What's available for A Level Maths.

An overview of the A Level Maths topics available in the Mathsbox Question Generator.

$\frac{dy}{dx}$ **Differentiation**
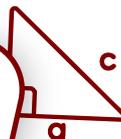
Fractions

$f(x)$ **Functions**

Geo

$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ **Matrices**

**Trigonome**

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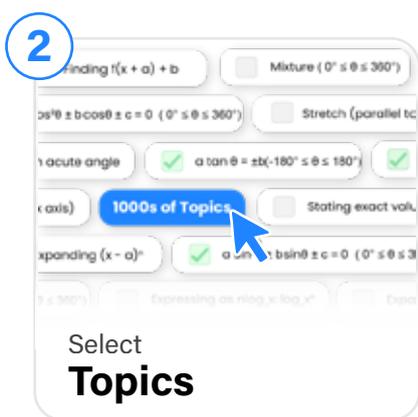
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1
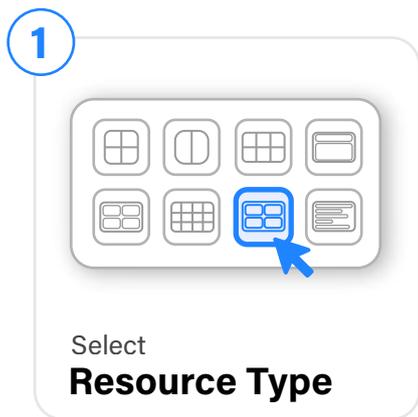
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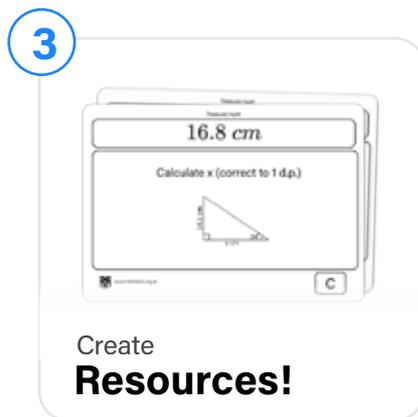
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Contents.

AS Pure Maths.

Polynomials and Quadratics

Polynomials

- 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
- Expressing: $(Ax^2 + Bx + c)(x + D) + E$

Quadratics

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

Quadratics

- Expanding: $(x \pm a)(x \pm b)$
- 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: Formula $x^2 + bx + c = 0$
- Solving: Formula $ax^2 + bx + c = 0$
- Discriminant: Determine the number of roots
- Discriminant: Find the Discriminant
- Discriminant: one repeated root
- Discriminant: 2 real roots
- Discriminant: No real roots
- Discriminant: Mixture
- Find the equation: two roots given
- Find the equation: two points given
- Find the equation: Mixed Questions
- Intersections: Quadratic & $y = mx + c$
- Intersections: Quadratic & $a + bx = c$
- Intersections: Mixed Questions

Indices and Surds

Indices

- Positive Unit Fractions
- Negative Unit Fractions
- Mixed Unit Fractions
- Positive Fractions
- Negative Fractions
- Mixed Fractions
- Multiplying: $ax^n \times bx^m$
- Dividing: $(ax^n y^m) / (bx^p y^q)$
- Brackets: $(ax^n)^m$

- Simplifying: $(x^n \times x^m) / x^p$
- Simplifying: $(ax^n \times bx^m) / cx^p$
- Simplifying: $nx^{a/b} \div mx^{c/b}$
- Simplifying: $(nx^{a/b})^2 \div mx^{c/b}$
- Simplifying: $x^{a/b} \div x^n$
- Simplifying: $nx^{a/b} \div mx^c$
- Simplify: $(ax^n(bx^m + c)) / x^p$
- Simplify: $(bx^m + c)^2 / x^p$
- Solving: $x^{a/b} = n$

Surds

- 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: $(a\sqrt{b})^n \pm c\sqrt{b}$
- Multiplying: $n\sqrt{a} \times m\sqrt{a}$

- Multiplying: $\sqrt{a} \times \sqrt{b}$
- Multiplying: $m\sqrt{a} \times n\sqrt{b}$
- Expanding: $\sqrt{a}(\sqrt{a} \pm b)$
- Expanding: $(\sqrt{a} + b)(\sqrt{a} - b)$
- Expanding: $(\sqrt{a} \pm b)(\sqrt{a} \pm c)$
- Expanding: $\sqrt{a}(n\sqrt{a} \pm b)$

AS Pure Maths.

Indices and Surds

Surds

- Expanding: $(c\sqrt{a} + b)(c\sqrt{a} - b)$
- Expanding: $(m\sqrt{a} \pm b)(n\sqrt{a} \pm c)$
- Expanding: Single bracket mixture
- Rationalising: $a / \sqrt{b}$
- Rationalising: $a / (c \pm \sqrt{b})$
- Rationalising: $(a \pm \sqrt{b}) / (c \pm \sqrt{b})$
- Rationalising: $a / (n\sqrt{b})$
- Rationalising: $a / (c \pm n\sqrt{b})$
- Rationalising: $(a \pm n\sqrt{b}) / (c \pm m\sqrt{b})$
- Rationalising: $(a \pm n\sqrt{b}) / (m\sqrt{b} \pm c)$
- Solving: $m - x\sqrt{b} = ax / \sqrt{b}$
- Solving: $m - x\sqrt{c} = ax / \sqrt{b}$
- Solving: $\sqrt{a} \pm (\sqrt{b} / cx) = 1 / (x\sqrt{d})$

Inequalities

Inequalities

- Solving Quadratic: $x^2 \pm bx \pm c <> 0$
- Solving Quadratic: $ax^2 \pm bx \pm c <> 0$
- Simultaneous: $x^2 \pm bx \pm c < d$, $x \pm m < n$

Inequalities - using set notation

- Solving Quadratic: $x^2 \pm bx \pm c < 0$
- Solving Quadratic: $ax^2 \pm bx \pm c < d$
- Simultaneous: $x^2 \pm bx \pm c < d$, $x \pm m < n$

Defining shaded regions

- Representing: $y \leq a$ or $y < a$
- Representing: $y \geq a$ or $y > a$
- Representing: $x \leq a$ or $x < a$
- Representing: $x \geq a$ or $x > a$
- Representing: $ax + by \leq c$ or $ax + by < c$
- Representing: $ax + by \geq c$ or $ax + by > c$
- Representing: $ax + by \leq c$ and axes bounds
- Representing: $ax + by \geq c$ and axes bounds
- Representing: $ax + by \leq c$, $x \geq p$, $y \geq 0$
- Representing: $ax + by \geq c$, $x \leq p$, $y \leq 0$
- Representing: $ax + by \leq c$, $x \geq 0$, $y \geq p$
- Representing: $ax + by \geq c$, $x \leq 0$, $y \leq p$
- Representing: $ax + by \leq c$, $x \geq p$, $y \geq q$
- Representing: $ax + by \geq c$, $x \leq p$, $y \leq q$

Defining unshaded regions

- 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: $ax + by \geq c$, $x \leq p$, $y \leq 0$
- Representing: $ax + by \leq c$, $x \geq p$, $y \geq 0$
- Representing: $ax + by \geq c$, $x \leq 0$, $y \leq p$
- Representing: $ax + by \leq c$, $x \geq 0$, $y \geq p$
- Representing: $ax + by \geq c$, $x \leq p$, $y \leq q$
- Representing: $ax + by \leq c$, $x \geq p$, $y \geq q$

Algebraic Fractions

Rational Expressions

- Simplifying
- Multiplication and division
- Multiplication
- Division

Working with Algebraic Fractions - GCSE

- Simplify: $x/a + x/b$
- Simplify: $x/a - x/b$
- Simplify: $ax/b + cx/d$
- Simplify: $ax/b - cx/d$
- Simplify: $(x + a)/b + (x + c)/d$
- Simplify: $(x + a)/b - (x + c)/d$
- Simplify: $(x + a)/b - (x - c)/d$

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Algebraic Fractions

Working with Algebraic Fractions - GCSE

- Simplify: $(x - a)/b - (x + c)/d$
- Simplify: $(x - a)/b - (x - c)/d$
- Simplify: $(x - a)/b + (x - c)/d$
- Simplify: $(x + a)/b - (x - c)/d$
- Simplify Mixture
- Simplifying - Multiplication and Division
- Multiply algebraic fractions
- Divide algebraic fractions

Simultaneous Equations

Linear

- $ax + by = r$ 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

Circle and a Line

- $x^2 + y^2 = r^2$ and $y = x \pm c$
- $x^2 + y^2 = r^2$ and $y = ax \pm c$

Non-linear and Linear

- $y = x^2 + bx + c$ 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 $x + y = d$
- $x^2 \pm ax\, y^2 \pm by = c$ and $x + y = d$
- $x^2 + y^2 = r^2$ and $y = x \pm c$
- $x^2 + y^2 = r^2$ and $y = ax \pm c$

Graphs and Transformations

Quadratic - Vertex and Symmetry

- Quadratic - Vertex and Symmetry
- 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: $y = ax^2 \pm bx \pm c$

Quadratic Transformations

- 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 $f(x - a) - b$

Sketching Graphs - Other

- 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 $y = -ax^3 \pm bx^2 \pm cx \pm d$
- 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 $y = \cos x \pm a$

Quadratic Transformations

- 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 $f(x - a) - b$

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Graphs and Transformations

Quadratic - Transformations

- Translation (+y)
- Translation (-y)
- Translation (-x)
- Translation (+x)
- Reflection (x-axis)
- Reflection (y-axis)
- Stretch (parallel to the y-axis)
- Stretch (parallel to the x-axis)
- Translation -x and +y
- Translation -x and -y
- Translation +x and +y
- Translation +x and -y

Cubic - Transformations

- Translation (+y)
- Translation (-y)
- Translation (-x)
- Translation (+x)
- Reflection (x-axis)
- Reflection (y-axis)
- Stretch (parallel to the y-axis)
- Stretch (parallel to the x-axis)
- Translation -x and +y
- Translation -x and -y
- Translation +x and +y
- Translation -x and -y

Coordinate Geometry

Coordinate Geometry

- Gradient and intercept: $y = mx + c$ or $y = c - mx$
- 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)
- Finding the equation of a parallel line
- Finding the equation of a perpendicular line
- Finding the equation of a perpendicular bisector

- Writing in the form: $ax + by = c$
- Finding the area of a triangle
- Finding the centre of a circle
- Finding the diameter of a circle
- Finding the centre and radius
- Finding the tangent to a circle

Binomial Expansion

Expanding (a + x) and (x + a)

- Expanding $(1 + x)^n$
- Expanding $(1 - x)^n$
- Expanding $(a + x)^n$
- Expanding $(a - x)^n$
- Expanding $(x + a)^n$
- Expanding $(x - a)^n$

Expanding (a + bx) and (ax + b)

- Expanding $(1 + ax)^n$
- Expanding $(1 - ax)^n$
- Expanding $(a + bx)^n$
- Expanding $(a - bx)^n$
- Expanding $(ax + b)^n$
- Expanding $(ax - b)^n$

Specific terms (a + x)

- Specific terms $(1 + bx)^n$
- Specific terms $(1 - bx)^n$
- Finding b $(1 + bx)^n$

Specific terms (a + bx)

- Specific terms $(a + bx)^n$
- Specific terms $(a - bx)^n$
- Finding b $(a + bx)^n$

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Differentiation

Differentiating

- ax
- x^n
- x^{-n}
- ax^n
- ax^{-n}
- $x^{\wedge}(m/n)$
- $x^{\wedge}(-m/n)$
- $ax^{\wedge}(m/n)$
- $ax^{\wedge}(-m/n)$
- $y = mx \pm c$
- $y = mx^2 \pm c$
- $y = ax^2 \pm bx$

- $y = ax^2 \pm bx \pm c$
- $y = ax^3 \pm c$
- $y = ax^3 \pm bx$
- $y = ax^3 \pm bx \pm c$
- $y = ax^3 \pm bx^2$
- $y = ax^3 \pm bx^2 \pm d$
- $y = ax^3 \pm bx^2 \pm cx$
- $y = ax^3 \pm bx^2 \pm cx \pm d$
- $y = (x \pm a)(x \pm b)$
- $y = (ax \pm c)(bx \pm d)$

Finding the gradient

- $y = mx \pm c$
- $y = ax^2 \pm c$
- $y = ax^2 \pm bx$
- $y = ax^2 \pm bx \pm c$
- $y = ax^3 \pm c$
- $y = ax^3 \pm bx$
- $y = ax^3 \pm bx \pm c$
- $y = ax^3 \pm bx^2$
- $y = ax^3 \pm bx^2 \pm c$
- $y = ax^3 \pm bx^2 \pm cx$
- $y = ax^3 \pm bx^2 \pm cx \pm d$

Finding the points and stationary points

- $y = ax^2 \pm bx$
- $y = ax^2 \pm bx \pm c$
- $y = ax^3 \pm bx^2 \pm cx \pm d$ (stationary point)

Integration

Indefinite Integration

- ax
- ax^2
- ax^{-n}
- $x^{\wedge}(m/n)$
- $x^{\wedge}(-m/n)$
- $ax^{\wedge}(m/n)$
- $ax^{\wedge}(-m/n)$
- $ax \pm b$
- $ax^2 \pm b$

- $ax^2 \pm bx$
- $ax^2 \pm bx \pm c$
- $ax^3 \pm b$
- $ax^3 \pm bx$
- $ax^3 \pm bx \pm c$
- $ax^3 \pm bx^2$
- $ax^3 \pm bx^2 \pm c$
- $ax^3 \pm bx^2 \pm cx$
- $ax^3 \pm bx^2 \pm cx \pm d$

Mixed Integration

- Find the function through a given point

Definite Integration

- Definite Integration: $ax \pm b$
- Definite Integration: $ax^2 \pm bx$
- Definite Integration: $ax^2 \pm bx \pm c$
- Definite Integration

Logarithms

Using the laws of logarithms - in terms of x

- Expressing as $n \log_a x$: $\log_a x^n$
- Expressing as $n \log_a x$: $(1/m) \log_a x^n$
- Expressing as $n \log_a x$: $(1/m) \log_a 1/x^n$
- Expressing as $n \log_a x$: $n \log_a 1/m\sqrt{x}$

- Expressing as $n \log_a x$: $\log_a x^m + \log_a x^n$
- Expressing as $n \log_a x$: $\log_a 1/x^m + \log_a 1/x^n$
- Expressing as $n \log_a x$: $\log_a 1/x^m - \log_a 1/x^n$
- Expressing as $n \log_a x$: Mixture

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Logarithms

Using the laws of logarithms

- Solving : $\log_a b = x$
- Solving : $\log_a b\ 1/b = x$
- Solving : $\log_x a = b$
- Expressing as $\log_a x$: $\log_a x = \log_a m + \log_a n$
- Expressing as $\log_a x$: $\log_a x = \log_a m - \log_a n$
- Expressing as $\log_a x$: $\log_a x = n \log_a m$
- Expressing as $\log_a x$: $\log_a x = (1/m) \log_a n + \log_a p$
- Expressing as $\log_a x$: $\log_a x = (1/m) \log_a n + p \log_a q$
- Expressing as $\log_a x$: $\log_a x = n \log_a m - (1/q) \log_a r$
- Expressing as $\log_a x$: $\log_a x = n \log_a m - (p/q) \log_a r$
- Expressing as $\log_a x$: $\log_a x = \log_a 1/m + (1/p) \log_a \sqrt{r}$
- Expressing as $\log_a x$: $\log_a x = \log_a 1/m - (1/p) \log_a \sqrt{r}$
- Expressing as $\log_a x$: Mix

Solving

- $a\wedge(bx) = c$
- $a\wedge(x + b) = c$
- $a\wedge(bx + c) = d$
- $e\wedge(ax) = b$
- $e\wedge(x \pm a) = b$
- $e\wedge(ax \pm b) = c$
- $a\wedge(x \pm b) = c\wedge(x \pm d)$
- $\log_m(ax \pm b) = 1$
- $\log_m(ax \pm b) - \log_m(cx \pm d) = 1$
- $\log_m(ax \pm b) + \log_m(x \pm d) = 1$

Trigonometry

Exact values

- 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

Solving $\sin^2 \theta = b$

- $\sin^2 \theta = b$ $(0° \leq \theta \leq 360°)$
- $\cos^2 \theta = b$ $(0° \leq \theta \leq 360°)$
- $\tan^2 \theta = b$ $(0° \leq \theta \leq 360°)$
- $\sin^2 \theta = b$ $(-180° \leq \theta \leq 180°)$
- $\cos^2 \theta = b$ $(-180° \leq \theta \leq 180°)$
- $\tan^2 \theta = b$ $(-180° \leq \theta \leq 180°)$
- Mixture

Solving $\sin(\theta \pm a) = \pm b$

- $\sin(\theta \pm a) = b$ $(0° \leq \theta \leq 360°)$
- $\cos(\theta \pm a) = b$ $(0° \leq \theta \leq 360°)$
- $\tan(\theta \pm a) = b$ $(0° \leq \theta \leq 360°)$
- $\sin(\theta \pm a) = b$ $(-180° \leq \theta \leq 180°)$
- $\cos(\theta \pm a) = b$ $(-180° \leq \theta \leq 180°)$
- $\tan(\theta \pm a) = b$ $(-180° \leq \theta \leq 180°)$

Solving $a\sin \theta = \pm b$

- $a\sin \theta = \pm b$ $(0° \leq \theta \leq 360°)$
- $a\cos \theta = \pm b$ $(0° \leq \theta \leq 360°)$
- $a\tan \theta = \pm b$ $(0° \leq \theta \leq 360°)$
- Mixture $(0° \leq \theta \leq 360°)$
- $a\sin \theta = \pm b$ $(-180° \leq \theta \leq 180°)$
- $a\cos \theta = \pm b$ $(-180° \leq \theta \leq 180°)$
- $a\tan \theta = \pm b$ $(-180° \leq \theta \leq 180°)$
- Mixture $(-180° \leq \theta \leq 180°)$

Solving $\sin a\theta = \pm b$

- $\sin(a\theta) = b$ $(0° \leq \theta \leq 360°)$
- $\cos(a\theta) = b$ $(0° \leq \theta \leq 360°)$
- $\tan(a\theta) = b$ $(0° \leq \theta \leq 360°)$
- $\sin(a\theta) = b$ $(-180° \leq \theta \leq 180°)$
- $\cos(a\theta) = b$ $(-180° \leq \theta \leq 180°)$
- $\tan(a\theta) = b$ $(-180° \leq \theta \leq 180°)$

Solving - using identities

- $\sin(a\theta) = b$ $(0° \leq \theta \leq 360°)$
- $\cos(a\theta) = b$ $(0° \leq \theta \leq 360°)$
- $\tan(a\theta) = b$ $(0° \leq \theta \leq 360°)$
- $\sin(a\theta) = b$ $(-180° \leq \theta \leq 180°)$
- $\cos(a\theta) = b$ $(-180° \leq \theta \leq 180°)$
- $\tan(a\theta) = b$ $(-180° \leq \theta \leq 180°)$

AS Pure Maths.

Trigonometry

Solving - using identities

- a sin θ = b cos θ   (0° ≤ θ ≤ 360°)
- $\sin^2 θ$ ± b sin θ ± c = 0   (0° ≤ θ ≤ 360°)
- $\cos^2 θ$ ± b cos θ ± c = 0   (0° ≤ θ ≤ 360°)
- $\tan^2 θ$ ± b tan θ ± c = 0   (0° ≤ θ ≤ 360°)
- $\cos^2 θ$ ± b sin θ ± c = 0   (0° ≤ θ ≤ 360°)
- $\sin^2 θ$ ± b cos θ ± c = 0   (0° ≤ θ ≤ 360°)
- $\cos^2 θ$ = b sin θ ± c   (0° ≤ θ ≤ 360°)
- $\cos^2 θ$ = b sin θ ± c   (0° ≤ θ ≤ 360°)
- $\sin^2 θ$ ± b sin θ ± c = d $\cos^2 θ$ (0° ≤ θ ≤ 360°)
- $\cos^2 θ$ ± b cos θ ± c = d $\sin^2 θ$ (0° ≤ θ ≤ 360°)
- a sin θ = b cos θ   (-180° ≤ θ ≤ 180°)
- $\sin^2 θ$ + b sin θ + c = 0   (-180° ≤ θ ≤ 180°)
- $\cos^2 θ$ + b cos θ + c = 0   (-180° ≤ θ ≤ 180°)
- $\tan^2 θ$ + b tan θ + c = 0   (-180° ≤ θ ≤ 180°)
- $\cos^2 θ$ - b sin θ - c = 0   (-180° ≤ θ ≤ 180°)
- $\sin^2 θ$ - b cos θ - c = 0   (-180° ≤ θ ≤ 180°)
- $\cos^2 θ$ = ±b sin θ ± c   (-180° to 180°)
- $\cos^2 θ$ = ±b sin θ ± c   (-180° to 180°)
- $\sin^2 θ$ ± b sin θ ± c = d $\cos^2 θ$ (-180° to 180°)
- $\cos^2 θ$ ± b cos θ ± c = d $\sin^2 θ$ (-180° to 180°)

Sine Rule

- Sine rule - calculating an angle
- Sine rule - calculating sides
- Sine rule - calculating angles and sides

Cosine Rule

- Cosine rule - calculating an angle
- Cosine rule - calculating sides
- Cosine rule - calculating angles and sides
- Sine and cosine rules calculating sides
- Sine and cosine rules calculating an angle
- Sine and cosine rules mixture

Sine and area

- Calculating the area (1 & 2)
- Calculating an angle
- Calculating a side
- Side and angle mixture
- Mixture

Vectors

i and j

- Simplifying
- Finding missing values
- Finding the modulus
- Finding the magnitude A
- Finding the magnitude B
- Finding unit vectors
- Angle with i
- Angle with j

Column Vectors

- Simplifying
- Finding missing values

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Binomial Series

First 3 Terms

- $(1 \pm ax)^{\wedge}(n)$
- $(1 \pm ax)^{\wedge}(-n)$
- $(1 \pm x)^{\wedge}(n/m)$
- $(1 \pm x)^{\wedge}(-n/m)$
- $(1 \pm ax)^{\wedge}(n/m)$
- $(1 \pm ax)^{\wedge}(-n/m)$
- $(a \pm x)^{\wedge}(n)$
- $(a \pm x)^{\wedge}(-n)$
- $(a \pm x)^{\wedge}(n/m)$
- $(a \pm x)^{\wedge}(-n/m)$
- $(a \pm bx)^{\wedge}(n)$
- $(a \pm bx)^{\wedge}(-n)$
- $(a \pm bx)^{\wedge}(n/m)$
- $(a \pm bx)^{\wedge}(-n/m)$

Finding Specific Terms

- $(1 \pm ax)^{\wedge}(\pm n)$
- $(1 \pm x)^{\wedge}(\pm n/m)$
- $(a \pm x)^{\wedge}(\pm n)$
- $(a \pm x)^{\wedge}(\pm n/m)$
- $(a \pm bx)^{\wedge}(\pm n)$
- $(a \pm bx)^{\wedge}(\pm n/m)$

Differentiation (1)

Simple

- $y = a\ e^{\wedge}x$
- $y = a\ e^{\wedge}(x \pm b)$
- $y = a \sin x$
- $y = a \cos x$
- $y = a \tan x$
- $y = a \ln x$
- $y = a \ln(xn)$
- $y = a \ln x \pm b\ ex$ find gradient
- $y = a \pm b\ ex$ gradient known - find x
- $y = x^2 - a \ln x$ gradient known - find x
- $y = a/x + b \ln x$ gradient known - find x

Chain Rule

- $y = a\ e^{\wedge}(bx)$
- $y = a\ e^{\wedge}(bx \pm c)$
- $y = a\ e^{\wedge}(c - bx)$
- $y = (e^{\wedge}(ax) \pm b) / e^{\wedge}(cx)$
- $y = (e^{\wedge}(ax) \pm b)(e^{\wedge}(cx) \pm d)$
- $y = (e^{\wedge}(ax) \pm b)(e^{\wedge}(-cx) \pm d)$
- $y = (ax \pm b)^{n}$
- $y = (ax^2 \pm b)^{\wedge}n$
- $y = (ax^2 \pm bx)^{\wedge}n$
- $y = (ax^2 \pm b)^{\wedge}(-n)$
- $y = (ax^2 \pm bx)^{\wedge}(-n)$
- $y = (a\ e^{\wedge}(bx) \pm cx)^{\wedge}(-n)$
- $y = a \sin(bx \pm c)$
- $y = a \sin(bx^2 \pm c)$
- $y = a \cos(bx \pm c)$
- $y = a \cos(bx^2 \pm c)$
- $y = a \tan(bx \pm c)$
- $y = a \tan(bx^2 \pm c)$
- $y = \sqrt{(ax \pm b)}$
- $y = \sqrt{(ax^2 \pm bx)}$

Chain Rule (use twice)

- $y = (\sin(ax))^{\wedge}n$
- $y = (\cos(ax))^{\wedge}n$
- $y = \sin(\ln(ax^{\wedge}n))$
- $y = \cos(\ln(ax^{\wedge}n))$
- $y = \ln(\sin(bx))$
- $y = \ln(\cos(bx))$
- $y = (\ln(ax))^{\wedge}n$
- $y = e^{\wedge}(\sqrt{(ax \pm b)})$
- $y = (\sin(\sqrt{(ax)}))^{\wedge}n$
- $y = (\cos(\sqrt{(ax)}))^{\wedge}n$

Differentiation (2)

Product Rule

- $y = a\ x^{\wedge}n\ (b\ x \pm c)^{\wedge}m$
- $y = a\ x^{\wedge}n\ (\ (b\ x \pm c)^{\wedge}(1/2)\ )$
- $y = (a\ x \pm b)^{\wedge}n\ (c\ x \pm d)^{\wedge}m$
- $y = e^{\wedge}(a\ x)\ (c\ x \pm d)^{\wedge}m$
- $y = a\ x^{\wedge}n \sin(b\ x)$
- $y = a\ x^{\wedge}n \cos(b\ x)$
- $y = a\ x^{\wedge}n \tan(b\ x)$
- $y = a\ x^{\wedge}n\ e^{\wedge}(b\ x)$
- $y = a\ x^{\wedge}n \ln(b\ x)$
- $y = a\ x^{\wedge}n \ln(b\ x \pm c)$
- $y = e^{\wedge}(a\ x) \ln(b\ x)$
- $y = e^{\wedge}(a\ x) \sin(b\ x)$
- $y = e^{\wedge}(a\ x) \cos(b\ x)$
- $y = e^{\wedge}(a\ x) \tan(b\ x)$
- $y = e^{\wedge}(a\ x) \tan(b\ x)$

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Quotient Rule

- $y = (ax) / (bx \pm c)$
- $y = (ax \pm b) / (cx \pm d)$
- $y = ((ax \pm b)^n) / (cx \pm d)$
- $y = ((ax \pm b)^{(1/2)}) / (cx)$
- $y = ((ax \pm b)^{(1/2)}) / (cx \pm d)$
- $y = (ax^n) / ((cx \pm d)^{(1/2)})$
- $y = (ax^2 \pm b) / (cx \pm d)$
- $y = (ax \pm b) / (cx^2 \pm d)$
- $y = \ln(x) / (bx \pm c)$
- $y = \ln(ax) / (bx^2 \pm c)$
- $y = e^{(ax)} / (bx \pm c)$
- $y = e^{(ax)} / ((bx \pm c)^{(1/2)})$

Implicit Differentiation

- $ax^2 \pm by^2 = c$
- $ax^n \pm by^m = c$
- $ay^n \pm bxy = c$
- $ax^n y \pm bxy^m = c$
- $(ax \pm y) / (bx \pm y) = cy$
- $(ax \pm y) / (bx \pm y) = cx$
- $ax e^y \pm y \ln(y) = cx^n$
- $ax e^y \pm by \ln(y) = cx^n$
- $(ay^n) / (bxy \pm c) = d$
- $(ax^n) / (bxy \pm c) = d$
- $y = a^x$
- $y = a^{(bx \pm c)}$

Integration (1)

Integration

- $y = a e^{(bx)}$
- $y = a e^{(bx \pm c)}$
- $y = a / x$
- $y = 1 / (ax)$
- $y = a / (bx)$
- $y = 1 / (ax \pm b)$
- $y = a / (bx \pm c)$
- $y = a / (b - cx)$
- $y = (ax \pm b)^n$
- $y = (a - bx)^n$
- $y = 1 / (ax + b)^n$
- $y = 1 / (a - bx)^n$
- $y = (ax) / (bx^2 \pm c)$
- $y = (ax) / (b - cx^2)$
- $y = ax (bx^2 \pm c)^n$
- $y = ax (c - bx^2)^n$
- $y = (ax) / ((bx^2 + c)^n)$
- $y = (ax) / ((c - bx^2)^n)$
- $y = (ax) / \sqrt{bx^2 + c}$
- $y = (ax) / \sqrt{c - bx^2}$

Trigonometric Functions

- $y = \sin(ax)$
- $y = \cos(ax)$
- $y = \sec^2(ax)$
- $y = \sin(ax \pm b)$
- $y = \cos(ax \pm b)$
- $y = \sec^2(ax \pm b)$
- $y = \sin(a - bx)$
- $y = \cos(a - bx)$
- $y = \sec^2(a - bx)$
- $y = ax \sin(bx^2 \pm c)$
- $y = ax \cos(bx^2 \pm c)$
- $y = ax \sec^2(bx^2 \pm c)$
- $y = a \sin^n(x) \cos(x)$
- $y = a \cos^n(x) \sin(x)$
- $y = a \sin^n(bx) \cos(bx)$
- $y = a \cos^n(bx) \sin(bx)$
- $y = (\sin(ax)) / (\cos^a(x))$
- $y = (\cos(ax)) / (\sin^n(x))$
- $y = (\tan(ax)) / (\sec^n(x))$
- $y = a \sin(bx) \cos(bx)$
- $y = a \sin^2(bx)$
- $y = a \cos^2(bx)$

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Integration by Parts

- $y = a\,x\,\sin(x)$
- $y = a\,x\,\cos(x)$
- $y = a\,x\,\sin(b\,x)$
- $y = a\,x\,\cos(b\,x)$
- $y = a\,x\,\sin(b\,x \pm c)$
- $y = a\,x\,\cos(b\,x \pm c)$
- $y = (a\,x \pm b)\,\sin(c\,x)$
- $y = (a\,x \pm b)\,\cos(c\,x)$
- $y = a\,x\,e^{x}$
- $y = a\,x\,e^{-x}$

- $y = a\,x\,e^{(b\,x)}$
- $y = a\,x\,e^{(-b\,x)}$
- $y = (a\,x \pm b)\,e^{(c\,x)}$
- $y = (a\,x \pm b)\,e^{(-c\,x)}$
- $y = a\,\ln(x)$
- $y = \ln(x^a)$
- $y = a\,x\,\ln(x)$
- $y = a\,x^n\,\ln(x)$
- $y = a\,x^{(-n)}\,\ln(x)$

By parts twice

- $y = a\,x^2\,e^{(b\,x)}$
- $y = a\,x^2\,e^{(-b\,x)}$
- $y = a\,x^2\,\sin(b\,x)$
- $y = a\,x^2\,\cos(b\,x)$

Modulus Functions

Equations

- $y = |a\,x| = b$
- $y = |x \pm a| = b$
- $y = |a - x| = b$
- $y = |a\,x \pm b| = c$
- $y = |b - a\,x| = c$
- $y = b \pm |a\,x \pm c| = d$
- $y = a\,|b\,x \pm c| \pm d = e$
- $y = a\,|x| \pm b = c\,|x| \pm d$
- $y = |a\,x \pm b| = |c\,x \pm d|$
- $y = |a\,x \pm b| = |d - c\,x|$

Inequalities

- $y = |a\,x| <> b$
- $y = |x \pm a| <> b$
- $y = |a - x| <> b$
- $y = |a\,x \pm b| <> c$
- $y = |b - a\,x| <> c$
- $y = b \pm |a\,x \pm c| <> d$
- $y = a\,|b\,x \pm c| \pm d <> e$
- $y = a\,|x| \pm b <> c\,|x| \pm d$
- $y = |a\,x \pm b| <> |c\,x \pm d|$
- $y = |a\,x \pm b| <> |d - c\,x|$

Partial Fractions (Rational Functions)

Rational Functions

- $y = |a\,x| = b$
- $y = |x \pm a| = b$
- $y = |a - x| = b$
- $y = |a\,x \pm b| = c$
- $y = |b - a\,x| = c$
- $y = b \pm |a\,x \pm c| = d$
- $y = a\,|b\,x \pm c| \pm d = e$
- $y = a\,|x| \pm b = c\,|x| \pm d$
- $y = |a\,x \pm b| = |c\,x \pm d|$
- $y = |a\,x \pm b| = |d - c\,x|$

Partial fractions

- $y = a\,/\,(b\,x \pm c) \pm d\,/\,(e\,x \pm f)$
- $y = a\,/\,(\,(b\,x \pm c)^2\,) \pm d\,/\,(b\,x \pm c)$
- $y = a\,/\,(b\,x + c) \pm d\,/\,(b\,x - c)$
- $y = a\,/\,(\,(b\,x \pm c)^2\,) \pm d\,/\,(b\,x \pm c) \pm e\,/\,(g\,x \pm h)$

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Sequences and Series

Arithmetic

- Express as a recurrence relation
- Find a specific term (1)
- Find the first term
- Find the common difference
- Find a specific term (2)
- Find the sum of the first n terms (1)
- 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 of the first n terms (2)
- Find the common difference
- Find the first term
- Calculate the number of terms
- Calculate the sum

Geometric

- Sum of the first n terms
- Find the first term – sum known
- Sum of an infinite series (1)
- Find the ratio – infinite series
- Find the first term – infinite series
- Find the sum – infinite series (2)

Summation Notation – Arithmetic

- Arithmetic 1 to n
- Arithmetic m to n

Trigonometry

Radians

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

Segments

- Calculate the area
- Calculate the perimeter

Solving Equations – Basic Trig

- sin, cos, tan θ (range 0 to 2π)
- sin, cos, tan θ (range $-\pi$ to π)
- sin $a\theta$ (mixed range)
- cos $a\theta$ (mixed range)
- tan $a\theta$ (mixed range)
- sin ($\theta \pm \pi/n$)
- cos ($\theta \pm \pi/n$)
- tan ($\theta \pm \pi/n$)
- sin ($a\theta \pm \pi/n$)
- cos ($a\theta \pm \pi/n$)
- tan ($a\theta \pm \pi/n$)

Sectors

- Calculate the arc length
- Calculate the perimeter
- Calculate the area
- Calculate the angle – area known
- Calculate the radius – area known
- Calculate the perimeter – area known
- Calculate the perimeter – area known

Period and Amplitude

- Identify the period and amplitude

Small Angle Approximations

- a cos θ cos b θ
- cos a θ cos b θ
- cos a θ cos (b/θ)
- cos a θ (1 $\pm$ b sin θ)
- cos a θ (1 $\pm$ sin b θ)
- cos a θ (1 $\pm$ sin b θ)^2
- (1 $\pm$ cos a θ)(tan b θ $\pm$ 1)^2
- (1 - cos a θ) / (sin b θ)
- (θ^2 $\pm$ cos a θ $\pm$ 1) / (sin b θ)
- (sin^2 a θ + cos^2 b θ) / (tan c θ)
- (1 - cos a θ) / (b θ sin c θ)

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Trigonometry

Solving Equations – Advanced Trig

- Solve a sin 2x = b sin x
- Solve a sin 2x + b sin x = 0
- Solve a sin 2x = b cos x
- Solve a sin 2x + b cos x = 0
- Solve a cos 2x - b sin^2 x = c
- Solve a cos 2x + b cos^2 x = c
- Solve a sin 2x = b tan x
- Solve a cos^2 x - b cos 2x = c
- Solve a sin^2 x - b cos 2x = c
- Solve a sin 2x cos x = b sin x

Reciprocals – Solving

- Solve cosec x = a
- Solve sec x = a
- Solve cot x = a
- Solve a cot^2 θ + b = c cosec θ
- Solve a tan^2 θ + b sec θ = c
- Solve a sec^2 θ + b tan θ = c

Reciprocals – Exact Values

- tan θ known -> find sec θ
- cosec θ known -> find cot θ
- cot θ known -> find sec θ
- cot θ known -> find cosec θ