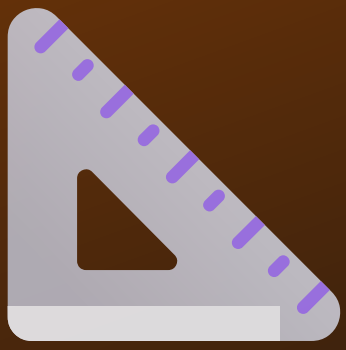
SPM · KSSM FORM 4 + FORM 5 · ENGLISH (DLP)

Mathematics Infographic Notes

One picture page per chapter

- 📄 **18** chapter pages
- ✍️ **54** quick-check questions
- ✅ Worked answers
- 🔤 English–BM glossary
- 📐 Formula / key terms box
- ⚠️ Common mistake box



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English–BM key terms glossary	**23**

1. Look at the picture first
The middle diagram shows the whole chapter. Cover the side cards and explain it out loud.

2. Learn the two boxes
The yellow box has the formulas and key words. The red box shows the mistake most students make.

3. Do the Quick Check
Answer the 3 questions on paper, then check the worked answers at the back.

Number Bases

Base 10

Our usual numbers: digits 0–9, place values 1, 10, 100…

Base 2

Computers: digits 0 and 1 only. Place values 1, 2, 4, 8, 16…

To base 10

Multiply each digit by its place value and add.

Place values in base 2

2^4	2^3	2^2	2^1	2^0
16	8	4	2	1
1	0	1	1	0

$10110_2 = 16 + 4 + 2 = 22_{10}$

Base 10 → base 2: keep dividing by 2

2 | 22	r 0
2 | 11	r 1
2 | 5	r 1
2 | 2	r 0
2 | 1	r 1
0	

read UP

Base n uses digits 0 to n − 1 only (base 5: 0, 1, 2, 3, 4)

From base 10

Divide by the new base again and again; read the remainders from the bottom.

Base 2 ↔ 8

Group binary digits in 3s from the right: $101\ 011_2 = 53_8$.

Adding

Carry when you reach the base: in base 2, $1 + 1 = 10_2$.

FORMULA / KEY TERMS

- Value = digit × $(\text{base})^{\text{position}}$
- Positions from the right: 0, 1, 2, 3 …
- Base 8 uses digits 0–7; base 5 uses 0–4
- Check: convert both sides to base 10

COMMON MISTAKE

❌ "352_5 is a number in base 5."

✅ Base 5 has digits 0–4 only, so the digit 5 is not allowed. 352_5 cannot exist.

QUICK CHECK (worked answers at the back, page 21)

1. Convert 213_4 to base 10.
2. Convert 45_{10} to base 2.
3. Find $1011_2 + 110_2$. Give your answer in base 2.

MATHEMATICS · FORM 4 · CHAPTER 4

Operations on Sets

Intersection ∩

Elements common to both sets: the overlap.

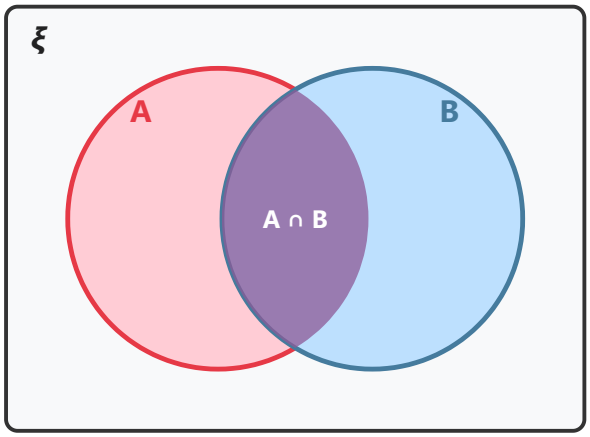
Union ∪

Every element in either set (count the overlap once).

Complement ′

Everything in ξ that is NOT in the set.

Venn diagram



A ∩ B (intersection): in A AND in B
A ∪ B (union): in A OR B or both
A′ (complement): NOT in A
n(A ∪ B) = n(A) + n(B) − n(A ∩ B)
Shade one step at a time for (A ∪ B)′ ∩ C

Combined

Do brackets first: (A ∪ B)′ means outside both circles.

Counting

Fill the overlap first, then the rest of each circle, then outside.

Word problems

"Like both" = ∩; "like at least one" = ∪; "like neither" = (A ∪ B)′.

📐 FORMULA / KEY TERMS

- n(A ∪ B) = n(A) + n(B) − n(A ∩ B)
- n(A′) = n(ξ) − n(A)
- A ∩ B ⊂ A ⊂ A ∪ B
- (A ∪ B)′ = A′ ∩ B′

⚠️ COMMON MISTAKE

❌ "n(A ∪ B) = n(A) + n(B)."

✅ That counts the overlap twice. Subtract n(A ∩ B) once.

✍️ QUICK CHECK (worked answers at the back, page 21)

1. n(ξ) = 40, n(A) = 25, n(B) = 18, n(A ∩ B) = 8. Find n(A ∪ B).
2. Using question 1, find n((A ∪ B)′).
3. In a class, 20 like football, 15 like badminton, 6 like both. How many like football only?

Network in Graph Theory

Graph

A set of vertices joined by edges. Shows links: roads, friends, flights.

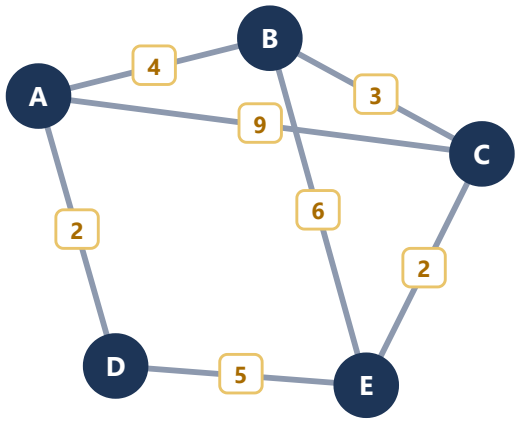
Degree

Number of edges meeting at a vertex. A loop adds 2.

Directed graph

Edges have arrows: one-way roads, followers.

A weighted graph



Vertex = dot, edge = line, weight = cost/distance
Degree of a vertex = number of edges at it
Sum of all degrees = 2 × number of edges
Tree: connected, no loops; edges = vertices − 1
Shortest A → C here: A–B–C = 7

Weighted graph

Edges carry values: distance, time, cost.

Tree

Connected graph with no cycle: edges = vertices − 1.

Shortest path

Compare every route's total weight; pick the smallest.

FORMULA / KEY TERMS

- Σ degrees = 2 × number of edges
- Tree: edges = vertices − 1
- Simple graph: no loops, no multiple edges
- Subgraph: part of a graph

COMMON MISTAKE

❌ "Sum of degrees = number of edges."

✅ Each edge has TWO ends, so Σ degrees = 2 × edges.

QUICK CHECK (worked answers at the back, page 21)

1. A graph has vertices with degrees 2, 3, 3, 2 and 4. How many edges does it have?
2. A tree has 8 vertices. How many edges does it have?
3. Roads: A–B 4 km, B–C 3 km, A–C 9 km, A–D 2 km, D–C 6 km. Find the shortest route from A to C.

MATHEMATICS · FORM 4 · CHAPTER 7

Graphs of Motion

Distance–time

Gradient = speed. Flat line = stationary.

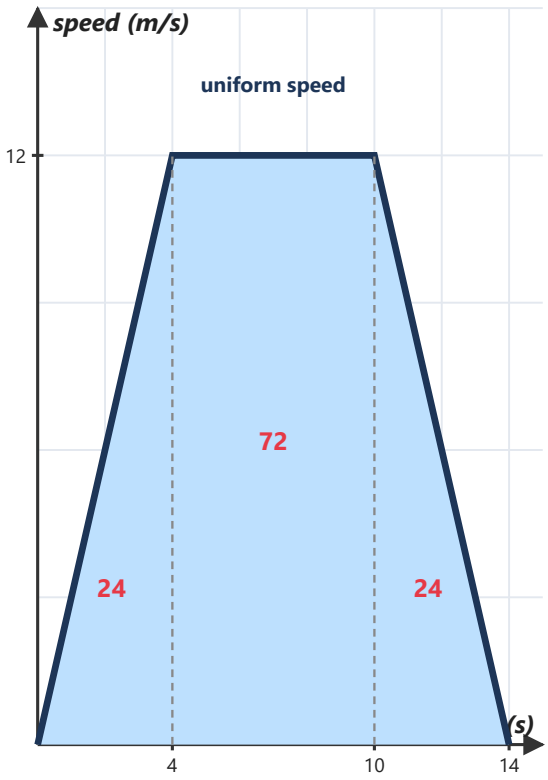
Speed–time

Gradient = acceleration (rate of change of speed).

Area

Area under a speed–time graph = distance travelled.

Speed–time graph: area = distance



Negative gradient

On a speed–time graph: deceleration (slowing down).

Return journey

Distance–time line going back to 0 = coming back to the start.

Average speed

TOTAL distance ÷ TOTAL time (include stops).

FORMULA / KEY TERMS

- Speed = distance ÷ time
- Acceleration = (v − u) ÷ t
- Distance = area under speed–time graph
- Trapezium area = ½(a + b)h

COMMON MISTAKE

❌ "Average speed = (first speed + last speed) ÷ 2."

✅ Average speed = TOTAL distance ÷ TOTAL time.

QUICK CHECK (worked answers at the back, page 21)

1. Using the graph shown, find the total distance travelled in 14 s.
2. Find the acceleration in the first 4 s.
3. Find the average speed for the whole journey.

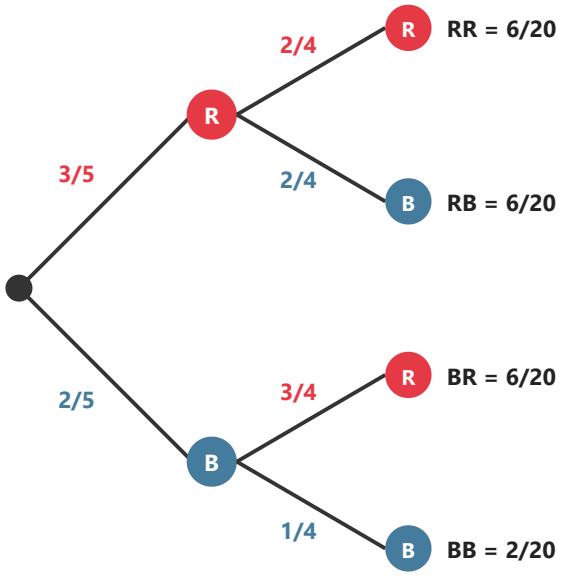
Probability of Combined Events

Sample space
All possible outcomes, e.g. coin + die: 2 × 6 = 12 outcomes.

Independent
One does not change the other: P(A and B) = P(A) × P(B).

Dependent
No replacement: the second probability changes.

3 red + 2 blue, pick 2 (no replacement)



Multiply ALONG a branch (and)
Add the end results (or). Total = 20/20 = 1

Mutually exclusive
Cannot happen together: P(A or B) = P(A) + P(B).

Tree diagram
Multiply along branches; add the end results you want.

At least one
P(at least one) = 1 − P(none).

FORMULA / KEY TERMS
- P(A ∩ B) = P(A) × P(B) (independent)
- P(A ∪ B) = P(A) + P(B) − P(A ∩ B)
- P(A') = 1 − P(A)
- Total of all outcomes = 1

COMMON MISTAKE
❌ "Without replacement, the second pick is still 3/5."

✅ One ball is gone: the total is now 4, and the count of that colour may drop too.

QUICK CHECK (worked answers at the back, page 21)
1. A bag has 3 red and 2 blue balls. Two are taken without replacement. Find P(both red).
2. Using question 1, find P(at least one blue).
3. A coin is tossed and a die is rolled. Find P(head and a 6).

Worked Answers (1/2)

Form 4 Chapter 1: Quadratic Functions and Equations in One Variable

1. $(x - 2)(x - 3) = 0 \rightarrow x = 2$ or $x = 3$.
2. $x = -b \div 2a = -(-8) \div (2 \times 2) = 8 \div 4 = 2$. Axis: $x = 2$.
3. $x(x + 3) = 40 \rightarrow x^2 + 3x - 40 = 0 \rightarrow (x + 8)(x - 5) = 0 \rightarrow x = 5$ ($x = -8$ is rejected: a length is positive).

Form 4 Chapter 2: Number Bases

1. $2 \times 4^2 + 1 \times 4 + 3 \times 1 = 32 + 4 + 3 = 39$.
2. $45 \div 2 = 22$ r1; $22 \div 2 = 11$ r0; $11 \div 2 = 5$ r1; $5 \div 2 = 2$ r1; $2 \div 2 = 1$ r0; $1 \div 2 = 0$ r1. Read up: 101101_2.
3. $1011_2 = 11$, $110_2 = 6$, total $17 = 16 + 1 = 10001_2$.

Form 4 Chapter 3: Logical Reasoning

1. "If $x > 3$, then $x > 5$." False (e.g. $x = 4$).
2. It did not rain. (Form III)
3. The terms go up by 3: $3n + 2$, $n = 1, 2, 3, \ldots$

Form 4 Chapter 4: Operations on Sets

1. $25 + 18 - 8 = 35$.
2. $40 - 35 = 5$.
3. $20 - 6 = 14$.

Form 4 Chapter 5: Network in Graph Theory

1. Σ degrees $= 14$, so edges $= 14 \div 2 = 7$.
2. $8 - 1 = 7$ edges.
3. A–B–C = 7 km; A–D–C = 8 km; A–C = 9 km. Shortest: A–B–C, 7 km.

Form 4 Chapter 6: Linear Inequalities in Two Variables

1. $2x + 5y \leq 50$.
2. $3 \geq 2$ ✓ and $2 + 3 = 5 < 6$ ✓. Yes, it is in the region.
3. Dashed (strict >). Shade ABOVE the line.

Form 4 Chapter 7: Graphs of Motion

1. Area $= \frac{1}{2}(4)(12) + (6)(12) + \frac{1}{2}(4)(12) = 24 + 72 + 24 = 120$ m.
2. $(12 - 0) \div 4 = 3$ m s^{-2}.
3. $120 \div 14 = 8.57$ m s^{-1} (3 s.f.).

Form 4 Chapter 8: Measures of Dispersion for Ungrouped Data

1. $\bar{x} = 30 \div 6 = 5$. $\Sigma x^2 = 4 + 16 + 16 + 25 + 49 + 64 = 174$. $\sigma^2 = 174 \div 6 - 5^2 = 29 - 25 = 4$. $\sigma = 2$.
2. Mean = 15, $\sigma = 6$.
3. $Q_1 = 5$ (2nd value), $Q_3 = 11$ (6th value). IQR $= 11 - 5 = 6$.

Form 4 Chapter 9: Probability of Combined Events

1. $3/5 \times 2/4 = 6/20 = 3/10$.
2. $1 - 3/10 = 7/10$.
3. $1/2 \times 1/6 = 1/12$.

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