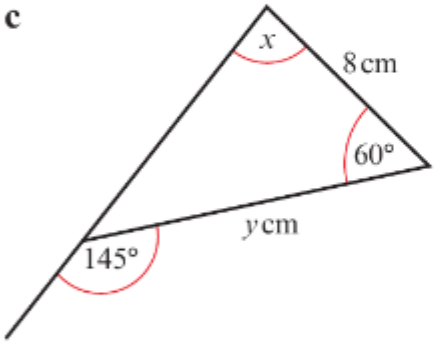
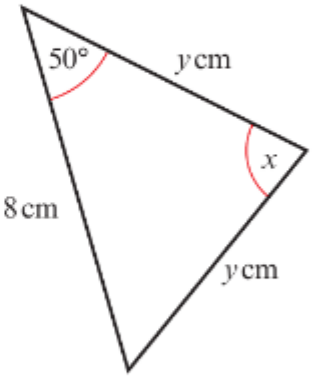


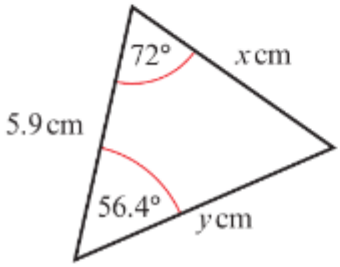
c



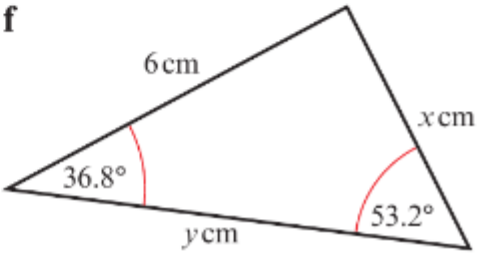
d



e

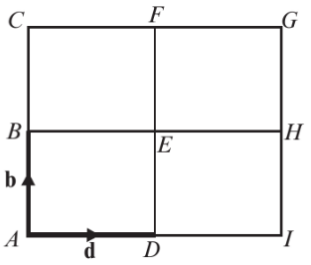


f



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

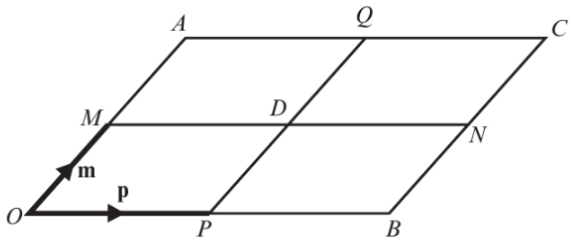
a $\overrightarrow{AC}$	**b** $\overrightarrow{BE}$	**c** $\overrightarrow{HG}$	**d** $\overrightarrow{DF}$
e $\overrightarrow{AE}$	**f** $\overrightarrow{DH}$	**g** $\overrightarrow{HB}$	**h** $\overrightarrow{FE}$
i $\overrightarrow{AH}$	**j** $\overrightarrow{BI}$	**k** $\overrightarrow{EI}$	**l**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



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 $\overrightarrow{OP}$ and $\overrightarrow{OM}$ respectively. Express in terms of $\mathbf{p}$ and $\mathbf{m}$.

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



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 $x^2 + 11x + 28$
b $x^2 - x - 6$
c $x^2 - 4x + 4$
d $2x^2 + 3x - 2xy - 3y$
e $4x^2 + 11xy - 3y^2$
f $6x^2 - 10xy - 4y^2$
g $2x^2 - 11x + 12$
h $9x^2 + 12xy + 4y^2$
i $4x^2 + 6x + 16xy + 24y$
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 $22y - 4y^2 - 5x + xy - 10$

2
a $5x^2 - 15x - 20$
b $14x^2 + 7x - 70$
c $3x^2 - 18x + 27$
d $x^3 - xy^2$
e $6x^3 + 8x^2 + 3x^2y + 4xy$
f $x^2y - 4xy - 5y$
g $12x^2y + 6xy - 8xy^2 - 4y^2$
h $19xy - 35y - 2x^2y$
i $10x^3 - 4x^2 + 5x^2y - 2xy$

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 $x=4$ **b** $x=0$ or $x=25$

c $x=0$ or $x=2$ **d** $x=0$ or $x=6$

e $x=-\frac{1}{2}$ or $x=-3$ **f** $x=-\frac{1}{3}$ or $x=\frac{3}{2}$

g $x=-\frac{2}{3}$ or $x=\frac{3}{2}$ **h** $x=\frac{3}{2}$ or $x=\frac{5}{2}$

Solving quadratics

1 **a** $x = \frac{1}{2}(-3 \pm \sqrt{5})$ **b** $x = \frac{1}{2}(3 \pm \sqrt{17})$

c $x = -3 \pm \sqrt{3}$ **d** $x = \frac{1}{2}(5 \pm \sqrt{33})$

e $x = \frac{1}{3}(-5 \pm \sqrt{31})$ **f** $x = \frac{1}{2}(1 \pm \sqrt{2})$

g $x = 2$ or $x = -\frac{1}{4}$ **h** $x = \frac{1}{11}(-1 \pm \sqrt{78})$

Solving simultaneous equations

1 **a** $x = 4, y = 2$ **b** $x = 1, y = 3$

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

e $x = -\frac{2}{3}, y = 2$ **f** $x = 3, y = 3$

2 **a** $x = 5, y = 2$ **b** $x = 5\frac{1}{2}, y = -6$

c $x = 1, y = -4$ **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)° **b** 90° **c** 60°
d 52.6° **e** 137° **f** 72.2°

Sine Rule

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

Vectors

2 **a** $2\mathbf{b}$ **b** $\mathbf{d}$ **c** $\mathbf{b}$
d $2\mathbf{b}$ **e** $\mathbf{d} + \mathbf{b}$ **f** $\mathbf{d} + \mathbf{b}$
g $-2\mathbf{d}$ **h** $-\mathbf{b}$ **i** $2\mathbf{d} + \mathbf{b}$
j $-\mathbf{b} + 2\mathbf{d}$ **k** $-\mathbf{b} + \mathbf{d}$ **l** $-\mathbf{d} - \mathbf{b}$

3 **a** $2\mathbf{m}$ **b** $2\mathbf{p}$ **c** $\mathbf{m}$
d $\mathbf{m}$ **e** $\mathbf{p} + \mathbf{m}$ **f** $\mathbf{p} + \mathbf{m}$
g $\mathbf{p} + 2\mathbf{m}$ **h** $\mathbf{p} - \mathbf{m}$ **i** $-\mathbf{m} - \mathbf{p}$
j $-2\mathbf{m} + \mathbf{p}$ **k** $-2\mathbf{p} + \mathbf{m}$ **l** $-\mathbf{m} - 2\mathbf{p}$

Year 12 MOCK Induction Test - (1 hour) Non-Calculator

1. Simplify fully, giving your answers in index form: [6 marks]

a. $(2x^3y^2)^4$

b. $4x^3y^2 \times 7x^2y^4z$

c. $\frac{12x^6y^4}{18x^2y^{-2}}$

2. Evaluate: [4 marks]

a. 4^{-2}

b. $25^{\frac{1}{2}}$

c. $\frac{64^{-\frac{2}{3}}}{8}$

3. Write as a single power of 10: [2 marks]

$10000^{-2} \times \left(\frac{1}{10^3}^{-\frac{1}{2}}\right)$

4. Expand and simplify: [2 marks]

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

5. Show that $\frac{\cos 30^0 + \sin 45^0}{tan45^0} = \frac{\sqrt{3}+\sqrt{2}}{2}$ [3 marks]

6. Make x the subject: [3 marks]

$$\frac{1}{x} - \frac{1}{y} + z = 5$$

7. Solve the following equations: [5 marks]

a. $x^2 + 6x - 16 = 0$

b. $3x^2 - 7x - 6 = 0$

8. The equation $2x^2 + 5x + 4 = 0$ has no real solutions. Explain why. [2 marks]

9. Find the coordinates of the point of intersection of the graphs with the following equations: [5 marks]

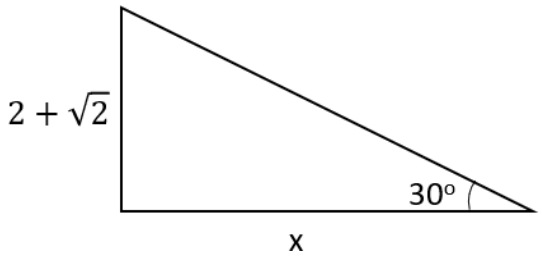
$$2 - y = 3x$$

$$x^2 + y^2 = 20$$

10. Consider the curve with equation $y = x^2 + 8x - 5$. Find the coordinates of intersection of this curve with the x-axis, giving your answers as surds in their simplest form. [3 marks]

11. Consider the curve with equation $y = x^2 - 7x + 3$. Find the coordinates of the turning point of this curve. [3 marks]

12. The diagram shows a right-angled triangle. Show that $x = 2\sqrt{3} + \sqrt{6}$ units in length. [3 marks]



13. A ship travels on a bearing of 050° for 10 miles from port A to port B. From port B, the ship then travels on a bearing of 170° for 12 miles until it reaches port C. Work out the distance from port A to port C. Give your answer as a surd in its simplest form. [4 marks]

Year 12 MOCK Induction Test - Marking Scheme

Total: 45 marks (32 Marks needed to pass)

Question 1 [6 marks total]

a. $(2x^3y^2)^4$ [2 marks]

- $(2x^3y^2)^4 = 2^4 \times (x^3)^4 \times (y^2)^4$ [1 mark]
- $= 16x^{12}y^8$ [1 mark]

b. $4x^3y^2 \times 7x^2y^4z$ [2 marks]

- $4 \times 7 \times x^3 \times x^2 \times y^2 \times y^4 \times z$ [1 mark]
- $= 28x^5y^6z$ [1 mark]

c. $(12x^6y^4)/(18x^2y^{-2})$ [2 marks]

- $12/18 \times x^{6-2} \times y^{4-(-2)}$ [1 mark]
- $= (2/3)x^4y^6$ [1 mark]

Question 2 [4 marks total]

a. 4^{-2} [1 mark]

- $= 1/4^2 = 1/16$ [1 mark]

b. 25^(1/2) [1 mark]

- $= \sqrt{25} = 5$ [1 mark]

c. (64/8)^(-2/3) [2 marks]

- = (8/64)^(2/3) = [(8/64)^(1/3)]² [1 mark]
- $= (2/4)^2 = 1/4$ [1 mark]

Question 3 [2 marks]

$10000^{-2} \times (1/10^3)^{-1/2}$

- $= (10^4)^{-2} \times (10^{-3})^{-1/2}$ [1 mark]
- $= 10^{-8} \times 10^{(3/2)} = 10^{-8} \times 10^{(3/2)} = 10^{-13/2}$ [1 mark]

Question 4 [2 marks]

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

- $= 6 - 2\sqrt{5} + 3\sqrt{5} - 5$ [1 mark]
- $= 1 + \sqrt{5}$ [1 mark]

Question 5 [3 marks]

Show that (cos30° + sin45°)/tan45° = (√3 + √2)/2

- cos30° = √3/2, sin45° = √2/2, tan45° = 1 [1 mark]
- (√3/2 + √2/2)/1 = (√3 + √2)/2 [1 mark]
- Hence shown [1 mark]

Question 6 [3 marks]

Make x the subject: 1/x - 1/y + z = 5

- 1/x = 5 + 1/y - z [1 mark]
- 1/x = (5y + 1 - zy)/y [1 mark]
- x = y/(5y + 1 - zy) [1 mark]

Question 7 [5 marks total]

a. $x^2 + 6x - 16 = 0$ [2 marks]

- (x + 8)(x - 2) = 0 [1 mark]
- x = -8 or x = 2 [1 mark]

b. $3x^2 - 7x - 6 = 0$ [3 marks]

- Using quadratic formula: x = (7 ± √(49 + 72))/6 [1 mark]
- x = (7 ± √121)/6 = (7 ± 11)/6 [1 mark]
- x = 3 or x = -2/3 [1 mark]

Question 8 [2 marks]

The equation $2x^2 + 5x + 4 = 0$ has no real solutions. Explain why.

- Use Quadratic Formula: (-5 ± $\sqrt{25 - 32}$) /4 [1 mark]
- Since the value under the square root is negative, there are no real solutions [1 mark]

Question 9 [5 marks]

Find intersection of $2 - y = 3x$ and $x^2 + y^2 = 20$

- Substitute: $x^2 + (2 - 3x)^2 = 20$ [1 mark]
- $x^2 + (9x^2 - 12x + 4) = 20$ [1 mark]
- $10x^2 - 12x - 16 = 0$ [1 mark]
- Factorising: x = -4/5 and x = 2 [1 mark]
- When x = -4/5, y = 22/5
- When x = 2, y = -4 [1 mark]

Question 10 [3 marks]

Find x-intercepts of $y = x^2 + 8x - 5$

- Set $y = 0$: $x^2 + 8x - 5 = 0$ [1 mark]
- $x = (-8 \pm \sqrt{(64 + 20)})/2 = (-8 \pm \sqrt{84})/2$ [1 mark]
- $x = (-8 \pm 2\sqrt{21})/2 = -4 \pm \sqrt{21}$ [1 mark]

Question 11 [3 marks]

Find turning point of $y = x^2 - 7x + 3$

- $dy/dx = 2x - 7 = 0$ [1 mark]
- $x = 7/2$ [1 mark]
- $y = (7/2)^2 - 7(7/2) + 3 = 49/4 - 49/2 + 3 = 49/4 - 98/4 + 12/4 = -37/4$
- Turning point: $(7/2, -37/4)$ [1 mark]

Question 12 [3 marks]

Show that $x = \sqrt{8} + 3$ in the right triangle

- Using trigonometry in the 60° angle: tan60° = opposite/adjacent [1 mark]
- $\sqrt{3} = (2 + \sqrt{2})/\text{base}$, so base $= (2 + \sqrt{2})/\sqrt{3}$ [1 mark]
- Using Pythagoras: $x^2 = (2 + \sqrt{2})^2 + [(2 + \sqrt{2})/\sqrt{3}]^2$
- Simplifying leads to $x = \sqrt{8} + 3$ [1 mark]

Question 13 [4 marks]

Distance from A to C using bearings

- Draw diagram showing triangle ABC with given bearings and distances [1 mark]
- Calculate angle ABC = 360° - (130° - 170°) = 60° [1 mark]
- Using Cosine Rule: $AC^2 = 41^2 + 12^2 - 2(10)(12)\cos 60 = 124$ [1 mark]
- $AC = \sqrt{124} = \sqrt{(4 \times 31)} = 2\sqrt{31}$ miles [1 mark]