Diagram and Notation Conventions

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The house style for every figure, symbol and proof layout in MATH1061 — read off the course's own lecture slides rather than assumed. This is the authority any new diagram for this course is checked against. Where the source does not settle something, that is said so explicitly rather than filled in.

What was read

Everything the course ships in the anchor set, in full: **all 176 slide pages across the 18 lecture decks (L01–L18), plus the 1-page examination formula sheet.** No sampling —

the whole corpus was viewed as rendered images so the drawings, ink colours and box shapes were seen, not inferred from extracted text.

Citations below use `L07 p2` = **PDF page 2** of `math1061-lecture-07-…pdf`. Two decks have a page-label offset worth knowing: `L03 p2-p3` carry the printed header *Lecture 2*, and `L17 p9-p10` carry the printed header *Lecture 18*. PDF page position is what is cited.

The course ships one written reference — the *MATH1061/MATH7861 Examination Formula Page*. It is a genuine notation authority (it fixes , , bold **t**/**c**, `A` , , `A - B`, and the numbering of the set identities), but it is **not a drawing guide**: it says nothing about figures, colour, layout or symbol shape. Everything in the *Diagrams* section below is inferred from the decks alone.

Only **18 of the course's 36 lectures** exist in this set (L19–L36 — one-to-one/onto functions, composition, cardinality, relations, equivalence and partial orders, groups, fields, counting, probability, pigeonhole, graph theory, walks, matrix representations, trees — are absent). Conventions for those topics are unestablished; see the last section.

Provenance: two lecturers, one template

The course is split between two lecturers (`L01 p12`, course schedule): **Sara Davies** takes L01–L09 and L18–L26; **Katie Clinch** takes L10–L17 and L27–L36. Both use the same slide frame, but their annotation habits and some box conventions differ. Where they diverge it is recorded under Inconsistencies, not resolved.

Textbook lineage

The recommended text is **Susanna Epp, *Discrete Mathematics with Applications*, 4th or 5th (metric) edition** (`L01 p3`, with the cover image on the slide). It is cited repeatedly by page for statements and exercises — `L14 p7` ("Q27 on page 279 of Epp"), `L14 p8` ("Q31 on page 279"), `L16 p12` ("page 310 (in 4th edition) or page 346 (in 5th edition)"), `L18 p8` ("pages 419-421 (ed. 5) or pages 378-380 (ed. 4)").

Important qualification: no slide anywhere carries a caption naming a textbook as the source of a *figure*. The Epp lineage is real for wording and content — the logical-equivalence names, the valid-argument-form names and the twelve numbered set identities are Epp's — but it is **not** documented evidence for any drawing style. Do not cite Epp as a figure source.

Slide frame and page furniture

Element	Convention	Evidence	Holds?
Header band	Page 1 of each deck: `MATH1061/MATH7861 Discrete Mathematics Semester 2, 2026` at far left, `Lecture N - Title` at far right. Later pages: right-hand lecture label only. A full-width thin black rule sits beneath.	`L02 p1` vs `L02 p2`; identical in every deck L02–L18	Every deck except L01, which has UQ-branded title slides
Pre-work box	A **purple rounded-rectangle** box, top right of page 1, headed `Pre-work video:` / `Pre-work videos:` in bold, listing `Video NNN Title` with three-digit zero-padded numbers	`L02 p1`, `L03 p1`, `L05 p1`, `L07 p1`, `L10 p1`, `L13 p1`, `L16 p1`, `L18 p1`	All 17 decks L02–L18 — the single most consistent element in the course
Learning goals	Bold `Learning Goals` heading, numbered list `1. 2. 3.`	`L02 p1` … `L18 p1`	Every deck L02–L18 (L07 p1 uses an unnumbered list — the one exception)
Student Q&A	Bold blue heading `Student questions and comments:` (or `Student questions:`), questions in **blue**, answers in **red**	`L02 p1`, `L04 p1`, `L06 p1`, `L08 p1`, `L11 p1`, `L12 p1`, `L15 p1`, `L18 p1`	Every deck L02–L18

Activities	Bold `Activity N:` restarting at 1 each lecture; pre-class items as `Q1 from the pre-class questions`; Clinch decks add `Poll question N:`	`L02 p3`, `L07 p5`, `L12 p2`, `L17 p3`	Throughout

Figures are **never numbered and never labelled "Figure"**. When a caption exists it sits centred directly beneath the drawing, either as the mathematical expression it depicts (`(A - B)`, `L18 p2`) or as a short prose verdict (`not a function` / `a function`, `L18 p9`).

Colour

Printed colour on slides

- **Red = the thing you must not get wrong.** Warnings, answers to student questions, "IMPORTANT NOTE", "Take care with notation!", "WARNING". `L01 p4` ("hurdles"), `L02 p1`, `L08 p2` ("WARNING"), `L10 p1` ("IMPORTANT NOTE"), `L11 p4` ("Take care with notation!"), `L17 p2` ("Warning!!!!"), `L17 p9`. Holds in both lecturers' decks, all semester.
- **Blue = student voice and explanatory gloss.** Student questions (`L02 p1` onward, universal) and, in Clinch's decks, a plain-English restatement placed *directly beneath* a formal condition written in red — `L12 p3` (`d|a and d|b` in red, "*d is a divisor of both a and b*" in blue below it), `L12 p4` (same pattern for lcm). That paired red-above/blue-below idiom is specific and recurs.
- **Colour as correspondence, not meaning.** Where two expressions must be matched piece-by-piece, matching pieces are given matching colours. `L03 p9` (a three-row table where `a  b`, `a if and only if b`, `b is necessary and sufficient for a` are colour-aligned column by column), `L06 p6` (quantifier negation, below), `L11 p3` (quotient in red above q, remainder in red above r, and the same two colours on the worked examples). This is the one place colour genuinely carries information.
- **Pastel highlight capsules** (yellow, green, blue, pink, orange) mark the single expression being tracked through a calculation — it keeps its capsule colour as it moves line to line. Heavily used by Clinch: `L11 p3`, `L12 p6`, `L13 p6`, `L14 p3`, `L16 p5`, `L17 p5`. Rare in Davies's decks.

Annotation ink (live handwriting)

Both lecturers annotate over the slides in ink. **Blue is the predominant ink for the main worked solution** — `L01 p13`, `L02 p7`, `L04 p4`, `L07 p4`, `L08 p5`, `L10 p5`, `L13 p7`, `L16 p7`, `L18 p3`. Other colours (green, red, purple, orange, teal) are layered over it for justifications, second solutions, and circling.

Be honest about what ink colour means: mostly, nothing fixed. It separates successive layers of annotation for legibility, and rotates. The two places it *is* systematic:

1. **Correspondence** — e.g. `L02 p6`, where each intermediate truth-table column is written in its own colour and numbered in that colour to show evaluation order, with the final column ringed and labelled "final answer".
2. **Verdict marks** — a green circled `T` and a red circled `F` for true/false answers: `L05 p7`, `L05 p8`, `L06 p4`. Green tick / red cross for correct/incorrect options: `L06 p3`, `L09 p4`, `L16 p2`.

Boxes and callouts

Shape	Meaning	Evidence	Holds?
Purple rounded rectangle	A named, quotable object: definition, Fact, Lemma, Theorem — and the pre-work video box	`L07 p1` (the six definitions), `L07 p2` (two Facts), `L08 p2`, `L09 p6` (Fact + Lemma), `L10 p6`, `L10 p7` (Unique Factorisation Theorem), `L10 p9`, `L10 p12`, `L11 p3` (Quotient-Remainder Theorem), `L11 p7`, `L11 p8`	Strong: both lecturers, L07 through L12
Plain thin black rectangle	A structural panel — a proof skeleton, or a two-way comparison	`L07 p3`, `L08 p3`, `L09 p2` (the four proof-method skeletons), `L11 p3` ("2 equivalent ways of defining…")	Consistent where it appears

Shape	Meaning	Evidence	Holds?
Red rectangle	Davies: a fact that must be memorised or a warning. Clinch: a numbered step caption or a named principle	`L02 p8` (De Morgan's laws), `L03 p4`, `L03 p9`, `L04 p1` ("Recall:"), `L01 p4`; and `L10 p6` (margin commentary), `L12 p10` (steps 1/2/3), `L14 p6` (Well-ordering Principle)	Both uses recur; see Inconsistencies
Margin callout with arrow	A red-outlined box in the right margin, with a red arrow to the exact proof line it explains, and a purple at the anchor point	`L10 p6` (two callouts, two arrows, two stars)	Seen once — extrapolating from a single instance
Hand-drawn cloud	An aside or a menu of options: "What type of proof will work?" with / against each method	`L09 p4`, `L09 p5`, `L09 p6`, `L09 p7`; `L14 p3`	Four consecutive slides in L09, once in L14

Logic notation

Fixed by the formula sheet and used unchanged in every deck:

Symbol	Reading	Note
`p`	not p	**The course symbol is the tilde , not ¬.** `L02 p1` answers this directly: "some common symbols for not include and ¬" — both exist, this course writes . Used in every deck and on the formula sheet
`p q`, `p q`	and, or	is **inclusive** or; exclusive or is (`L02 p5`)
`p → q`	if p then q	`L03 p1`; defined as `p q`

Symbol	Reading	Note
p q	if and only if	A **connective that combines** statements
p q, p q	logically equivalent / not	A **relation that compares** statements
t, **c**	tautology, contradiction	Bold upright, lower case. Formula sheet; L02 p9
	therefore	Prefixes the conclusion of an argument

versus is stated explicitly and must not be blurred (L03 p7): "The biconditional ( ) is a conjunction used to **combine** statements (similar to +, -, x, ÷ … with numbers). Logical equivalence ( ) is used when **comparing** two statements (similar to = with numbers)."

Precedence (L02 p5, extended at L03 p7): first; and equal second; → and equal third; within a tier, work left to right — "but parentheses should always be used to avoid confusion."

Statement variables are lower-case italic p, q, r. When a problem is in English, the letters are chosen as mnemonics of the English phrase: w = wages, b = buying, d = depression (L04 p4); q = queued, s = sent to the buffer (L05 p2).

Truth tables

The course calls this **"standard truth table form"** and requires it (L02 p4): *"You should construct your truth tables in standard form so that you are sure you have covered all combinations … and it is easy for someone to check your work."*

- **Values are the single upright capitals T and F** — never 1/0, never True/False. Universal: L02 p4, L03 p1, L04 p5, L06 p2, L07 p3, L09 p2.
- **2 rows for *n* variables**, in a fixed order: the first variable is T for the whole top half then F for the whole bottom half; each subsequent variable halves again; the last variable alternates T,F every row. Shown for n = 1, 2, 3, 4 side by side at L02 p4.
- **A narrow solid-filled amber/orange column separates the input block from the compound-form block.** L02 p4 (after the variable columns, before "Statement form"); L04 p5 (after the variables *and* their simple negations, before the premise and conclusion columns). Two instances, both lecturers' style aside — treat as the course's own table furniture.
- **Header row typeset in red italic maths** (p, q, p → q), body values in black upright. L03 p1, L03 p4, L04 p1, L04 p2, L04 p5, L07 p3, L08 p3, L09 p2. Consistent throughout Davies's decks; Clinch draws no printed truth tables.
- Full ruled grid — every cell bordered.

- **When built by hand, columns are added left to right in evaluation order and numbered beneath**, each in its own ink colour, with the answer column ringed. `L02 p6`, `L03 p2`. At `L03 p2` the two columns that must match are marked with a beneath and the verdict written out: "Starred columns are identical so ((p q) (p q)) p".

Arguments and inference proofs

Argument form (formula sheet; `L04 p2`, `L04 p3`, `L04 p6`, `L05 p2`, `L05 p4`): premises stacked one per line, left-aligned; the conclusion on the last line prefixed by . **No horizontal rule above the conclusion.** Premises are numbered `1. 2. 3.` and the line is left unnumbered.

Rules-of-inference proof (`L04 p6`, `L04 p7`, `L05 p4`): numbered lines down the left, the derived statement in the middle, and the **justification in its own right-hand column**, phrased as `from by contraposition`, `from & by transitivity`, `by double negative law`, `by definition of →`. The annotation at `L04 p6` is emphatic: **"must write explanations!"**.

Equivalence-law chains (`L02 p10`, `L03 p8`, `L18 p5`, `L18 p7`): first line is the starting expression; every subsequent line begins with (or = for sets), vertically aligned, with the named law in a right-hand column — `by de Morgan's law`, `by the negation law`, `by identity law`. For set identities the numbered law from the formula sheet is cited: `by set diff law (12)`, `by de Morgan (9b)`, `dist. law (3b)`, `complement law (5b)`, `identity law (4a)` (`L18 p7`).

Biconditional proofs are marked by direction: and label the two halves (`L12 p8`). Two named methods, with a stated preference — Method 1, prove each direction separately, is annotated "**recommended method**"; Method 2, an `iff` chain, is annotated "**Be careful! Quicker method but easy to make a logical error**" (`L12 p8`, `L12 p9`).

Quantifiers

- `x D, P(x)` — universal, **comma** after the domain.
- `x D such that P(x)` — existential, the words **"such that"**, abbreviated **`s.t.`** (`L06 p1`, `L05 p7`).
- Both established at `L05 p5` and used unchanged through `L08 p1`, `L17 p3`.
- reads "is an element of" / "belongs to"; "is not an element of" (`L05 p5`).
- Negation rules, stated as displayed equivalences at `L08 p1`: `( x D such that P(x))` `x D, P(x)` and `( x D, P(x))` `x D such that P(x)`.

Number sets

Blackboard-bold, established at L05 p1 and used unchanged to the end: , , , .

Irrational numbers are written ‾ — with an overbar (L05 p1, L09 p1, L09 p3, L09 p6). Not ; the equality = ‾ is written by hand at L09 p1 as a gloss, but the barred form is what the printed slides use.

Restrictions are written as superscripts on the set symbol, in italic, not as subscripts and not as prose:

```
^even ^odd ^nonneg ^prime ^composite ^{>1} ^{ 2} ^{ 1}
```

Evidence: L05 p1 (, ^even, ^nonneg), L07 p2 (^even, ^odd, ^prime, ^composite, ^{ 1}, ^{>1}), L07 p6 (^{ 2}), L10 p12 (^{ 2}), L17 p10 (,). Strong and semester-long.

Proof layout

The four methods each have a **fixed printed skeleton**, given verbatim on a repeated slide (L07 p3, L08 p3, L09 p2 — the same panel, grown one box at a time as methods are introduced). Reproduce these wordings:

- **Direct proof** — `Let x  D and suppose P(x). … Hence Q(x).`
- **Disproof by counterexample** — `Let x =  . Then x  D and P(x) is true. However, Q(x) is false.  So x is a counterexample and the statement is false.`
- **Proof by contradiction** — `Suppose the negation of  x  D, P(x) → Q(x) is true. That is, suppose  x  D such that P(x) is true but Q(x) is false. … Hence something that is obviously wrong…  This is a contradiction, and we conclude that … is true.`
- **Proof by contraposition** — `We prove the contrapositive of  x  D, P(x) → Q(x), namely that  x  D,  Q(x) → P(x).  Let x  D and suppose  Q(x).  … Hence,  P(x).`

Each box carries a red caption directly beneath it saying what it establishes: `Shows the statement is true.` / `Shows the statement is false.` (L07 p3, L08 p3).

Other layout facts:

- `Proof:` **label**, then the hypothesis line, then the working with = signs vertically aligned in a column, then a Hence/Thus/So conclusion. L07 p4, L07 p5, L08 p5, L09 p3, L10 p5.
- **Method comparison is a two-column layout** with bold centred headings — `Direct Proof` left, `Proof by contradiction` right (L08 p5, L08 p6); `Proof SMI` / `Proof MI` / `Proof WOP` (L14 p7, L14 p8).

- **Without loss of generality, spelled out then abbreviated WLOG** (L08 p8, L09 p5).
- **Case splits are labelled Case 1: / Case 2:** (L10 p6, L10 p12, L14 p5).
- **Every proof unfolds definitions.** The six definitions in the purple box at L07 p1 / L08 p2 are stated as **biconditionals using** — e.g. n is an even integer n = 2k for some integer k, d|n d 0 and n = dk for some integer k — because they are used in both directions.
- **Introduce a *new* variable for each new existential.** Annotated explicitly at L08 p6: "use a **new** variable!" where m = 2k+1 is followed by n = 2 +1.

End-of-proof mark

Printed proofs end with an **open square** : L07 p3, L07 p4, L08 p3, L09 p2, L10 p6, L10 p11, L10 p12.

Handwritten proofs end with either a hand-drawn open square (L07 p5, L08 p8, L09 p4, L09 p5, L09 p6) or a **double slash //** (L10 p5, L11 p6, L13 p7, L13 p9, L14 p10, L15 p5, L16 p7, L18 p3, L18 p7). At L11 p6 the lecturer writes an explicit legend of the acceptable marks: **// or QED**. Treat all four as sanctioned.

Contradiction mark

Davies writes ( ) — two arrows meeting — inline at the point the contradiction lands: L08 p3, L08 p5, L08 p6, L08 p7, L08 p8, L09 p6. Clinch instead uses a small crossed glyph inline, e.g. "(proof by)" for "proof by contradiction" (L14 p6, twice). See Inconsistencies.

Induction

The named-step skeleton is fixed and printed identically in five separate proofs:

```
Proof:  Let P(n) be the predicate  statement .
Basis step:        verify P(a)  … so P(a) is true.
Inductive step:    Prove that  k    with k  a, if P(k) is true, then P(k+1) is true.
Inductive hypothesis:  Suppose that k  a is an integer and that P(k) is true.
        LHS of P(k+1):  chain of = with the RHS reached
        Therefore P(k+1) is true.
Therefore, by  PMI / SMI ,  statement  for each integer n  a.
```

Evidence: L13 p6, L13 p8, L14 p3, L14 p7, L16 p6, L16 p8, L16 p10. Step labels are printed in **blue** at L13 p6 and in **red** at L14 p3/L14 p7.

- `LHS` / `RHS` are the standard abbreviations, and the two sides are named and worked separately: `LHS of P(1): … RHS of P(1): …` (`L13 p6`, `L13 p7`, `L16 p7`).
- The step where the hypothesis is used is annotated `(by the inductive hypothesis)` on the same line (`L13 p6`, `L13 p7`, `L14 p3`).
- Slides ask for the steps to be named: *"It is a good idea to list these explicitly in your proofs to help the reader to follow the proof"* (`L13 p1`).
- Multiple base cases are listed one per line when strong induction needs them (`L14 p4`, `L15 p8`).

Number-theory notation

- **Divides: `d | n`. Does not divide: `d  n`** (slashed bar). `L05 p7`, `L07 p1`, `L10 p1`, `L10 p10`, `L14 p8`.
- Equivalent phrasings given at `L10 p1`: *d divides n*, *d is a divisor of n*, *d is a factor of n*, *n is a multiple of d*.
- **`n mod d = r`** (upright `mod` as a binary operator, no brackets) versus **`m  n (mod d)`** (congruence, `(mod d)` bracketed after the statement). These are different things and the course flags it twice under a red heading `Take care with notation!` — `L11 p3`, `L11 p4`, recapped `L12 p2`.
- **`gcd(a, b)` and `lcm(a, b)`**, lower case, upright roman (`L12 p3`, `L12 p4`). At `L12 p3` the alternative `hcf(a,b)` is written and then **struck through** — it is not this course's name.
- **Floor `x` and ceiling `x`** (`L11 p2`).
- **Standard factored form**: `n = p^{e} p^{e}  p_k^{e_k}` with the primes in **increasing** order `p < p <  < p_k` (`L10 p7`, annotated "increasing" at `L10 p8`).
- **Multiplication is a centred dot** · in printed slides: `2 · 3 · 5 · 7 · 11  p` (`L10 p11`), `5859 = 1232 · 4 + 931` (`L12 p6`), `2 · 100 + 5 · 10 + 4 · 1` (`L11 p8`), `3 · 1 + 2` (`L13 p6`).

Sequences, sums and recurrences

- **Summation Σ with `i = m` below and `n` above**; index letters `i`, `j`, `k`; change of variable written as `j = i + 1` (`L13 p3`, `L13 p4`, `L13 p6`).
- A recursive definition of a **sequence** requires two named parts: **a recurrence relation** and **initial conditions** (`L15 p3`, `L16 p7`, `L16 p9`).
- A recursive definition of a **set** requires three named parts: **Base**, **Recursion**, **Restriction** — always in that order, with the Restriction worded "Nothing is in B other than objects defined by the Base and the Recursion" (`L15 p6`, `L15 p7`).
- Verifying a guessed explicit formula has two named methods: **Method 1** (check the initial conditions and the recurrence relation — annotated "quicker") and **Method 2** (prove it by induction — annotated "rigorous"). `L16 p4`, used at `L16 p5`–`L16 p10`.

- `n!` with `0! = 1` by definition (`L15 p5`).

Set-theory notation

Notation	Meaning	Evidence
`x  A`	is an element of	`L17 p1`
`A  B`	is a subset of	`L17 p1`, `L17 p3`
`A  B`	is a **proper** subset of (and there is an element of B not in A)	`L17 p3` — the course does use strictly for proper
`A  B`, `A  B`	intersection, union; indexed forms `_{i=1}^{3} A` , `_{i=1}^{3} A`	`L17 p1`, `L17 p6`
`A - B`	set difference; **`A \ B` is stated to be equally acceptable**	`L17 p1` — answered directly: "Yes. `A - B` can be written as `A \ B`"
`A`	complement, superscript `c`	`L17 p1`, `L18 p1`, formula sheet
`(A)`	power set, calligraphic script `P`	`L17 p1`, `L17 p7`, `L17 p8`
`A × B`	Cartesian product; `×` also written ²	`L17 p1`, `L17 p9`
	empty set, also written `{ }`	`L17 p5`
`|A|`	cardinality	`L17 p7`, `L17 p9`
`{n  | n  2 (mod 8)}`	set-builder with a vertical bar	`L17 p3`, `L18 p2`
`[a, b]`	closed interval `{x  | a  x  b}`	`L17 p6`

Sets take capital italic letters (`A, B, C, S, T, D, E, R, X, Y`), the universal set is `U`, elements take lower case (`x, y, t`). `L17 p3`, `L18 p1`, `L18 p6`.

The / distinction is the course's flagged trap — a red `Warning!!!!` at `L17 p2` and the first learning goal of both L17 and L18. `2  {2}` (`L17 p2`); is false, is true (`L17 p1`, `L17 p2`).

Proof of set statements has three named methods (`L18 p4`): **the element method**, **using the laws of logical equivalence**, and **using set identities** (citing the formula sheet's numbering, as above).

Functions (`L18 p9`–`L18 p11`): `f: X → Y`; `f  X × Y` such that for each `x  X` there is a unique `y  Y` with `(x, y)  f`. Domain `X`, **co-domain** `Y` (hyphenated in print), range `f(X) = {f(x)`

`: x  X}`. Image of a subset `f(A)`; **inverse image or preimage** `f ¹(B)` — both words are given as correct.

Diagrams

This is what the decks actually draw. Nine idioms recur; everything else is a one-off and is labelled as such.

1. Nested closed curves for containment (Euler style)

Number systems are drawn as **concentric plain closed curves with each label written inside its own region** — `: rational numbers` outermost, containing `: integers`, containing `: natural numbers`; labelled above the frame, `¯: irrational numbers` in a separate adjacent panel. Thin blue rule dividing the two panels; curves thin black; no shading; no element dots. `L05 p1`. **Seen once for number systems**, but the same nested-oval idiom recurs for subsets at `L17 p3` and `L18 p3`, so the shape convention is safe — the specific number-system figure is not.

2. Rectangle partitions

A **plain rectangle with a thin blue/teal outline** stands for the ambient set; **thin internal straight lines** split it into disjoint parts; each part is labelled in **red italic** with its superscript-qualified name; the ambient set's own label sits **above and outside** the top-left corner. Two instances on one page: split into `^even | ^odd`, and split into `^{ 1} | ^prime / ^composite`. `L07 p2`. **Seen on one page only** — but it is the course's only *printed* partition figure, and it is the natural pairing with the superscript set notation above.

3. Two-circle Venn diagrams

- **Exactly two circles of equal radius, overlapping, drawn side by side in a horizontal row**; thin black outline; labels `A` and `B` placed **inside** each circle near its top outer edge.
- **The region being denoted is filled solid grey.** The undecorated pair is drawn first, unshaded, as the reference.
- **The expression it depicts is the caption, centred directly beneath** — `(A - B)`, `(B - A)`.
- `L18 p2`. Three diagrams in a row.
- Hand-drawn variant at `L18 p3`: a **rectangle for the universe with red diagonal hatching** over the complement region, with `A` (green) inside `B` (green outline) inside it.

Critical rule, stated by the course itself: at `L18 p2` a hand annotation brackets all three Venn diagrams and writes "**not a proof!**". A Venn diagram in this course illustrates a set statement; it never discharges one. Proofs go through the element method, the laws of logical equivalence, or the set identities (`L18 p4`).

4. Small icon strip for set relations

A row of thumbnail two-set diagrams, one per notation, aligned under the list of symbols they gloss: **set A drawn as a green ellipse, set B as a pale blue/grey ellipse**; an element as a small filled dot; the operation's region filled or hatched in blue. `L17 p1` (the full strip: `x  A`, `A  B`, `A  B`, `A  B`, `A  B`, `A - B`, and `A = B` drawn as coincident ellipses). Repeated as single icons at `L17 p3`, `L17 p4`, `L17 p6`. **The green-A / grey-B colour pairing holds across all five appearances.**

5. Function arrow diagrams (bipartite)

- **Two vertical ellipses side by side: the domain `X` on the left, the co-domain `Y` on the right**, each labelled **beneath** the ellipse in blue.
- Elements are **labelled dots stacked vertically inside** each ellipse.
- Each element of `X` is joined to its image by a **straight blue line segment**. Flow is left to right.
- A subset under discussion is marked by a **translucent coloured blob** drawn around the relevant dots, labelled just outside in the matching colour with its expression (`f({2,3})`, `f ⁻¹({1})`, `f({1})`).
- `L18 p11` — four diagrams on the page, all hand-drawn, all following this arrangement.

6. Cartesian-plane graphs

Axes as **thin double-headed arrows crossing at the origin**; the `y` label at the top of the vertical axis and the `x` label at the right of the horizontal axis, both immediately beside the arrowhead; the curve in **blue**; marked points as **filled dots labelled with their coordinate pair** `(0,1)`, `(5,11)`; a **prose caption centred beneath** (`Plot of the function y = 2x + 1.`, `not a function`, `a function`). The vertical line test is shown as a **red vertical line** crossing the curve twice. `L18 p9` — three panels in a row.

7. Number lines

Drawn as a **horizontal line with an arrowhead at each end**, evenly spaced tick marks, **integer labels beneath the ticks**, and marked points or brackets **above** the line. `L11 p2` (two of them: the real line from -5 to 4 for floor/ceiling, and a minimal one showing only `k`

and k+1 with k + ½ between); L17 p6 (interval [a,b] drawn above the line with filled dots at the closed endpoints, the axis labelled at the right end).

8. Colour-coded correspondence diagrams

The single most information-dense idiom in the course. At L06 p6, the negation of a two-quantifier statement is shown as **two copies of the same statement schema stacked one above the other and horizontally aligned part-for-part**, with each corresponding pair of parts underlined in its own colour and joined by a **double-headed arrow of that colour**:

- red: x X x X such that
- green: y Y such that y Y,
- cyan: P(x,y) P(x,y)
- a purple curved double-headed arrow spanning both rows, **labelled negation**

Seen once, but it is the canonical figure for the topic. The same alignment-plus-colour technique without arrows appears at L03 p9 and L12 p3.

9. Algorithm and process cascades

- **Euclidean algorithm** (L12 p6): the successive equations a = bq + r stacked vertically down the left; each numeral wrapped in a **pastel capsule, and each number keeps the same capsule colour as it migrates** from b to a and r to b on the next line; **red diagonal arrows** trace those two migrations; a parallel right-hand column carries the matching gcd(a,b) = gcd(b,r) chain with the same capsule colours. Colour here is pure identity-tracking.
- **Sequence hops** (L16 p2, L16 p3, L15 p5): terms written in a horizontal row, **short curved arrows above or below each gap, labelled with the operation** (+3, ×3, × −1).
- **Recursive-construction tree** (L15 p6): root at the **left**, branches as plain straight segments fanning **rightwards**, node labels at the branch tips, **no arrowheads on the branches**. The separate derivation chain uses arrows with the rule name written above: --1--> 1 --1--> 11 --01--> 1101 (L15 p7).
- **State sequences** (L16 p11, Tower of Hanoi): three vertical blue pegs on a base line; discs as short red horizontal bars, widest at the bottom; **each state enclosed in a plain black rectangle**; states run **left to right**; green curved arrows between states labelled with the move count (m_{n-1}, 1, m_{n-1}).
- **Partitions of a set as coloured blobs** (L17 p10): irregular non-overlapping closed curves in distinct colours, each containing dots, each **labelled just outside in its own colour** (A green, A red, A yellow, A blue). On the same page a number line is partitioned instead by **weaving highlighter stripes** — pink for S, green for T — over the tick labels.

Tables

- Full ruled grid, header row present.
- Truth tables as described above.
- Comparison tables put the item varying across the top and the cases down the side, with T/F in the cells (L06 p2: three quantified statements across, three sets S down).
- **Material reproduced from the examination formula sheet is pasted as an image and therefore appears in serif LaTeX type**, visually distinct from the sans-serif slide body: L02 p9 (Logical Equivalences), L04 p3 (Valid Argument Forms), L18 p6 (Set Identities). If reproducing one of those tables, reproduce the formula sheet's own wording and numbering.

Inconsistencies

The course does these things more than one way. **Both readings are recorded; no winner is picked. A decision is needed before any new figure fixes one.**

1. **End-of-proof mark.** Printed proofs use (L07 p3, L10 p11). Handwritten proofs use a hand-drawn square (L09 p4) *or* // (L13 p7, L18 p7). At L11 p6 the lecturer offers all of //, , and QED as equivalent. Clinch's printed induction proofs (L14 p7, L16 p6) end with a concluding sentence and **no mark at all**. Four options, all sanctioned. **Decide.**

2. **Contradiction mark.** Davies writes ( ) (L08 p3, L08 p5, L08 p6, L08 p7, L08 p8, L09 p6). Clinch writes a crossed glyph and uses it as a noun — "(proof by)" (L14 p6, two occurrences on one page). **Decide.**

3. **Name of the induction principle.** Within four decks: "by the principle of mathematical induction" (L13 p6), "by PMI" (L13 p8, L16 p12), "by MI" (L16 p10), "by SMI" (L14 p5, L16 p8), "by PSMI" (L14 p3, L14 p7). PMI/MI and SMI/PSMI are used for the same two principles in the same lecturer's decks. **Decide.**

4. **Sequence delimiters.** Printed: {b }_{n 0} (L13 p2), {a }_{n 1} (L15 p3), and bare a , a , a , … (L14 p3, L16 p2). Handwritten on the same slide (L13 p1): (a)_{n 0} **and** {a }_{n=1}^{ω}. Four forms. **Decide.**

5. **Set-builder separator.** Vertical bar in {n | n 2 (mod 8)} (L17 p3), {(x,y)|x and y } (L18 p9); colon in f = {(x,y) × : y = 2x + 1} (L18 p9, same page), f ¹(B) = {x X : f(x) B} and f(A) = {f(x): x A} (L18 p11). Both on the same page as each other. **Decide.**

6. **Multiplication sign.** Printed slides use the centred dot: 1232 · 4 (L12 p6), 2 · 3 · 5 · 7 (L10 p11). Handwriting on the very next slide uses ×: 2431 × 1 (L12 p7), 4 × 9 (L13 p9), ×3 (L16 p2). **Decide.**

7. **Set difference symbol.** `A - B` throughout the printed slides and the formula sheet; `A \ B` explicitly declared equally correct at `L17 p1`. Not a conflict of fact, but a live choice.
8. **Which box shape carries a named principle.** Purple rounded rectangle for Theorem/Lemma/Definition/Fact (`L07 p1`, `L10 p7`, `L11 p3`) versus a **red** rectangle for the Well-ordering Principle (`L14 p6`). Same category of object, two shapes.
9. **Text colour inside the purple definition box.** Red at `L07 p1`, `L08 p2`, `L11 p7`; blue at `L10 p7` (Unique Factorisation Theorem); black at `L07 p2` (the two Facts). Three colours for the same box type.
10. **Capitalisation of the induction step labels.** "Inductive hypothesis" (`L13 p6`, `L14 p3`) versus "Inductive Hypothesis" (`L16 p6`, `L16 p8`, `L16 p10`). Also "Let P(n) **be** the predicate" (`L13 p7`, `L16 p6`) versus "Let P(n) **denote** the predicate" (`L13 p6`).
11. **`LHS` versus `L.H.S`.** `L.H.S` / `R.H.S` with stops at `L13 p1`; `LHS` / `RHS` without at `L13 p6`, `L13 p7`, `L16 p7`, `L16 p9`.
12. **Does contain 0?** The printed diagram at `L05 p1` shows `: natural numbers` nested inside without saying which. The handwritten annotation on the same slide gives both `= {0,1,2,…}` **and** `= {1,2,3,…}` with the note "**take care!**" — the course is deliberately flagging the ambiguity rather than settling it. `^nonneg = {0,1,2,3,…}` is defined unambiguously on the same slide and is the safe alternative.
13. **Writing two variables in the same domain.** Three forms shown side by side at `L06 p5`: `x  D and y  E …` (annotated "more clear"), `x  D and y  E …`, and `x, y  D …` (annotated "short hand for same domain"). Preference is hinted at but not stated as a rule.

Not established by the source

Be candid: these are where a new diagram would be inventing, not conforming.

- **Arrowheads on function-diagram connectors.** Every mapping at `L18 p11` is drawn with a **plain line segment**. Whether an arrowhead is intended, required, or merely omitted in fast handwriting cannot be told from one page. Nothing in the corpus shows an arrowheaded mapping diagram.
- **Three-set Venn diagrams.** Only two-circle Venns are ever printed (`L18 p2`). The set identities involving three sets (associative, distributive — `L18 p6`) are never illustrated. There is no evidence for the standard three-circle arrangement, region labelling, or which regions get shaded.
- **A universe rectangle in printed Venn diagrams.** `L18 p2` has no enclosing rectangle at all. The only universe rectangle appears in a hand annotation (`L18 p3`) with red diagonal hatching. Whether a printed figure should include `U` is unsettled.

- **Shading colour and fill style.** One printed instance uses solid mid-grey (`L18 p2`); the icon strip uses blue hatching and blue solid interchangeably on the same row (`L17 p1`). No stated palette.
- **Line weights, stroke colours for plain geometry, and typeface.** Nothing is specified anywhere. Slide body text is a Calibri-like sans; reproduced formula-sheet extracts are serif LaTeX. Beyond that, invent nothing.
- **Figure numbering and cross-referencing.** No figure in 176 pages carries a number or the word "Figure". There is no established way to refer to a diagram from body text.
- **Any convention for the second half of the course.** L19–L36 have no decks in this set. That means **nothing is established** for: one-to-one / onto / inverse function diagrams; composition diagrams; cardinality and countability arguments (the Schröder–Bernstein theorem is on the formula sheet but never drawn); **relation digraphs**; **Hasse diagrams** for partial orders; equivalence-class pictures; Cayley tables for groups; counting trees and Pascal's triangle; **graph drawings** (vertex shape, edge style, labelling, directedness); walks/trails/circuits notation; **adjacency-matrix layout**; and tree drawings for graph theory. The only graph-theoretic images in the corpus are the Königsberg bridge photograph and a Tower of Hanoi photograph on `L01 p13`, which establish nothing.
- **Whether hand-annotation colour should be reproduced at all.** The ink layers exist because the slides are annotated live. A clean redrawn figure has no equivalent of "second colour for the second pass", and the corpus gives no printed-only version of most annotated diagrams to copy from.
- **A logic-gate or circuit notation.** None appears; MATH1061 is not a circuits course, but `L01 p10` motivates logic via computer science, so the absence is worth stating.
- **Whether may ever mean plain subset.** The course defines it as *proper* subset (`L17 p3`) and uses it that way consistently in the pages seen, but never says "we never use loosely", so a reader coming from other texts has no explicit prohibition to point at.