MathsBox

AS & A Level

QUESTION GENERATOR OVERVIEW

Question structures for A Level Maths.

Every question structure available for A Level Maths in the Mathsbox Question Generator, organised by topic so you can find exactly what you need.

- Algebra and Functions
- Coordinate Geometry
- Binomial
- Trigonometry
- Exponentials and Logarithms
- Differentiation
- Integration
- Terminology
- Vectors
- Mechanics
- Statistics
- Sequences and Series
- Differential Equations
- Numerical Methods
- Parametrics

1,657 question structures

145 topics

15 strands

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01 A LEVEL MATHS Algebra and Functions

35 topics
359 structures

Polynomials

Polynomials — AS — 18

- Expand 2 brackets
- Expand 3 brackets
- Factorise : $ax^2 + bx + c$
- Polynomial Division
- Factorising : cubic function
- Verify a factor
- Finding k given a factor
- Finding k given a root
- Finding k - mixture
- Finding unknowns given 2 roots
- Finding unknowns given 2 factors
- Finding unknowns mixture
- Finding the remainder
- Finding Unknowns
- Factor and Remainder
- $(Ax^2 + Bx + c)(x + D) + E$
- Expanding : $(x \pm a)(x \pm b)$
- Polynomials : Mixture

Quadratics

Solving equations (1) — AS — 11

- Expand $(ax \pm b)(cx \pm d)$
- Factorising : $x^2 + bx + c$
- Factorising : $ax^2 + bx + c$
- Express as $(x \pm a)^2 \pm b$
- Express as $a(x \pm a)^2 \pm b$
- Solving :$(x \pm a)^2 \pm b = 0$
- Solving : a $(x \pm b)^2 \pm c = 0$
- Solving : Factorising $a = 1$
- Solving : Factorising
- Solving : Formula $x^2 + bx + c = 0$
- Solving :Formula $ax^2 + bx + c = 0$

Using the discriminant — AS — 6

- Determine the number of roots
- Find the Discriminant
- One repeated root
- 2 real roots
- No real roots
- Discriminant : Mixture

Finding the equation — AS — 3

- Find the equation : two roots Given
- Find the equation : two points Given
- Find the equation : Mixed Questions

Points of intersection — AS — 3

- Intersections : Quadratic & $y = mx + c$
- Intersections : Quadratic & $a + bx = c$
- Intersections : Mixed Questions

Solving (2) — AS — 5

- Solving : $ax^4 + bx^2 + c = 0$
- Solving : $ax^{2/n} + bx^{1/n} = c$
- Solving : $ax^{2/n} + bx^{1/n} = c$
- Solving : $ax + \frac{c}{x} = b$
- Quadratics : Mixture

Indices

Indices — AS — 20

- Positive Unit Fractions
- Negative Unit Fractions
- Mixed Unit Fractions
- Positive Fractions
- Negative Fractions
- Mixed Fractions
- Multiplying $ax^n \times bx^m$
- Dividing $\frac{ax^n y^m}{bx^p y^q}$
- Brackets $(ax^n)^m$
- Mixed Questions
- Simplifying :$\frac{x^n \times x^m}{x^p}$
- Simplifying : $\frac{ax^n \times bx^m}{cx^p}$
- Simplifying : $x^{\frac{a}{b}} \div x^n$
- Simplifying : $x^{\frac{a}{b}} \div x^{\frac{c}{b}}$
- Simplifying : $(nx^{\frac{a}{b}})^2 \div mx^{\frac{c}{b}}$
- Simplifying : $nx^{\frac{a}{b}} \div mx^c$
- Simplify : $\frac{ax^n(bx^m + c)}{x^p}$
- Simplify : $\frac{(bx^m + c)^2}{x^p}$
- Solving $x^{\frac{a}{b}} = n$
- Indices : Mixture

Surds

Simplifying — AS — 12

- Simplifying : $\sqrt{a}$
- Simplifying : $\sqrt{a} \pm b + \sqrt{a} \pm c$
- Simplifying : $n\sqrt{a} \pm b + m\sqrt{a} \pm c$
- Simplifying :$n\sqrt{a} + \sqrt{b}$
- Simplifying :$(a\sqrt{b})^n \pm c\sqrt{b}$
- Simplifying Mixture : Sets 1 - 4
- Simplifying Mixture Sets 1 - 5
- Multiplying : $n\sqrt{a} \times m\sqrt{a}$
- Multiplying : $\sqrt{a} \times \sqrt{b}$
- Multiplying :$m\sqrt{a} \times n\sqrt{b}$
- Multiplying : Mixture
- Simplifying Surds : Mixture

Expanding brackets — AS — 10

- Expanding : $\sqrt{a}(\sqrt{a} \pm b)$
- Expanding : $(\sqrt{a} + b)(\sqrt{a} - b)$
- Expanding : $(\sqrt{a} \pm b)(\sqrt{a} \pm c)$
- Expanding : Mixture
- Expanding : $\sqrt{a}(n\sqrt{a} \pm b)$
- Expanding : $(c\sqrt{a} + b)(c\sqrt{a} - b)$
- Expanding : $(m\sqrt{a} \pm b)(n\sqrt{a} \pm c)$
- Expanding : Single bracket mixture
- Expanding : Mixture
- Surds Expanding brackets : Mixture

Rationalising the denominator — AS — 10

- Rationalising : $\frac{a}{\sqrt{b}}$
- Rationalising : $\frac{a}{c \pm \sqrt{b}}$
- Rationalising : $\frac{a \pm \sqrt{b}}{c \pm \sqrt{b}}$
- Rationalising : Mixture
- Rationalising : $\frac{a}{n\sqrt{b}}$
- Rationalising : $\frac{a}{c \pm n\sqrt{b}}$
- Rationalising : $\frac{a \pm n\sqrt{b}}{c \pm m\sqrt{b}}$
- Rationalising : $\frac{a \pm n\sqrt{b}}{m\sqrt{b} \pm c}$

Rationalising the denominator *continued*

Rationalising : Mixture
Surds - Rationalising : Mixture

Solving equations AS 5

Solving : $m - x\sqrt{b} = \frac{ax}{\sqrt{b}}$
Solving : $m - x\sqrt{c} = \frac{ax}{\sqrt{b}}$
Solving : $\sqrt{a} \pm \frac{\sqrt{b}}{cx} = \frac{1}{x\sqrt{d}}$
Solving : Mixed
Surds - Solving equations : Mixture

Inequalities

Solving · Standard answer notation AS 5

Linear Inequalities
Solving Quadratic :$x^2 \pm bx \pm c <> 0$
Solving Quadratic :$ax^2 \pm bx \pm c <> 0$
Simultaneous inequalities quadratic/linear
Inequalities : Mixture

Solving · Answers in set notation AS 4

Quadratic :$x^2 \pm bx \pm c < 0$
:$ax^2 \pm bx \pm c < d$
Simultaneous inequalityquadratic/linear
Inequalities - set notation : Mixture

Representing inequalities · Defining the shaded region AS 15

$y \leq a$ or $y < a$
$y \geq a$ or $y > a$
$x \leq a$ or $x < a$
$x \geq a$ or $x > a$
$ax + by \leq c$ or $ax + by < c$
$ax + by \geq c$ or $ax + by > c$
$ax + by \leq c$ and axes bounds
$ax + by \geq c$ axes bounds
$ax + by \leq cx \geq p, y \geq 0$
$ax + by \geq cx \leq p, y \leq 0$
$ax + by \leq cx \geq 0, y \geq p$
$ax + by \geq cx \leq 0, y \leq p$
$ax + by \leq cx \geq p, y \geq q$
$ax + by \geq cx \leq p, y \leq q$
Representing inequalities (1) : Mixture

Representing inequalities · Defining the unshaded region AS 15

Representing :$y \geq a$ or $y > a$
Representing :$y \leq a$ or $y < a$
Representing :$x \geq a$ or $x > a$
Representing :$x \leq a$ or $x < a$
Representing :$ax + by \geq c$ or $ax + by > c$
Representing :$ax + by \leq c$ or $ax + by < c$
Representing :$ax + by \geq c$ and axes bounds
Representing :$ax + by \leq c$ and axes bounds
Representing :$ax + by \geq cx \leq p, y \leq 0$
Representing :$ax + by \leq cx \geq p, y \geq 0$
Representing :$ax + by \leq cx \geq 0, y \leq p$
Representing :$ax + by \geq cx \leq 0, y \geq p$
Representing :$ax + by \geq cx \leq p, y \leq q$
Representing :$ax + by \leq cx \geq p, y \geq q$
Representing inequalities (2) : Mixture

Algebraic Fractions

Simplifying – factorising AS 7

Simplifying
Simplifying

Simplifying – factorising *continued*

Multiplication
Multiplication
Division
Division
Algebraic Fractions - factorising : Mixture

Simplifying – addition and subtraction AS 15

Simplify :$\frac{x}{a} + \frac{x}{b}$
Simplify :$\frac{x}{a} - \frac{x}{b}$
Simplify :$\frac{ax}{b} + \frac{cx}{d}$
Simplify :$\frac{ax}{b} - \frac{cx}{d}$
Simplify :$\frac{x+a}{b} + \frac{x+c}{d}$
Simplify :$\frac{x+a}{b} - \frac{x+c}{d}$
Simplify :$\frac{x+a}{b} - \frac{x-c}{d}$
Simplify :$\frac{x-a}{b} - \frac{x+c}{d}$
Simplify :$\frac{x-a}{b} - \frac{x-c}{d}$
Simplify :$\frac{x-a}{b} + \frac{x-c}{d}$
Simplify :$\frac{x+a}{b} - \frac{x-c}{d}$
Simplify Mixture
Multiply algebraic fractions
Divide algebraic fractions
Algebraic Fractions - Simplifying : Mixture

Simultaneous Equations

Linear Simultaneous Equations AS 6

$ax + by = r$ and $cx + dy = s$
$ax - by = r$ and $cx - dy = s$
$ax - by = r$ and $cx + dy = s$
$ax + by = r$ and $cx - dy = s$
Mixed questions (1 - 4)
Linear Simultaneous Equations : Mixture

Non-Linear Simultaneous Equations AS 14

$x + y = s$ and $xy = p$
$ax + y = c$ and $x^2 + by = d$
$y = mx$ and $y = x^2 \pm c$
$y = x \pm a$ and $y = x^2 \pm b$
$y = x^2 + bx + c$ and $y = dx + e$
$ax^2 \pm by^2 = c$ and $x + y = d$
$x^2 + y^2 \pm xy = c$ and $x + y = d$
$x^2 + y^2 \pm axy = c$ and $x + y = d$
$x^2 + y^2 \pm ax = c$ and $x + y = d$
$x^2 + y^2 \pm ay = c$ and $x + y = d$
$x^2 \pm axy^2 \pm by = c$ and $x + y = d$
$x^2 + y^2 = r^2$ and $y = x \pm c$
$x^2 + y^2 = r^2$ and $y = ax \pm c$
Mixture

Graphs

Quadratic and cubic graphs AS 12

Complete the square and find the vertex
Complete the square and find the vertex
Symmetry $y = (x \pm a)(x \pm b)$
Symmetry $y = x^2 \pm bx \pm c$
Symmetry $y = ax^2 \pm bx \pm c$
Roots $y = x^2 \pm bx \pm c$
Roots $y = ax^2 \pm bx \pm c$
Sketching $y = x^2 \pm bx \pm c$
Sketching $y = -x^2 \pm bx \pm c$
Sketching $y = ax^3 \pm bx^2 \pm cx \pm d$
Sketching $y = -ax^3 \pm bx^2 \pm cx \pm d$
Quadratic & cubic graphs : Mixture

Trig graphs AS 10

Complete the square and find the vertex

Trig graphs *continued*

Sketching $y = a\sin x$
Sketching $y = a\cos x$
Sketching $y = \sin ax$
Sketching $y = \cos ax$
Sketching $y = \sin(x \pm a)$
Sketching $y = \cos(x \pm a)$
Sketching $y = \sin x \pm a$
Sketching $y = \cos x \pm a$
Trig graphs : Mixture

Transforming Graphs · Function notation - Quadratic - transformations (function notation)

AS 13

Finding $f(x) + a$
Finding $f(x) - a$
Finding $f(x + a)$
Finding $f(x - a)$
Finding $-f(x)$
Finding $f(-x)$
Finding $af(x)$
Finding $f(ax)$
Finding $f(x + a) + b$
Finding $f(x + a) - b$
Finding $f(x - a) + b$
Finding $f(x - a) - b$
Transforming Graphs Quadratic (1): Mixture

Transforming Graphs · Function notation - Cubic- transformations (function notation)

AS 13

(1c)Finding $f(x) + a$
Finding $f(x) - a$
Finding $f(x + a)$
Finding $f(x - a)$
Finding $-f(x)$
Finding $f(-x)$
Finding $af(x)$
Finding $f(ax)$
Finding $f(x + a) + b$
Finding $f(x + a) - b$
Finding $f(x - a) + b$
Finding $f(x - a) - b$
Transforming Graphs Cubic (1): Mixture

Transforming Graphs · Transformations descriptions -quadratic

AS 13

Translation (+ve y)
Translation (-ve y)
Translation (-ve x)
Translation (+ve x)
Reflection (x-axis)
Reflection (y-axis)
Stretch (parallel to the y axis)
Stretch (parallel to the x axis)
Translation -ve x and +ve y
Translation -ve x and -ve y
Translation +ve x and +ve y
Translation +ve x and -ve y
Transforming Graphs Quadratic (2): Mixture

Transforming Graphs · Transformations descriptions

AS 12

Translation (+ve y)
Translation (-ve y)
Translation (-ve x)
Translation (+ve x)
Reflection (x-axis)
Reflection (y-axis)

Transforming Graphs · Transformations descriptions *continued*

Stretch (parallel to the y axis)
Stretch (parallel to the x axis)
Translation -ve x and +ve y
Translation -ve x and -ve y
Translation +ve x and +ve y
Transforming Graphs Cubic (2): Mixture

Rational Functions

Rational Functions

A LEVEL 8

Express as $A + \frac{B}{ax \pm b}$
Express as $A + \frac{B}{ax \pm b}$
Express as $Ax + B + \frac{C}{ax \pm b}$
Express as $\frac{a}{bx \pm c} \pm \frac{d}{ex \pm f}$
Express as $\frac{a}{(bx \pm c)^2} \pm \frac{d}{bx \pm c}$
Express as $\frac{a}{bx + c} \pm \frac{d}{bx - c}$
Express as $\frac{a}{(bx \pm c)^2} \pm \frac{d}{bx \pm c} \pm \frac{e}{gx \pm h}$
Rational Functions : Mixture

Modulus Functions

Equations

A LEVEL 11

: $|ax| = b$
: $|x \pm a| = b$
: $|a - x| = b$
: $|ax \pm b| = c$
: $|b - ax| = c$
: $b \pm |ax \pm c = d$
: $a|bx \pm c| \pm d = e$
: $a|x| \pm b = c|x| \pm d$
: $|ax \pm b| = |cx \pm d|$
: $|ax \pm b| = |d - cx|$
Modulus Functions - equations: Mixture

Inequalities

A LEVEL 11

: $|ax| <> b$
: $|x \pm a| <> b$
: $|a - x| <> b$
: $|ax \pm b| <> c$
: $|b - ax| <> c$
: $b \pm |ax \pm c <> d$
: $a|bx \pm c| \pm d <> e$
: $a|x| \pm b <> c|x| \pm d$
: $|ax \pm b| <> |cx \pm d|$
: $|ax \pm b| <> |d - cx|$
Modulus Functions - Inequalities :Mixture

Functions

Largest domain

A LEVEL 8

Largest domain : $f(x) = ax^n + bx^{n-1}$..
Largest domain : $f(x) = \sqrt{x \pm a}$
Largest domain : $f(x) = \frac{x \pm a}{x \pm b}$
Largest domain : $f(x) = \frac{1}{x \pm a}$
Largest domain : $f(x) = \frac{1}{\sqrt{x \pm a}}$
Largest domain : $f(x) = \frac{1}{ax^2 \pm bx \pm c}$
Largest domain : $f(x) = \frac{1}{\sqrt{x - a}}$
Largest domain : Mixture

Largest range

A LEVEL 10

Largest range : $f(x) = \pm ax^2$
Largest range : $f(x) = (x \pm a)^2)$
Largest range : $f(x) = x^2 \pm a$
Largest range : $f(x) = a - x^2$
Largest range : $f(x) = \sqrt{x \pm a}$

Largest range *continued*

Largest range : $f(x) = \frac{a}{x}$
Largest range : $f(x) = \frac{a}{x^2}$
Largest range : $f(x) = \pm ae^{\pm bx}$
Largest range : $f(x) = a\ln(\mathrm{bx})$
Largest range : Mixture

Range for a given domain

A LEVEL 11

Find the range : $y = ax + b$
Find the range : $y = b - ax$
Find the range : $y = x^2 \pm c$
Find the range : $y = a - x^2$
Find the range : $y = ax^2 \pm c$
Find the range : $y = b - ax^2$
Find the range : $y = ax^2 \pm bx$
Find the range : $y = bx - ax^2$
Find the range : $y = \frac{a}{x}$
Find the range : $y = \frac{a}{x^2}$
Range for a given domain : Mixture

Composite functions · Finding $fg(x)$ and $gf(x)$

A LEVEL 14

$fg(x) : f(x) = ax \pm b$ and $g(x) = cx \pm d$
$gf(x) : f(x) = ax \pm b$ and $g(x) = cx \pm d$
$gf(x) : f(x) = a \pm bx$ and $g(x) = cx \pm d$
$f^2(x) : f(x) = ax \pm b$
$fg(x) : f(x) = x^2$ and $g(x) = ax \pm b$
$gf(x) : f(x) = x^2$ and $g(x) = ax \pm b$
$fg(x) : f(x) = ax^2$ and $g(x) = bx \pm c$
$gf(x) : f(x) = ax^2$ and $g(x) = bx \pm c$
$fg(x) : f(x) = x^2 \pm a$ and $g(x) = x \pm b$
$gf(x) : f(x) = x^2 \pm a$ and $g(x) = x \pm b$
$fg(x) : f(x) = a \pm bx$ and $g(x) = cx \pm d$
$f^2(x) : f(x) = x^2 \pm b$
$f^2(x) : f(x) = ax^2 \pm b$
Composite functions (1): Mixture

Composite functions · Finding $fg(x \pm n)$ and $gf(x \pm n)$

A LEVEL 11

$fg(x \pm n) : f(x) = ax \pm b$ and $g(x) = cx \pm d$
$gf(x \pm n) : f(x) = ax \pm b$ and $g(x) = cx \pm d$
$fg(x \pm n) : f(x) = a \pm bx$ and $g(x) = cx \pm d$
$gf(x \pm n) : f(x) = a \pm bx$ and $g(x) = cx \pm d$
$fg(x \pm n) : f(x) = x^2$ and $g(x) = ax \pm b$
$gf(x \pm n) : f(x) = x^2$ and $g(x) = ax \pm b$
$fg(x \pm n) : f(x) = ax^2$ and $g(x) = bx \pm c$
$gf(x \pm n) : f(x) = ax^2$ and $g(x) = bx \pm c$
$fg(x \pm n) : f(x) = x^2 \pm a\ g(x) = x \pm b$
$gf(x \pm n) : f(x) = x^2 \pm a\ g(x) = x \pm b$
Composite functions (2) : Mixture

Composite functions · Solving equations involving $fg(x) = n$ and $gf(x) = n$

A LEVEL 11

$fg(x) = n : f(x) = ax^2 \pm b\ g(x) = x \pm c$
$fg(x) = n : f(x) = ax \pm b\ g(x) = x^2 \pm c$
$fg(x) = n : f(x) = \frac{a}{x}\ g(x) = \frac{x \pm b}{x}$
$gf(x) = n : f(x) = \sqrt{x \pm a}\ g(x) = bx^2 \pm c$
$fg(x) = n : f(x) = \frac{a}{x}\ g(x) = c \pm bx$
$gf(x) = n : f(x) = \frac{a}{x}\ g(x) = c \pm bx$
$f^2(x) = n : f(x) = \frac{x \pm a}{x}$
$fg(x) = n : f(x) = \ln x\ g(x) = ax \pm b$
$gf(x) = n : f(x) = \ln x\ g(x) = ax \pm b$
$gf(x) = n : f(x) = e^x\ g(x) = ax^2 \pm b$
Composite functions - solving equations : Mixture

Inverse functions

A LEVEL 7

Find $f^{-1}(x) : f(x) = \frac{a}{x \pm d}$
Find $f^{-1}(x) : f(x) = \frac{ax}{x \pm d}$
Find $f^{-1}(x) : f(x) = \frac{ax \pm b}{cx \pm d}$
Find $f^{-1}(x) : f(x) = \sqrt{ax \pm b}$
Find $f^{-1}(x) : f(x) = a\ln(ax \pm b)$
Find $f^{-1}(x) : f(x) = ae^{bx} \pm c$
Inverse functions : Mixture

02 A LEVEL MATHS Coordinate Geometry

2 topics
26 structures

Straight line graphs

Equations of lines

AS 19

Gradient and intercept :$y =$
Gradient and intercept :rearranging needed
Finding the equation : gradient and $0, a)$
Finding the equation : gradient and (a, b)
Finding the equation : (a, b) and $(0, c)$
Finding the equation : (a, b) and (c, d)
Writing in the form: $ax + by = c$
Parallel line - (0,a)
Parallel line - (0,a) (rearranging)
Parallel line - (a,b)
Parallel line - (a,b)(rearranging)
Perpendicular line - (0,a)
Perpendicular line - (0,a) (rearranging)
Perpendicular line - (a,b)

Equations of lines *continued*

Perpendicular line - (a,b) (rearranging)
Finding the equation - perpendicular line
Finding the equation - perpendicular bisector
Finding the area of a triangle
Equations of lines : Mixture

Circles

Circles

AS 7

Finding the centre of a circle
Finding the diameter of a circle
Finding the centre and radius
Finding the tangent to a circle
Tangent to a circle (centre not at origin)
Tangent to a circle (expanded form)
Circles : Mixture

03 A LEVEL MATHS Binomial

2 topics
22 structures

Expanding

Expanding — AS 13

Binomial expanding : $(1+x)^n$
Binomial expanding : $(1-x)^n$
Binomial expanding : $(a+x)^n$
Binomial expanding : $(a-x)^n$
Binomial expanding : $(x+a)^n$
Binomial expanding : $(x-a)^n$
Binomial expanding :$(1+ax)^n$
Binomial expanding :$(1-ax)^n$
Binomial expanding :$(a+bx)^n$
Binomial expanding :$(a-bx)^n$
Binomial expanding :$(ax+b)^n$
Binomial expanding :$(ax-b)^n$
Binomial expanding (1) : Mixture

Coefficients and Specific terms

Finding Coefficients and Specific terms · Coefficients and Specific terms — AS 9

Binomial finding specific terms : $(1+bx)^n$
Binomial finding specific terms $(1-bx)^n$
Binomial finding b : $(1+bx)^n$
Binomial finding b : $(1-bx)^n$
Binomial finding specific terms : $(a+bx)^n$
Binomial finding specific terms: $(a-bx)^n$
Binomial finding b : $(a+bx)^n$
Binomial finding b : $(a-bx)^n$
Binomial - Finding Coefficients : Mixture

04 A LEVEL MATHS Trigonometry

14 topics
156 structures

Exact Values and non-calculator

Exact Values and non-calculator — AS 6

Stating exact values in the range 0 to 360
Given that - find ratio for an acute angle
Given that - find ratio for an obtuse angle
Given that - find ratio for a reflex angle
Given that - mixture
Trigonometry - Exact values : Mixture

Solving Equations

Solving Equations — AS 29

$\sin\theta = \pm b, (0^o - 360^o)$
$a\cos\theta = \pm b, (0^o - 360^o)$
$a tan\theta = \pm b, (0^o - 360^o)$
Mixture (1 - 3)
$\sin\theta = \pm b, (-180^o - 180^o)$
$a\cos\theta = \pm b, (-180^o - 180^o)$
$a tan\theta = \pm b, (-180^o - 180^o)$
Mixture (1 - 7)
$\cos^2\theta = b, (0^o - 360^o)$
$\tan^2\theta = b, (0^o - 360^o)$
Mixture 10-12
Mixture (1-12)
$\sin^2\theta = b, (-180^o - 180^o)$
$\cos^2\theta = b, (-180^o - 180^o)$
$\tan^2\theta = b, (-180^o - 180^o)$
Mixture (15 - 17)
$sina\theta = b, (0^o - 360^o)$
$\cos a\theta = b, (0^o - 360^o)$
$\tan a\theta = b, (0^o - 360^o)$
$\sin a\theta = b, (-180^o - 180^o)$
$\cos a\theta = b, (-180^o - 180^o)$
$\tan a\theta = b, (-180^o - 180^o)$
$\sin(\theta \pm a) = b, (0^o - 360^o)$
$\cos(\theta \pm a) = b, (0^o - 360^o)$
$\tan(\theta \pm a) = b, (0^o - 360^o)$

Solving Equations *continued*

$\sin(\theta \pm a) = b, (-180^o - 180^o)$
$\cos(\theta \pm a) = b, (-180^o - 180^o)$
$\tan(\theta \pm a) = b, (-180^o - 180^o)$
Trigonometry - Solving equations (1) : Mixture

Solving equations - using identities — AS 21

$asin\theta = b\cos\theta\ (0^o - 360^o)$
$a\sin^2\theta \pm b\sin\theta \pm c = 0\ (0^o - 360^o)$
$a\cos^2\theta \pm b\cos\theta \pm c = 0\ (0^o - 360^o)$
$a\tan^2\theta \pm b\tan\theta \pm c = 0\ (0^o - 360^o)$
$a\cos^2\theta \pm b\sin\theta \pm c = 0\ (0^o - 360^o)$
$a\sin^2\theta \pm b\cos\theta \pm c = 0\ (0^o - 360^o)$
$a\cos^2\theta = b\sin\theta \pm c\ (0^o - 360^o)$
$a\sin^2\theta = b\cos\theta \pm c\ (0^o - 360^o)$
$a\cos^2\theta \pm b\cos\theta \pm c = d\sin^2\theta\ (0^o - 360^o)$
$a\sin^2\theta \pm b\sin\theta \pm c = d\cos^2\theta\ (0^o - 360^o)$
$a\sin\theta = b\cos\theta, (-180^o - 180^o)$
$a\sin^2\theta + b\sin\theta + c = 0\ (-180^o - 180^o)$
$a\cos^2\theta + b\cos\theta + c = 0\ (-180^o - 180^o)$
$a\tan^2\theta + b\tan\theta + c = 0\ (-180^o - 180^o)$
$a\cos^2\theta - b\sin\theta - c = 0\ (-180^o - 180^o)$
$a\sin^2\theta - b\cos\theta - c = 0\ (-180^o - 180^o)$
$a\cos^2\theta = \pm b\sin\theta \pm c\ (-180^o - 180^o)$
$a\cos^2\theta = \pm b\sin\theta \pm c\ (-180^o - 180^o)$
$a\sin^2\theta \pm b\sin\theta \pm c = d\cos^2\theta$
Solving :$a\cos^2\theta \pm b\cos\theta \pm c = d\sin^2\theta$
Trigonometry - Solving equations (2) : Mixture

Solving Equations - radians — A LEVEL 13

Identify the period and amplitude
$\sin\cos\tan\theta\ (range\ 0\ to\ 2\pi)$
$\sin\cos\tan\theta\ (range\ -\pi\ to\ \pi)$
$\sin a\theta$
$\cos a\theta$
$\tan a\theta$
$\sin(\theta \pm \frac{\pi}{n})$
$\cos(\theta \pm \frac{\pi}{n})$

Solving Equations - radians *continued*

$\tan(\theta \pm \frac{\pi}{n})$
$\sin(a\theta \pm \frac{\pi}{n})$
$\cos(a\theta \pm \frac{\pi}{n})$
$\tan(a\theta \pm \frac{\pi}{n})$
Trigonometry Equations : Mixture

Solving Equations - double angle & reciprocals
A LEVEL 17

$a\sin 2x = b\sin x$
$a\sin 2x + b\sin x = 0$
$a\sin 2x = b\cos x$
$a\sin 2x + b\cos x = 0$
$a\cos 2x - b\sin^2 x = c$
$a\cos 2x + b\cos^2 x = c$
$a\sin 2x = b\tan x$
$a\cos^2 x - b\cos 2x = c$
$a\sin^2 x - b\cos 2x = c$
$a\sin 2x \cos x = b\sin x$
$\operatorname{cosec} x = a$
$\sec x = a$
$\cot x = a$
$a\cot^2\theta + b = c\operatorname{cosec}\theta$
$a\tan^2\theta + b\sec\theta = c$
$a\sec^2\theta + b\tan\theta = c$
Double angle & reciprocals : Mixture

Sine and Cosine Rules

Sine Rule
AS 8

Sine rule - calculating an angle
Sine rule - calculating an angle
Sine rule - calculating an angle (mix)
Sine rule- calculating sides
Sine rule- calculating sides
Sine rule- calculating sides (mix)
Sine rule - calculating angles and sides
Sine Rule : Mixture

Cosine Rule
AS 4

Cosine rule - calculating an angle
Cosine rule - calculating sides
Cosine rule - calculating angles and sides
Cosine Rule : Mixture

Mixture
AS 4

Sine and cosine rules calculating sides
Sine and cosine rules calculating an angle
Sine and cosine rules mixture
Sine & cosine rule : Mixture

Area of a triangle

Area of a triangle
AS 7

Calculating the area
Calculating the area
Calculating the area (1 & 2)
Calculating an angle
Calculating a side
Side and angle mixture
Area of a triangle : Mixture

Radians, Sectors, Segments

Radians
A LEVEL 5

Degrees to radians (exact)
Radians to degrees (exact)
Degrees to radians (2 d.p.)
Radians to degrees (2 d.p.)
Radians - Mixture

Sectors and Segments
A LEVEL 10

Arc length of a sector (exact)
Perimeter of a sector (exact)
Area of a sector (exact)
Angle of a sector - area known
Radius of a sector - area known
Perimeter of a sector- area known
Perimeter of a sector- area known
Calculate the area of a segment
Calculate the perimeter of a segment
Sectors and Segments : Mixture

Small Angle Approximations

Small Angle Approximations
A LEVEL 12

$a\cos\theta\cos b\theta$
$\cos\theta\cos b\theta$
$\cos a\theta\cos\frac{b}{\theta}$
$\cos a\theta(1 \pm b\sin\theta)$
$\cos a\theta(1 \pm \sin b\theta)$
$\cos a\theta(1 \pm \sin b\theta)^2$
$(1 \pm \cos a\theta)(\tan b\theta \pm 1)^2$
$\frac{1-\cos a\theta}{\sin b\theta}$
$\frac{\theta^2 \pm \cos a\theta \pm 1}{\sin b\theta}$
$\frac{\sin^2 a\theta + \cos^2 b\theta}{tanc\theta}$
$\frac{1-\cos a\theta}{b\theta a\sin c\theta}$
Small Angle Approximations : Mixture

Addition Formulae

Using Addition Formulae
A LEVEL 15

Express $\sin(x \pm \theta)$ as $a\sin x \pm b\cos x$
Express $\cos(x \pm \theta)$ as $a\cos x \pm b\sin x$
Max $a\sin x\cos\theta + a\cos x\sin\theta$
Max $a\sin x\cos\theta - a\cos x\sin\theta$
Max $a\cos x\cos\theta + a\sin x\sin\theta$
Max $a\cos x\cos\theta - a\sin x\sin\theta$
Min $a\sin x\cos\theta + a\cos x\sin\theta$
Min $a\sin x\cos\theta - a\cos x\sin\theta$
Min $a\cos x\cos\theta + a\sin x\sin\theta$
Min $a\cos x\cos\theta - a\sin x\sin\theta$
$R\sin(x + \theta)$
$R\sin(x - \theta)$
$R\cos(x + \theta)$
$R\cos(x - \theta)$
Addition Formulae : Mixture

Using known ratios

Using known ratios
A LEVEL 5

$\tan\theta$ known find $\sec\theta$
$\operatorname{cosec}\theta$ known find $\cot\theta$
$\cot\theta$ known find $\sec\theta$
$\cot\theta$ known find $\operatorname{cosec}\theta$
Using known ratios : Mixture

05 A LEVEL MATHS Exponentials and Logarithms

2 topics
35 structures

Simplifying

Simplifying — AS — 20

Expressing as $log_a x$: $log_a m + log_a n$
Expressing as $log_a x$: $log_a m - log_a n$
Expressing as $log_a x$: $nlog_a m$
Expressing as $log_a x$: Mix (1 to 3)
Expressing as $log_a x$: $\frac{1}{m}log_a n + log_a p$
Expressing as $log_a x$: $\frac{1}{m}log_a n + plog_a q$
Expressing as $log_a x$: $nlog_a m - \frac{1}{q}log_a r$
Expressing as $log_a x$: $nlog_a m - \frac{p}{q}log_a r$
Expressing as $log_a x$: $log_a \frac{1}{m} + \frac{1}{p}log_a \sqrt{r}$
Expressing as $log_a x$: $log_a \frac{1}{m} - \frac{1}{p}log_a \sqrt{r}$
Expressing as $log_a x$: Mix (5-10)
Expressing as $nlog_a x$: $log_a x^n$
Expressing as $nlog_a x$: $\frac{1}{m}log_a x^n$
Expressing as $nlog_a x$: $\frac{1}{m}log_a \frac{1}{x^n}$
Expressing as $nlog_a x$: $nlog_a \frac{1}{\sqrt[m]{x}}$
Expressing as $nlog_a x$: $log_a x^m + log_a x^n$
Expressing as $nlog_a x$: $log_a \frac{1}{x^m} + log_a \frac{1}{x^n}$
Expressing as $nlog_a x$: $log_a \frac{1}{x^m} - log_a \frac{1}{x^n}$

Simplifying *continued*

Expressing as $nlog_a x$: Mixture (12 to 18)
Simplifying : Mixture

Solving equations

Solving equations — AS — 15

$log_a b = x$
$log_a \frac{1}{b} = x$
Mixture (1 & 2)
$log_x a = b$
$a^{bx} = c$
$a^{x+b} = c$
$a^{bx+c} = d$
Solving :$e^{ax} = b$
$e^{x \pm a} = b$
$e^{ax \pm b} = c$
$a^{x \pm b} = c^{x \pm d}$
$\log_m(ax \pm b) = 1$
$\log_m(ax \pm b) - \log_m(cx \pm d) = 1$
$\log_m(ax \pm b) + log_m(x \pm d) = 1$
Solving Mixture

06 A LEVEL MATHS Differentiation

9 topics
125 structures

Basic differentiation

Basic differentiation — AS — 23

Differentiation :ax
Differentiation : x^n
Differentiation : x^{-n}
Differentiation : ax^n
Differentiation : ax^{-n}
Differentiation : $x^{\frac{m}{n}}$
Differentiation : $x^{-\frac{m}{n}}$
Differentiation : $ax^{\frac{m}{n}}$
Differentiation :$ax^{-\frac{m}{n}}$
Differentiation : $y = mx \pm c$
Differentiation : $y = mx^2 \pm c$
Differentiation : $y = ax^2 \pm bx$
Differentiation : $y = ax^2 \pm bx \pm c$
Differentiation : $y = ax^3 \pm c$
Differentiation : $y = ax^3 \pm bx$
Differentiation : $y = ax^3 \pm bx \pm c$
Differentiation : $y = ax^3 \pm bx^2$
Differentiation : $y = ax^3 \pm bx^2 \pm d$
Differentiation : $y = ax^3 \pm bx^2 \pm cx$
Differentiation : $y = ax^3 \pm bx^2 \pm cx \pm d$
Differentiation : $y = (x \pm a)(x \pm b)$
Differentiation : $y = (ax \pm c)(bx \pm d)$
Basic differentiation : Mixture

Finding the gradient

Finding the gradient — AS — 14

Find the gradient : $y = mx \pm c$
$y = ax^2 \pm c$

Finding the gradient *continued*

$y = ax^2 \pm bx$
$y = ax^2 \pm bx \pm c$
$y = ax^3 \pm c$
$y = ax^3 \pm bx$
$y = ax^3 \pm bx \pm c$
$y = ax^3 \pm bx^2$
$y = ax^3 \pm bx^2 \pm c$
$y = ax^3 \pm bx^2 \pm cx$
$y = ax^3 \pm bx^2 \pm cx \pm d$
Find the point $y = ax^2 \pm bx$
Find the point $y = ax^2 \pm bx \pm c$
Finding the gradient : Mixture

Stationary points

Stationary points — AS — 2

Stationary point : $y = ax^3 \pm bx^2 \pm cx \pm d$
Mixture

Exponenial and ln

Exponenial and ln — A LEVEL — 12

Differentiation: $y = ae^x$
Differentiation : $y = ae^{x \pm b}$
Differentiation : $y = \text{asin } x$
Differentiation : $y = \text{acos } x$
Differentiation : $y = atanx$
Differentiation : $y = alnx$
Differentiation : $y = alnx^n$
Differentiation: $y = alnx \pm be^x$ find gradient
Differentiation : $y = a \pm be^x$ find x

Exponenial and ln *continued*

Differentiation : $y = x^2 - alnx$ find x
Differentiation : $y = \frac{a}{x} + blnx$ find x
Differentiation - exponenial & ln : Mixture

Chain rule

Chain rule - single

A LEVEL 21

Chain Rule: $y = ae^{bx}$
Chain Rule: $y = ae^{bx \pm c}$
Chain Rule: $y = ae^{c-bx}$
Chain Rule: $y = \frac{e^{ax} \pm b}{e^{cx}}$
Chain Rule: $y = (e^{ax} \pm b)(e^{cx} \pm d)$
Chain Rule: $y = (e^{ax} \pm b)(e^{-cx} \pm d)$
Chain Rule: $y = (ax \pm b)^n$
Chain Rule: $y = (ax^2 \pm b)^n$
Chain Rule: $y = (ax^2 \pm bx)^n$
Chain Rule: $y = (ax^2 \pm b)^{-n}$
Chain Rule: $y = (ax^2 \pm bx)^{-n}$
Chain Rule: $y = (ae^{bx} \pm cx)^{-n}$
Chain Rule: $y = \text{asin}\,(bx \pm c)$
Chain Rule: $y = \text{asin}\,(bx^2 \pm c)$
Chain Rule: $y = \text{acos}\,(bx \pm c)$
Chain Rule: $y = \text{acos}\,(bx^2 \pm c)$
Chain Rule: $y = \tan\,(bx \pm c)$
Chain Rule: $y = \tan\,(bx^2 \pm c)$
Chain Rule: $y = \sqrt{ax \pm b}$
Chain Rule: $y = \sqrt{ax^2 \pm bx}$
Differentiation Chain Rule (1): Mixture

Chain rule - twice

A LEVEL 11

Chain Rule: $y = sin^n ax$
Chain Rule: $y = \cos^n ax$
Chain Rule: $y = \sin\,(lnax^n)$
Chain Rule: $y = \cos\,(lnax^n)$
Chain Rule: $y = ln(\text{asin}\,bx)$
Chain Rule: $y = ln(\text{acos}\,bx)$
Chain Rule: $y = (ln\ ax)^n$
Chain Rule: $y = e^{\sqrt{ax \pm b}}$
Chain Rule: $y = \sin^n\sqrt{ax}$
Chain Rule: $y = \cos^n\sqrt{ax}$
Differentiation Chain Rule (2): Mixture

Product Rule

Product Rule

A LEVEL 16

Product Rule: $y = ax^n(bx \pm c)^m$
Product Rule: $y = ax^n\sqrt{bx \pm c}$
Product Rule: $y = (ax \pm b)^n(cx \pm d)^m$

Product Rule *continued*

Product Rule: $y = e^{ax}(cx \pm d)^m$
Product Rule: $y = ax^n \sin bx$
Product Rule: $y = ax^n cosbx$
Product Rule: $y = ax^n \tan bx$
Product Rule: $y = ax^n e^{bx}$
Product Rule: $y = ax^n lnbx$
Product Rule: $y = ax^n ln(bx \pm c)$
Product Rule: $y = e^{ax} lnbx$
Product Rule: $y = e^{ax} \sin bx$
Product Rule: $y = e^{ax} \cos bx$
Product Rule: $y = e^{ax} \tan bx$
Product Rule: $y = \sin ax \tan bx$
Differentiation - Product Rule : Mixture

Quotient Rule

Quotient Rule

A LEVEL 13

Quotient Rule: $y = \frac{ax}{bx \pm c}$
Quotient Rule: $y = \frac{ax \pm b}{cx \pm d}$
Quotient Rule: $y = \frac{(ax \pm b)^n}{cx \pm d}$
Quotient Rule: $y = \frac{\sqrt{ax \pm b}}{cx}$
Quotient Rule: $y = \frac{\sqrt{ax \pm b}}{cx \pm d}$
Quotient Rule: $y = \frac{ax^n}{\sqrt{cx \pm d}}$
Quotient Rule: $y = \frac{ax^2 \pm b}{cx \pm d}$
Quotient Rule: $y = \frac{ax \pm b}{cx^2 \pm d}$
Quotient Rule: $y = \frac{lnx}{bx \pm c}$
Quotient Rule: $y = \frac{lnax}{bx^2 \pm c}$
Quotient Rule: $y = \frac{e^{ax}}{bx \pm c}$
Quotient Rule: $y = \frac{e^{ax}}{\sqrt{bx \pm c}}$
Differentiation - Quotient Rule : Mixture

Implicit

Implicit Differentiation

A LEVEL 13

: $ax^2 \pm by^2 = c$
$ax^n \pm by^m = c$
$ay^n \pm bxy = c$
$ax^n y \pm bxy^m = c$
$\frac{ax \pm y}{bx \pm y} = cy$
$\frac{ax \pm y}{bx \pm y} = cx$
$axe^y \pm ylny = cx^n$
$axe^y \pm bylny = cx^n$
$\frac{ay^n}{bxy \pm c} = d$
$\frac{ax^n}{bxy \pm c} = d$
$y = a^x$
$y = a^{bx \pm c}$
Implicit Differentiation : Mixture

07 A LEVEL MATHS Integration

6 topics
97 structures

Basic Integration

Indefinite integration

AS 19

Integration ax
Integration ax^2
Integration ax^{-n}
Integration $x^{\frac{m}{n}}$
Integration $x^{-\frac{m}{n}}$
Integration $ax^{\frac{m}{n}}$
Integration $ax^{-\frac{m}{n}}$

Indefinite integration *continued*

Integration $ax \pm b$
Integration $ax^2 \pm b$
Integration $ax^2 \pm bx$
Integration $ax^2 \pm bx \pm c$
Integration $ax^3 \pm b$
Integration $ax^3 \pm bx$
Integration $ax^3 \pm bx \pm c$
Integration $ax^3 \pm bx^2$
Integration $ax^3 \pm bx^2 \pm c$

Indefinite integration *continued*

Integration $ax^3 \pm bx^2 \pm cx$
Integration $ax^3 \pm bx^2 \pm cx \pm d$
Stationary points : Mixture

Definite Integration AS 9

Find the function through a given point
Definite Integration $ax \pm b$
Definite Integration $ax^2 \pm bx$
Definite Integration $ax^2 \pm bx \pm c$
Definite Integration
Definite Integration
Definite Integration
Definite Integration
Definite Integration : Mixture

Integration - inspection / substitution

Integration -inspection / substitution A LEVEL 21

Integration : ae^{bx}
Integration : $ae^{bx \pm c}$
Integration : $\frac{a}{x}$
Integration : $\frac{1}{ax}$
Integration : $\frac{a}{bx}$
Integration : $\frac{1}{ax \pm b}$
Integration : $\frac{a}{bx \pm c}$
Integration : $\frac{a}{b - cx}$
Integration : $(ax \pm b)^n$
Integration : $(a - bx)^n$
Integration : $\frac{1}{(ax+b)^n}$
Integration : $\frac{1}{(a-bx)^n}$
Integration : $\frac{ax}{bx^2 \pm c}$
Integration : $\frac{ax}{b - cx^2}$
Integration : $ax(bx^2 \pm c)^n$
Integration : $ax(c - bx^2)^n$
Integration : $\frac{ax}{(bx^2+c)^n}$
Integration : $\frac{ax}{(c-bx^2)^n}$
Integration : $\frac{ax}{(\sqrt{bx^2+c})^n}$
Integration : $\frac{ax}{\sqrt{c-bx^2}}$
Integration - inspection/substitution : Mixture

Integration - Trig functions

Integration - Trig functions A LEVEL 23

Integration : $sinax$
Integration : $\cos ax$
Integration : $\sec^2 ax$
Integration : $\sin(ax \pm b)$
Integration : $\cos(ax \pm b)$

Integration - Trig functions *continued*

Integration : $\sec^2(ax \pm b)$
Integration : $\sin(a - bx)$
Integration : $\cos(a - bx)$
Integration : $\sec^2(a - bx)$
Integration : $ax\sin(bx^2 \pm c)$
Integration : $ax\cos(bx^2 \pm c)$
Integration : $ax\sec^2(bx^2 \pm c)$
Integration : $a\sin^n x\cos x$
Integration : $a\cos^n x\sin x$
Integration : $a\sin^n bx\cos bx$
Integration : $a\cos^n bx\sin bx$
Integration : $\frac{\sin ax}{\cos^a x}$
Integration : $\frac{\cos ax}{\sin^n ax}$
Integration : $\frac{\tan ax}{\sec^n ax}$
Integration : $a\sin bx\cos bx$
Integration : $a\cos^2 bx$
Integration : $a\sin^2 bx$
Integration - Trig functions : Mixture

Integration By Parts

Integration By Parts - single A LEVEL 20

Integration : $axsinx$
Integration : $ax\cos x$
Integration : $ax\sin bx$
Integration : $ax\cos bx$
Integration : $ax\sin(bx \pm c)$
Integration : $ax\cos(bx \pm c)$
Integration : $(ax \pm b)\sin cx$
Integration : $(ax \pm b)\cos cx$
Integration : axe^x
Integration : axe^{-x}
Integration : axe^{bx}
Integration : axe^{-bx}
Integration : $(ax \pm b)e^{cx}$
Integration : $(ax \pm b)e^{-cx}$
Integration : $alnx$
Integration : lnx^a
Integration : $axlnx$
Integration : $ax^n lnx$
Integration : $ax^{-n} lnx$
Integration By Parts (1): Mixture

Integration By Parts - double A LEVEL 5

Integration : $ax^2 e^{bx}$
Integration : $ax^2 e^{-bx}$
Integration : $ax^2 sinbx$
Integration : $ax^2 cosbx$
Integration By Parts (2) : Mixture

08 A LEVEL MATHS Terminology

2 topics
3 structures

Terminology AS 1

AS Level Pure

Terminology A LEVEL 2

A Level Pure
Mixture

09 A LEVEL MATHS Vectors

1 topics
11 structures

Vectors · AS · 11

Vectors Simplifying
Vectors: finding missing values
Vectors: finding missing values
Vectors: finding the modulus
Vectors: finding the magnitude A
Vectors: finding the magnitude B

Vectors *continued*

Vectors: finding unit vectors
Vectors: angle with $\mathbf{i}$
Vectors: angle with $\mathbf{j}$
Vectors: Simplifying
Vectors : Mixture

10 A LEVEL MATHS Mechanics

27 topics
350 structures

Kinematics

Constant acceleration-Using Graphs · Using Graphs · AS · 6

Using graphs - calculating time
Using graphs - calculating distance(1)
Using graphs - calculating distance(2)
Using graphs - calculating distance(3)
Using graphs - calculating distance(4)
Using graphs - mixed questions

Using formulae for contant acceleration · SUVAT Problems (1) · AS · 24

$v = u + at$: finding v
$v = u + at$: finding a
$v = u + at$: finding u
$v = u + at$: finding t
$v = u + at$: mixture
$s = ut + \frac{1}{2}at^2$: finding s
$s = ut + \frac{1}{2}at^2$: finding u
$s = ut + \frac{1}{2}at^2$: finding a
$s = ut + \frac{1}{2}at^2$: finding t
$s = ut + \frac{1}{2}at^2$: mixture
$v^2 = u^2 + 2as$: finding v
$v^2 = u^2 + 2as$: finding u
$v^2 = u^2 + 2as$: finding a
$v^2 = u^2 + 2as$: finding s
$v^2 = u^2 + 2as$: mixture
$s = \frac{1}{2}(u + v)t$: finding s
$s = \frac{1}{2}(u + v)t$: finding u
$s = \frac{1}{2}(u + v)t$: finding v
$s = \frac{1}{2}(u + v)t$: finding t
$s = \frac{1}{2}(u + v)t$: mixture
$s = vt - \frac{1}{2}at^2$: finding s
Mixed formulae - finding the subject
Mixed formulae - finding any variable
SUVAT (1) : Mixture

Vertical Motion · Vertical Motion · AS · 10

Finding the maximium height
Finding the time of flight
Finding the initial velocity
Finding the time above h
Finding the height above a point
Finding the height of projection point
Finding the distance travelled
Finding the time (2 balls)

Vertical Motion · Vertical Motion *continued*

Finding the height (2 balls)
Vertical Motion : Mixture

Using formulae for contant acceleration · SUVAT Problems (2) · AS · 11

Car - distance travelled
Bus - time taken to stop
Car - stopping distance
Particle - distance travelled (1)
Particle - distance travelled (2)
Particle - total time
Train - distance between stations
Car chase - time to catch
Car chase - speed when caught
Car chase - distance covered
SUVAT Mixture (2): Mixture

Non-Uniform acceleration · Displacement equations · AS · 14

s given (cubic) - displacement
s given (cubic) - initial velocity
s given (cubic) - velocity
s given (cubic) - acceleration (when v = 0)
s given (quartic) - initial velocity
s given (quartic) - acceletation
s given (quartic) - time acceletation = 0
Finding equation for s
Finding equation for s - velocity
Finding equation for s - time
Finding equation for s - time
Two particles - distance between
Two particles - difference - velocity
Displacement: Mixture

Non-Uniform acceleration · Velocity and acceleration equations · AS · 7

v given (quadratic) - displacement
v given (quadratic) - displacement
a given (linear) - displacement
a given (quadratic) - velocity
a given (quadratic) - displacement
a given (quadratic) - displacement (v = 0)
Velocity & acceleration : Mixture

Non-Uniform acceleration · Minimum and Maximum problems

AS 11

s given - maximum displacement
s given - maximum velocity
s given - maximum acceleration
v given - maximum velocity
v given - maximum acceleration
a given - maximum acceleration
Boomerang - maximum displacement
Rocket launch - maximum velocity
Rocket launch - maximum height
Journey - maximum velocity
Min & Max : Mixture

Velocity (magnitude and direction)

A LEVEL 10

Components from speed and angle
Components - vertical projection
Speed from i,j components
Components from km/h with angle α
Speed and direction from components
Magnitude direction (negative component)
Resultant of two velocity vectors
Direction from symbolic components
Bearing from velocity components
Velocity : Mixture

Constant acceleration – Projectiles

A LEVEL 14

Projectile - maximum height
Projectile - time to max height
Projectile - time of flight
Projectile - range
Projectile - position at time t
Projectile - speed or components at time t
Projectile - speed at max height
Horizontal projection from a cliff
Projectile - speed on landing
Projectile from cliff - time or range
Projectile - height - horizontal distance
Projectile - angle from range
Projectile - height on hitting a wall
Projectiles : Mixture

Working with vectors

A LEVEL 12

Speed from velocity vector
Direction of motion from velocity
Velocity after t (constant a)
Position vector after t
Time when at rest (constant a)
Time when velocity parallel to a vector
Relative velocity
Time when velocity perpendicular to vector
Distance from origin
Acceleration from u and v
Acceleration from velocity vector
Working with vectors : Mixture

Non-uniform acceleration (2 dimensions)

A LEVEL 14

Magnitude of acceleration
Acceleration from v(t)
Velocity from r(t)
Acceleration from r(t)
Speed at time t from v(t)
Position from v(t)
Velocity from a(t)
Time when particle at rest
Position when at rest
Time when v parallel to vector
Speed when a perpendicular to v
Distance from origin at t

Non-uniform acceleration (2 dimensions) *continued*

Position from v(t) - find unknown coordinate
Non-uniform acceleration (2 dimensions) : Mixture

Forces as Vectors

Forces as Vectors

AS 9

Finding the magnitude $ai + bj$ N
Finding the direction $ai + bj$ N
Finding the magnitude $\begin{pmatrix} 2 \\ 4 \end{pmatrix}$
Finding the direction $\begin{pmatrix} 2 \\ 4 \end{pmatrix}$
Magnitude given - find a
Find the angle between 2 forces
Find the force - given magnitude
Find the force - magnitude = 1
Forces as Vectors : Mixture

Resultant forces

Resultant forces and equilibrium

AS 11

Resultant force $ai + bj$
Magnitude of the resultant $ai + bj$
Direction of the resultant $ai + bj$
Resultant force $\begin{pmatrix} a \\ b \end{pmatrix}$ N
Magnitude of the resultant $\begin{pmatrix} a \\ b \end{pmatrix}$ N
Direction of the resultant $\begin{pmatrix} a \\ b \end{pmatrix}$ N
3 forces in equilibrium $ai + bj$
3 forces resultant known $ai + bj$
3 forces in equilibrium $\begin{pmatrix} a \\ b \end{pmatrix}$ N
3 forces resultant known $\begin{pmatrix} a \\ b \end{pmatrix}$ N
Resultant forces : Mixture

Newtons Laws of motion

Newtons Laws of motion (1) · Newtons Laws of motion (1)

AS 7

Mass and accerleration known
Force and acceleration known
Force and mass known
Mass and accerleration known
Finding velocity after t seconds
Finding displacement after t seconds
Newtons Laws (1) : Mixture

Newtons Laws of motion (2) · Newtons Laws of motion (2)

AS 26

Block - finding velocity after $\mathrm{t\ seconds}$
Block - finding displacement after $\mathrm{t\ seconds}$
Block - finding displacement-given velocity
Block - finding mass - displacement given
Block - finding mass - velocity given
Block - finding mass - vel/disp given
Block - finding resultant - displacement given
Block - finding resultant - velocity given
Block - finding resultant - vel/disp given
Object - finding friction (1)
Object - finding friction (2)
Particle - finding velocity $u \neq 0$
String - accelerating upwards
String - accelerating downwards
Car - finding time to reach given velocity
Car - finding time to reach given velocity
Particle - finding force - change in velocity

Newtons Laws of motion (2) · Newtons Laws of motion (2) *continued*

- Particle - finding normal reaction - acc
- Particle - finding normal reaction - disp
- Particle - finding normal reaction - vel
- Particle (friction)- finding normal reaction
- Particle (friction)- finding normal reaction
- Particle (friction)- finding normal reaction
- Using $ai + bj$ N - finding speed
- Using $ai + bj$ N - finding mass
- Newtons Laws (2) : Mixture

Connected particles AS 14

- Lift - tension - at rest
- Lift - tension - accelerating down
- Lift - tension - accelerating up
- Lift - tension - constant speed
- Lift - normal R - accelerating down
- Lift - normal R - accelerating up
- Lift - normal R - constant speed
- Lift - normal R from tension
- Lift - normal R from tension
- Lift - normal R from tension
- Car / Caravan - acceleration
- Car / Caravan - tension with driving force
- Car / Caravan - tension - constant speed
- Connected particles : Mixture

Pulleys and Pegs AS 14

- Pulley-acceleration
- Pulley-tension
- Pulley-time - distance given
- Pulley-distance - time given
- Pulley-tension - time/distance given
- Pulley-mass - time/distance given
- Pulley-speed when at ground level
- Pulley-height
- Block - acceleration
- Block - tension
- Block - (friction) - tension
- Block - (friction) - acceleration (tension)
- Block - (friction) - mass (tension)
- Pulleys and Pegs : Mixture

Forces and Direction

Resolving forces A LEVEL 13

- Vertical component of weight
- Resolve weight on horizontal
- Horizontal component of a force
- Resolve force into H and V
- Angle from force and component
- Magnitude and angle from components
- Resolve force given a bearing
- Resolve weight on an incline
- Resolve horizontal force on an incline
- Resolve parallel and perpendicular to a line
- Angle between plane and vertical
- Resolve angled force on incline
- Resolving forces : Mixture

Resultant and equilibrium A LEVEL 14

- Two perpendicular forces - resultant
- Resultant of two forces - magnitude
- Resultant of two forces - direction
- Resultant of force vectors
- Three forces in equilibrium - find third
- Force to maintain equilibrium
- Equilibrium with weight - find tension

Resultant and equilibrium *continued*

- Equilibrium on smooth incline with string
- Unknown force in equilibrium
- Two strings supporting mass
- Forces in equilibrium - P and Q from diagram
- Forces in equilibrium from diagram
- Equilibrium on incline - find R and F
- Resultant & equilibrium : Mixture

Friction A LEVEL 11

- Limiting friction
- Finding the coefficient of friction
- Friction - limiting or not
- Limiting friction with vertical force
- Minimum horizontal force to move
- Minimum force at an angle to move
- Finding mu from limiting motion
- Minimum force below horizontal
- Force at an angle - about to move
- Angle at limiting motion
- Friction : Mixture

Newtons Laws A LEVEL 14

- Horizontal force on smooth surface
- Force from mass and acceleration vectors
- Mass from force and acceleration vectors
- Force at an angle - acceleration
- Vehicle - driving force and resistance
- Accelerating truck - slipping
- Resistance from deceleration
- Smooth incline - acceleration
- Lift - tension
- Lift decelerating - tension
- Normal reaction in lift
- Rough horizontal - acceleration
- Two forces - resultant acceleration
- Newtons Laws : Mixture

Friction, Inclined planes and dynamics A LEVEL 19

- Rough incline - acceleration down
- Force to hold on a rough incline
- Constant speed up a rough incline
- Force up a rough incline - acceleration
- Finding mu from motion on an incline
- Time to slide down a rough incline
- Projected up a rough incline - distance
- Acceleration up rough incline under force
- Horizontal force - acceleration up
- Horizontal force - acceleration down
- Horizontal force - time to bottom
- Horizontal force - speed at bottom
- Minimum mu to prevent sliding down
- Force at angle to plane - acceleration up
- Force at angle to plane - acceleration down
- Force at angle to plane - time to bottom
- Force at angle to plane - speed at bottom
- Projected up incline - time to return
- Inclined planes : Mixture

Connected particles and pulleys A LEVEL 11

- Rough table and hanging particle
- Incline and hanging particle
- Rough incline-hanging particle - up
- Rough incline-and hanging particle - down
- Rough incline - find M - up
- Rough incline - find M - down
- Pulley at bottom of incline - mass of B
- Pulley at bottom of incline - acceleration
- Pulley at bottom of incline - time

Connected particles and pulleys *continued*

Particles on a wedge
Connected particles and pulleys : Mixture

Moments

Moments · A LEVEL · 14

Moment of a perpendicular force
Finding a force from its moment
Finding perpendicular distance
Moment of a couple
Moment of a force at an angle
Moment of the weight of a rod
Total moment about A from diagram
Total moment about B from diagram
Moment about point not at rod end
Resolve force then take moment
Zero moment - find force
Zero net moment - find distance
Range of X for clockwise rotation about O
Moments : Mixture

Moments in equilibrium · A LEVEL · 12

Rod on two supports - reaction
See-saw - find fulcrum position
See-saw - find mass of child
Pivot position for equilibrium
Beam with extra mass - reactions
Non-uniform rod - centre of mass
About to tip - limiting position
Rectangular lamina - tension
Plank on trestles - tipping
Beam with load - reaction
Strut supporting horizontal sign

Moments in equilibrium *continued*

Moments in equilibrium : Mixture

Reaction forces · Ladders · A LEVEL · 13

Ladder - reaction at smooth wall
Ladder - reaction at the ground
Ladder - minimum mu at ground
Ladder - limiting angle
Ladder with a person - wall reaction
Ladder - horizontal force to prevent slip
Ladder - greatest distance before slipping
Ladder - horizontal reaction at wall
Ladder - rough wall and ground
Man climbs - friction at ground
Ladder - reactions at wall and ground
Ladder with load at midpoint - min mu
Reaction forces (1) : Mixture

Reaction forces · Hinged rods and supports · A LEVEL · 15

Hinged rod - vertical string
Hinged rod - tension in string
Hinged rod - hinge reaction
Light rod with strut or string
Non-uniform hinged rod - tension
Trapdoor - cable tension
Hanging sign - tension or reaction
Hinged rod at angle - horizontal string
Hinged horizontal rod - string at angle
Rod on ground - minimum mu
Rod on ground - reaction at B
Strut compression with particle
Hinge reaction components
Rod with string not at free end
Reaction forces (2) : Mixture

11 A LEVEL MATHS Statistics

25 topics
276 structures

Presentation and Interpretation

Presentation · Histograms and cumulative frequency · AS · 10

Histogram - draw from a table
Histogram - find total from graph
Histogram - find frequency in a range
Histogram - total given, find in a range
Histogram - estimate from a range
Cumulative freq - plot and read
Cumulative freq - read quartiles
Cumulative freq - estimate percentages
Cumulative freq - box plot
Presentation : Mixture

Measures of central tendancy · Measures of central tendancy · AS · 15

Median - from a list (1)
Median - from a list (2)
Median - from a table
Median - from a grouped table
Median - missing frequency
Mean - from a list
Mean - from a table
Mean - from a grouped table
Mean - Problem 1

Measures of central tendancy · Measures of central tendancy *continued*

Mean - Problem 2
Mean - Problem 3
Mean - Problem 4
Mean - Problem 5
Mean - Problem 6
Measures of central tendancy : Mixture

Measures of spread · Measures of spread · AS · 20

Quartiles from a list
Inter-quartile range from a list
Inter-quartile range - from a table
Inter-quartile range - from a grouped table
Percentile - from a table
Percentile range - from a table
Percentile - from a grouped table
Percentile range - from a grouped table
Variance from a list
Standard deviation from a list
Standard deviation - summary statistics (1)
Standard deviation - summary statistics (2)
Standard deviation - from a table
Standard deviation - from a grouped table
Mixture
Outliers - 3 standard deviations rule

Measures of spread · Measures of spread *continued*

Coding - find mean and s.d. of x
Coding - decode mean and s.d.
Coding - find the coding equation
Measures of spread : Mixture

Probability

Sample Space AS 12

Two 4-sided dice - sum
Two 4-sided dice - difference
Two 4-sided dice - product
Two 6-sided dice - sum
Two 6-sided dice - product
Two 6-sided dice - difference
6 and 4-sided dice - sum
6 and 4-sided dice - product
6 and 4-sided dice - difference
Coin and spinner
Coin and die
Sample Space : Mixture

Venn Diagrams AS 9

Shaded region - set notation
Venn probability - two sports
Venn probability - pens
Venn probability - cars
Venn probability - reading and glasses
Venn probability - subjects
Venn with probabilities - find P (words)
Venn with probabilities - find P (set notation)
Venn Diagrams : Mixture

Two-Way Tables AS 7

Two-way table - simple probability (2×2)
Two-way table - conditional probability (2×2)
Two-way table - simple probability (3×2)
Two-way table - conditional probability (3×2)
Two-way table from probabilities - conditional
Two-way table with x - conditional
Two-Way Tables : Mixture

Additon law AS 8

Given P(A) P(B) $P(A \cap B)$
Given P(A') P(B) $P(A \cap B)$
Given P(A') P(B) $P(A \cup B)$
Given P(A) P(B) $P(A' \cup B)$
Given P(A) $P(A \cup B)$ $P(A \cap B)$
Given P(A) P(B) $P(A|B)$
Given P(A) $P(A|B)$ $P(A \cup B)$
Probability - Additon law : Mixture

Mutually Exclusive Events AS 10

Given P(A) and P(B)
Given P(A') and P(B)
Given $P(A \cup B)$ and P(A)
Given $P((A \cup B)')$ and P(A)
Given P(A') and $P(A \cup B)$
Given P(A) and $P(A \cup B)$
Given P(B') and P(A)
Given P(A') and P(B')
Algebraic
Mutually Exclusive Events : Mixture

Independent events AS 11

Given P(A) and P(B)
Given P(A') and P(B)
Given P(A) and $P(A \cup B)$

Independent events *continued*

Given $P((A \cup B)')$ and P(A)
Independent - $P(A|B)=P(A)$
Given $P(A|B)$ and P(B)
Given P(A') and P(B')
Given $P(A \cup B)$ and P(A)
Given P(A') and P(B)
Algebraic
Independent events : Mixture

Tree Diagrams AS 8

Without replacement - group selection
Without replacement - matching items
Dependent days - service / machine
Dependent days - person
With replacement - find from given outcome
Algebraic (1)
Algebraic (2)
Tree Diagrams : Mixture

Set notation A LEVEL 11

Complement of an event
Addition law - union
Mutually exclusive events
Independent events
Intersection with a complement
Complement of a union
Probabilities from Venn regions
Conditional probability from sets
$P(A \cap B)$ for independent events
Three-set Venn region
Probability - Set notation : Mixture

Conditional Probability A LEVEL 21

Finding $P(A|B)$ from $P(B|A)$
Probability of the complement given B
Update probability after evidence
Conditional from Venn numbers
$P(A|B)$ from tree
Independent events and conditioning
Conditional probability from a table
Conditional probability $P(A|B)$
Finding an intersection from $P(A|B)$
Two-stage tree diagram
$P(A|B)$ and $P(B|A)$
Law of total probability
Three-stage tree path
With replacement conditional
Without replacement - conditional
Tree then reverse probability
Medical test - reverse probability
Factory / machines - reverse probability
Three-group reverse probability
Three causes - most likely
Conditional Probability : Mixture

Discrete Random Variables

Discrete Random Variables · Probability Distributions AS 15

Unequal spinner sectors
Two dice - max or min
Coin then different dice
Spinner with coin double/triple
Strange die plus fair die - sum
Three coins different biases
Biased coin then fair coin(s)
Discrete uniform on integers
Linear decreasing $k(c-x)$

Discrete Random Variables · Probability Distributions *continued*

- Linear increasing $k(bx + c)$
- Linear decreasing $k(c - bx)$
- Linear with unknown constant a
- Quadratic $k(x^2 + px + q)$
- Biased die / spinner proportional
- Discrete Random Variables : Mixture

Cumulative Distribution Functions · Cumulative Distribution Functions AS 8

- CDF from probability table
- CDF from listed probabilities
- CDF with unknown probability p
- CDF from spinner labels
- CDF from P(X=x)=x/S
- CDF from coin then dice
- Algebraic F(x) - find k
- Cumulative Distribution Functions : Mixture

Binomial

Calculating Probabilities · Binomial distribution - calculating AS 13

- P(X = a)
- P(X < a)
- P(X > a)
- P(X ≤ a)
- P(X ≥ a)
- P(a < X < b)
- P(a ... X ... b) varied inequalities
- Mixed binomial probabilities
- Email / message delivery
- Shots / free throws
- Customers / purchases
- State distribution and find P
- Binomial - Probabilities : Mixture

Binomial hypothesis tests · Binomial hypothesis tests AS 5

- Upper tail - rate higher than claimed
- Two-tailed - is the claim true?
- Lower tail - rate lower than claimed
- Upper tail - no more than / at most
- Binomial hypothesis tests : Mixture

Correlation and Regression

Regression with coded data A LEVEL 13

- Mean of original from coded data
- Gradient of regression line
- Intercept of regression line
- Regression line from summaries
- Interpret the gradient
- Regression line and estimate
- Predicted value from regression
- Residual from given equation
- Residual from summary statistics
- Coded regression to original
- Exponential model from log graph
- Power model from log-log graph
- Regression with coded data : Mixture

Finding the PMCC A LEVEL 7

- Interpret the PMCC
- Comparing strength of correlation
- PMCC from a data set
- PMCC and interpret from table (context)

Finding the PMCC *continued*

- PMCC and interpret from table (p and q)
- Effect of outlier on r
- Finding the PMCC : Mixture

Hypothesis testing A LEVEL 10

- Critical value for PMCC
- Significance of a sample PMCC
- One-tailed test - positive correlation
- One-tailed test - negative correlation
- Two-tailed test for correlation
- Context - evidence of positive correlation
- Context - evidence of negative correlation
- One-tailed test at 1%
- Critical region for r
- Hypothesis testing : Mixture

Normal Distribution

Normal Distribution A LEVEL 7

- Normal - P(X < a)
- Normal - P(X > a)
- Normal - P(X ≤ a)
- Normal - P(X ≥ a)
- Normal - P(a < X < b)
- Normal - within k standard deviations
- Normal Distribution : Mixture

Standard Normal Distribution A LEVEL 11

- Standard normal - P(Z < Z)
- Standard normal - P(Z > Z)
- Standard normal - P(a < Z < b)
- Standardising a normal variable
- Inverse normal - P(Z < a) = p
- Inverse normal - P(Z > a) = p
- Inverse normal - two-tailed
- Finding a value from a probability
- Finding a value from P(X > a)
- P(|Z| < a) = p
- Standard Normal Distribution : Mixture

Mean and Standard Deviation A LEVEL 12

- Finding the mean
- Mean from an upper-tail probability
- Finding the standard deviation
- SD from a percentage above a value
- Unknown parameter from a percentile
- SD from a symmetric interval
- Finding mean and standard deviation
- Mean and SD from two percentiles
- SD from P(X < a)
- Both parameters from two tails
- Percentage within μ±kσ
- Mean and Standard Deviation : Mixture

Real life problems A LEVEL 12

- Heights - proportion above a value
- Packet weights - underfilled
- Journey times - probability of late
- Exam marks - grade boundary
- Percentage within a range
- Top percentage threshold
- Quality control - rejection rate
- Warranty threshold
- Proportion within tolerance
- Two independent normals
- Stockout over two consecutive days
- Real life problems : Mixture

Binomial (normal approximation) — A LEVEL — 11

Mean and variance of approximating normal
Continuity correction
Normal approx - P(X ≤ k)
Normal approx - P(X ≥ k)
Normal approx - P(X < k)
Normal approx - P(X > k)
Normal approx - P(a ≤ X ≤ b)
Checking conditions and approximating
P(X = k) with correction
Context binomial to normal
Binomial (normal approximation) : Mixture

Hypothesis testing (mean) — A LEVEL — 10

Critical values for a z-test
Two-tailed test for a mean
Upper one-tailed test for a mean
Lower one-tailed test for a mean
p-value for a z-test
Test statistic and conclusion
Context - testing a mean weight claim
Context - one-tailed test for a mean time
Critical region for sample mean
Hypothesis testing (mean) : Mixture

12 A LEVEL MATHS Sequences and Series

4 topics
50 structures

Arithmetic series

Arithmetic — A LEVEL — 16

Express as a recurrence relation
Find a specific term
Find the first term
Find the common difference
Find a specific term
Find the sum - first n terms
Find the first term - sum known
Find the last term - sum known
Find the first term
Find the number of terms - sum known
Find the sum - first n terms
Find the common difference
Find the last term
Calculate the number of terms
Calculate the sum
Arithmetic -series : Mixture

Summation Notation

Summation notation — A LEVEL — 3

Arithmetic: 1 to n
Arithmetic: m to n
Summation Notation : Mixture

Geometric series

Geometric — A LEVEL — 7

Geometric : Sum of the first n terms
Geometric: Find the first term - sum known
Geometric: Sum of an infinite series

Geometric *continued*

Geometric: Find the ratio - infinite series
Geometric: Find first term - infinite series
Geometric: Find sum - infinite series
Geometric Series : Mixture

Binomial

Specific Terms — A LEVEL — 24

Binomial : $(1 \pm ax)^{n}$
Binomial : $(1 \pm ax)^{-n}$
Binomial : $(1 \pm x)^{\frac{n}{m}}$
Binomial : $(1 \pm x)^{-\frac{n}{m}}$
Binomial : $(1 \pm ax)^{\frac{n}{m}}$
Binomial : $(1 \pm ax)^{-\frac{n}{m}}$
Binomial : $(a \pm x)^{n}$
Binomial : $(a \pm x)^{-n}$
Binomial : $(a \pm x)^{\frac{n}{m}}$
Binomial : $(a \pm x)^{-\frac{n}{m}}$
Binomial : $(a \pm bx)^{n}$
Binomial : $(a \pm bx)^{-n}$
Binomial : $(a \pm bx)^{\frac{n}{m}}$
Binomial : $(a \pm bx)^{-\frac{n}{m}}$
Binomial : $(1 \pm ax)^{\pm n}$
Binomial : $(1 \pm x)^{\pm \frac{n}{m}}$
Binomial : $(a \pm x)^{\pm n}$
Binomial :$(a \pm x)^{\pm \frac{n}{m}}$
Binomial : $(a \pm bx)^{\pm n}$
Binomial : $(a \pm bx)^{\pm \frac{n}{m}}$
Binomial : $\frac{ax}{(b \pm cx)^{n}}$
Binomial : $\frac{ax}{(b \pm cx)^{\frac{n}{m}}}$
Binomial : $\frac{a}{(1 \pm bx)^{n}} \pm \frac{c}{(1 \pm dx)^{m}}$
Binomail - Specific Terms : Mixture

13 A LEVEL MATHS Differential Equations

4 topics
38 structures

General Solutions

Integrating — A LEVEL — 12

General solution : $\frac{1}{(x\pm a)^n}\frac{dy}{dx} = b$
General solution : $(x \pm a)^n \frac{dy}{dx} = b$
General solution : $e^{-ax}\frac{dy}{dx} = b$
General solution : $e^{ax}\frac{dy}{dx} = b$
General solution : $\frac{b}{\cos x}\frac{dy}{dx} = a\sin^n x$
General solution : $\frac{b}{\sin x}\frac{dy}{dx} = a\cos^n x$
General solution : $(x^2 + bx + c)\frac{dy}{dx} = ax \pm b$
General solution : $\frac{a}{x}\frac{dy}{dx} = b\ln x$
General solution : $\frac{a}{bx}\frac{dy}{dx} = ax \pm b$
General solution : $b\frac{dy}{dx} = ae^{cx}$
General solution : $\frac{a}{bx}\frac{dy}{dx} = c\ln x$
General Solutions (1): Mixture

Separating the Variables — A LEVEL — 7

General solution : $\frac{dy}{dx} = axy$
General solution : $\frac{dy}{dx} = \frac{ax}{by}$
General solution : $\frac{dy}{dx} = y \pm b$
General solution : $\frac{dy}{dx} = axe^{by}$
General solution : $\frac{dy}{dx} = ax^n(y \pm b)$
General solution : $\frac{dy}{dx} = y^2(ax \pm b)$
Separating the Variables : Mixture

Modelling (Questions)

Equation given — A LEVEL — 10

Equation of a curve : $\frac{dy}{dx} = axy^2$
Cooling problem (1) : $\frac{d\theta}{dt} = a - bt$
Cooling problem (2) : $\frac{d\theta}{dt} = a - bt$
Acceleration problem (1) : $\frac{dV}{dt} = a + bt^2$
Acceleration problem (2) : $\frac{dV}{dt} = a + bt^2$
Decreasing population (1) : $\frac{dP}{dt} = -kt$
Decreasing population (2) : $\frac{dP}{dt} = -kt$
Increasing mass (2) : $\frac{dP}{dt} = a + bM$
Increasing mass (2) : $\frac{dP}{dt} = a + bM$
Modelling (1): Mixture

Forming and using equations — A LEVEL — 9

Radio active decay : $\frac{dM}{dt} = -kP$
Radio active decay : $\frac{dM}{dt} = -kP$
Circular patch : $\frac{dr}{dt} = kr$
Circular patch : $\frac{dr}{dt} = kr$
Change in temperature : $\frac{d\theta}{dt} = k(T - \theta)$
Change in temperature : $\frac{d\theta}{dt} = k(T - \theta)$
Thickness of ice : $\frac{dx}{dt} = \frac{k}{\sqrt{x}}$
Thickness of ice : $\frac{dx}{dt} = \frac{k}{\sqrt{x}}$
Modelling (2) : Mixture

14 A LEVEL MATHS Numerical Methods

6 topics
54 structures

Locating Roots

Change of sign (1) — A LEVEL — 9

Change of sign : $ax^3 \pm bx^2 \pm cx \pm d = 0$
Change of sign : $ax^2 \pm b\sqrt{x} - c = 0$
Change of sign : $a + bx^3 - \frac{c}{x} = 0$
Change of sign : $e^{ax} - bx^2 = 0$
Change of sign : $a\sin bx + e^{-cx} = 0$
Change of sign : $ax^2 + bx - e^{-cx} = 0$
Change of sign : $ax^2 + b\ln x = 0$
Change of sign : $\tan x - ax + bx^2 = 0$
Change of sign (1) : Mixture

Change of sign (2) — A LEVEL — 9

Root given : $ax^3 \pm b\sqrt{x} \pm c = 0$
Root given : $e^{x+a} \pm bx \pm c = 0$
Root given : $-ax\ln x - \frac{b}{x}$
Root given : $\ln(ax \pm b) - cx^2$
Root given : $ae^x \pm bx^2 \pm c$
Root given : $ax^4 \pm \frac{b}{x} \pm c$
Root given : $a\cos(bx) \pm c\ln x$
Root given : $\sin(a - x) \pm bx^3 \pm c$
Change of sign (2) : Mixture

Newton-Raphson

Newton-Raphson — A LEVEL — 8

N-R : $ax^3 \pm bx^2 \pm cx \pm d = 0$
N-R : $\sin\frac{x}{a} \pm b \pm cx = 0$

Newton-Raphson — *continued*

N-R : $ae^{-x} \pm b\sqrt{x} = 0$
N-R : $ax^2 - \ln(bx + c) = 0$
N-R : $ax - (\ln(bx))^2 - c = 0$
N-R : $\sin(ax) - (\ln(bx) + c = 0$
N-R : $ax - \frac{b}{x^2} - c = 0$
Newton-Raphson : Mixture

Trapezium Rule

Trapezium Rule — A LEVEL — 10

$y = a\cos\frac{\theta}{b}$
$y = x\sqrt{a - x} + b$
$y = \ln(ax^2 - b)$
$y = \frac{a}{bx+c}$
$y = ae^{-bx} + c$
$y = \frac{1}{\sqrt{ae^x \pm b}}$
$y = e^{ax} - e^{-bx}$
$y = \sqrt{a\sin x} + b$
Expanded cubic
Trapezium Rule : Mixture

Fixed point iteration

Fixed point iteration — A LEVEL — 9

$x = a\ln(x + b)$
$x = ae^{-b} + c$
$x = \tan\frac{x}{a} \pm b$
$x = a + \ln(bx + c)$

Fixed point iteration *continued*

$x = x^2 \pm b\ln x \pm c$
$x = a\sin(bx + c)$
$x = \frac{a}{x \pm b} \pm c$
$x = a\sqrt{x} \pm b$
Fixed point iteration : Mixture

Rearranging for iteration

Rearranging for iteration — A LEVEL — 9

Rearranging : $x = \sqrt{ax + \frac{b}{x} + c}$

Rearranging for iteration *continued*

Rearranging : $x = ax^2 + \frac{b}{x} + c$
Rearranging : $x = \frac{ax^3 \pm b}{c \pm dx}$
Rearranging : $x = \sqrt{ax + \frac{b}{\sqrt{x}}}$
Rearranging : $x = \sqrt{ax \pm \frac{b}{x} + c}$
Rearranging : $x = \sqrt[3]{ax^2 \pm bx \pm c}$
Rearranging : $x = \frac{1}{a}e^{bx^2 + c}$
Rearranging : $x = \frac{1}{a}\ln(\frac{1}{bx^2 + cx})$
Rearranging for iteration : Mixture

15 A LEVEL MATHS Parametrics

6 topics
55 structures

Finding the cartesian equation

Cartesian equations from parametric equations — A LEVEL — 18

$x = at^2,\ y = bt$
$x = at^2,\ y = b + t$
$x = at^3,\ y = bt^2$
$x = \frac{a}{t},\ y = t \pm b$
$x = at \pm b,\ y = \frac{c}{t}$
$x = a - t,\ y = bt^2 \pm c$
$x = \frac{a}{t \pm b},\ y = \frac{c}{t \pm d}$
$x = \sqrt{t} \pm a,\ y = b\sqrt{t}$
$x = \ln(t \pm a),\ y = \frac{1}{t \pm b}$
$x = \ln(t \pm a),\ y = t^2 \pm b$
$x = a\sin\theta,\ y = b\cos\theta$
$x = a\cos 2\theta,\ y = b\cos\theta$
$x = a\tan\theta,\ y = b\sec\theta$
$x = \sin\theta \pm a,\ y = \cos\theta \pm b$
$x = \cot\theta \pm a,\ y = \operatorname{cosec}\theta \pm b$
$x = a\sin\theta,\ y = b\tan 2\theta$
$x = a\cos\theta + b\sin\theta,\ y = a\sin\theta - b\cos\theta$
Cartesian equations : Mixture

Finding coordinates - axis intercepts

Finding axes intercepts — A LEVEL — 8

$x = t \pm a,\ y = b - t$
$x = at^2,\ y = t \pm b$
$x = t \pm a,\ y = t^2 - b$
$x = at^2,\ y = t^2 \pm bt \pm c$
$x = \frac{a}{t} \pm a,\ y = t^2 \pm bt \pm c$
$x = t^3 \pm at,\ y = t^2 - b$
$x = a\cos\theta,\ y = b\sin\theta$
Axes intercepts : Mixture

Distance between 2 points

Calculating the distance — A LEVEL — 7

$x = at \pm b,\ y = c - t$

Calculating the distance *continued*

$x = at^3,\ y = bt^2$
$x = at^2 \pm b,\ y = c - t$
$x = at \pm b,\ y = \frac{c}{t}$
$x = \frac{a}{t},\ y = bt^2 \pm c$
$x = at,\ y = bt \pm ct^2$
Distance between 2 points : Mixture

Finding the gradient

Finding the gradient — A LEVEL — 10

$x = at^2,\ y = bt$
$x = at^2,\ y = b \pm ct$
$x = at^3,\ y = b \pm ct^2$
$x = at^2,\ y = \frac{b}{t}$
$x = \frac{a}{t^3},\ y = \frac{b}{t^2}$
$x = a\sin t,\ y = b\cos t$
$x = a\cos 2t,\ y = b\cos t$
$x = a\sec t,\ y = b\cos t$
$x = \frac{a}{bt \pm c},\ y = \frac{d}{bt \pm c}$
Finding the gradient : Mixture

Tangents and Normals

Equations of Tangents — A LEVEL — 6

Tangent : $x = at^2,\ y = bt$
Tangent : $x = at \pm b,\ y = ct^2$
Tangent : $x = at^2,\ y = bt^3$
Tangent : $x = at \pm b,\ y = \frac{c}{t}$
Tangent : $x = ae^{bt}\ y = e^t \pm b$
Equations of Tangents : Mixture

Equations of Normals — A LEVEL — 6

Normal : $x = at^2,\ y = bt$
Normal : $x = at \pm b,\ y = ct^2$
Normal : $x = at^2,\ y = bt^3$
Normal : $x = at \pm b,\ y = \frac{c}{t}$
Normal : $x = ae^{bt}\ y = e^t \pm b$
Equations of Normals : Mixture