|  |  |
| --- | --- |
| Quadratics for  , Δ > 0 : 2, Δ = 0 : 1, Δ < 0 : 0 Inequalities LHS +y: dir = “>” ? ↑ : ↓ (Any equations)  LHS +x: selection = dir of > Transformation f(x + t) t → -x  f(x) + t t → y  f(sx) s →  sf(x) s → y Coordinate geometry {//}:  {⊥}:  mid-point: Trigonometry A  H  O  s  c  t  Cosine rule: /  Sine rule:  Think about which angles and lengths and variables, if two possible angles are discovered, the second angle is 180 - θ  Area: Sectors & radians Area:  Sector area: Calculus First principle:  →  **Method:** Proving geometric series  S = a + ar + … + arn-1  S \* r = ar + ar+ + … + arn  S-Sr = a - arn  S(1-r)=a(1-rn)  S = | Remainders and divisions →  → Proves **Expressions**  Is a multiple of x: xn  Even number (is a multiple of 2): 2n  Odd number: 2n + 1  Consecutive numbers: n, n + 1  Consecutive odd numbers: 2n +1, 2n + 3  **Known facts**  **Proving true**  Build up prove by known facts  Revert result to known facts  Try each case if the range is narrow  **Proving false**  Counter-examples Circle Circle {c:(a,b), r:r}:  Tangent and the radius of a circle is perpendicular  Tangents drawn from a common point to a circle are equal in length   * For **right angled triangles with corners touching the same circle**, the side opposite to the right angle is the diameter * Intersections of perpendicular bisectors of chords of circles is the center of the circle  Pascal, Factorial, Binomial expansion The **r**th entry in the **n**th row of Pascal’s triangle is given by  **Method:** finding unknown factorials by canceling like terms  **Binomial expansion** {} Sequences **Arithmetic: constant difference**  {p: term difference, ix: term x}  Sequence: {a: first term, d: common difference}  Series: or {l: last term}  **Method:** Proving series  S = a + [a + d] + … + [a + (n-1)d]  S = [a + (n-1)d] + … + [a + d] + a  2S = [2a + (n-1)d] + … + [2a + (n-1)d]  ∴  **Geometric: constant ratio**  .  or  **Convergent sum to infinity**  where  **Types of sequence**  Increasing:  Decreasing:  Periodic: {k: order / period of sequence} |

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| Exponential and logarithms ⇌  Exponential graphs: Asymptote ,  **Method:** group by logarithms and cancel  For equations like   1. Make both sides a logarithm object by applying the logarithm laws 2. Cancel out the logarithm to proceed   **Method:** Find common factors in quadratic form  For equations like , treat them as quadratics and solve the problem More trigonometry CAST are the prefixes of angles which are positive.  reflex  obtuse  acute  There are multiple answers to a trigo function, the values returned by calculator is the principle value.  **Method:** revolutions  Example:   1. Get the principle value: 2. Obtain other answers by rotating the imaginary line on the CAST graph to the regions where the answers are positive, and substitute to the region’s function  * sin: same row * cos: same column * tan: opposite side  1. List out all the possible answers   **Method:** solve for , in the interval   1. → 2. Keep in mind the range of answers are ratio-ed by n → 3. solve for , in the interval using the revolutions method 4. solve for  And more calculus Local maximum: : pos → 0 → neg  Local minimum: : neg → 0 → pos  Point of inflection: : dir → 0 → dir  Stationary point:  : local minimum  : local maximum  : point of inflection, local max / min.  **Definite integrals**  Finite area of f(x) to x-axis from a → b:  If the finite area is under the x-axis, value returned will be .  Area between 2 curves from a → b:  Limits not given? Find it yourself by subbing the functions together  **Trapezium rule**  Used to approximate the area beneath a curve from a → b with n strips:  where strip width  If the graph:  Bends outwards: underestimate of area  Bends inwards: overestimate of area |

## Equalities

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| Surds |  |  |  |  |
| Indices |  |  |  |  |
|  |  |  |  |  |
| Exponential |  |  |  |  |
|  |  |  |  |  |
| Sequences |  |  |  |  |
| Trigonometry |  |  |  |  |

## Exam tips

* Read the WHOLE question before you start your answer
* Draw clear well-labelled diagrams
* Look for clues or key words given in the question
* Write down formulae before substituting numbers
* Make sure you finish a ‘prove’ or a ‘show’ question – quote the end result
* Don’t fudge your answers (particularly if the answer is given)!
* Don’t round your answers prematurely
* Make sure you give your final answers to the required/appropriate degree of accuracy
* Check details at the end of every question (e.g. particular form, exact answer)
* Take note of the part marks given in the question
* If your solution is becoming very lengthy, check the original details given in the question
* If the question says “hence” make sure you use the previous parts in your answer
* Keep going through the paper – go back over questions at the end if time

## Symbols and notations

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| **Symbol** | **Description** | **Example** |
| N | Natural numbers | 1, 2, 3 |
| R | Real numbers | Any real numbers (false: sqrt(-1)) |
| Z | Integers | -1, 0, 1 |
| Q | Rational numbers | Numbers which are not repeating w/o patterns |
| P | Irrational numbers | Pi, sqrt(3) |
|  | For every |  |
|  | Element of |  |
| {} | Domain container |  |
| \ | Except |  |