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

Additional 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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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.

Functions

Function

Every object has exactly ONE image. Vertical line test on a graph.

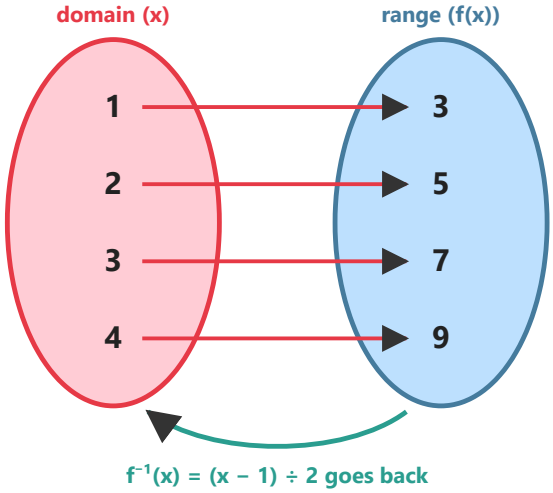
Domain + range

Domain: allowed x. Range: the images you actually get.

Absolute value

|f(x)|: reflect the part below the x-axis upwards.

f : x → 2x + 1 and its inverse



$f^{-1}(x) = (x - 1) \div 2$ goes back

One-to-one: each image from ONE object → only these have an inverse
Composite fg(x) = f(g(x)): do g FIRST
f^{-1}: swap x and y, make y the subject
$ff^{-1}(x) = f^{-1}f(x) = x$

Composite

fg(x) = f(g(x)). Usually fg ≠ gf.

Inverse

f^{-1} undoes f. Graph of f^{-1} = reflection of f in y = x.

Find g from fg

Given f and fg, write f(g(x)) and solve for g(x).

FORMULA / KEY TERMS

- fg(x) = f[g(x)]
- If f(a) = b then $f^{-1}(b) = a$
- f^{-1}: let y = f(x), make x the subject
- $f^{-1}f(x) = x$

COMMON MISTAKE

❌ "fg(x) means f(x) × g(x)."

✅ fg(x) is a COMPOSITE: put g(x) INTO f. Work from the inside out.

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

1. f(x) = 2x + 3 and $g(x) = x^2$. Find fg(x) and gf(2).
2. Find $f^{-1}(x)$ for f(x) = 2x + 3.
3. f(x) = |x − 4|. Find f(1).

Systems of Equations

Three variables

Use elimination to cut 3 equations in x, y, z down to 2, then 1.

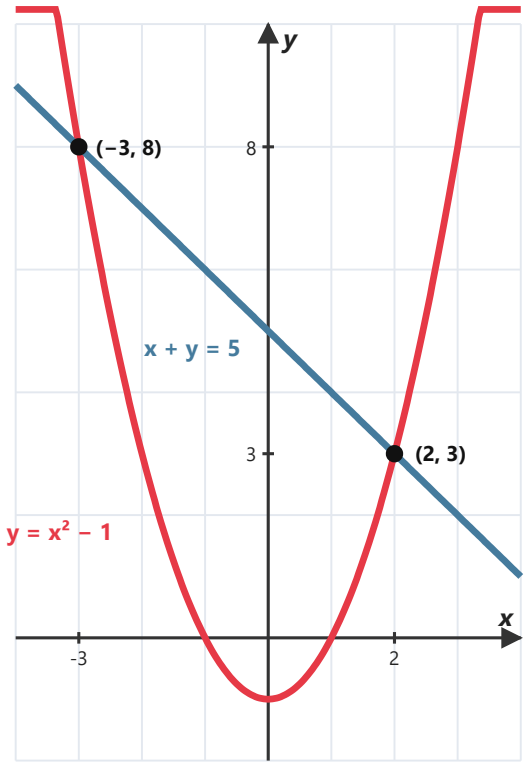
Substitute

Linear + non-linear: make x or y the subject of the LINEAR one.

Then solve

Put it into the other equation → a quadratic. Get two pairs.

Solutions = where the graphs meet



Meaning

Each solution pair is an intersection point of the graphs.

Check

Put each pair back into BOTH equations.

Word problems

Name each unknown first, write one equation per fact.

FORMULA / KEY TERMS

- Elimination: add/subtract equations to remove one variable
- Substitution: x = … from the linear equation
- Always give answers in PAIRS (x, y)
- Number of solutions = number of intersections

COMMON MISTAKE

❌ "Find x, then stop."

✅ Every x needs its matching y (and z). Give the solution as pairs.

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

1. Solve $x + y = 5$ and $y = x^2 - 1$.
2. Solve $x + y + z = 6$, $x - y + z = 2$, $2x + y - z = 1$.
3. Solve $x - 2y = 1$ and $xy = 3$.

Progressions

AP test

$T_2 - T_1 = T_3 - T_2 = d$ (common difference).

GP test

$T_2/T_1 = T_3/T_2 = r$ (common ratio).

Find n

Set T_n = last term and solve for n (n must be a positive whole number).

	Arithmetic (AP)	Geometric (GP)
Pattern	add d each time	multiply by r
Example	3, 7, 11, 15 … d = 4	16, 8, 4, 2 … r = ½
nth term	$T_n = a + (n - 1)d$	$T_n = ar^{n-1}$
Sum of n	$S_n = n/2\ [2a + (n - 1)d]$ or $n/2\ (a + l)$	$S_n = a(1 - r^n) \div (1 - r)$
Sum to ∞	—	$S\infty = a/(1 - r)$ only if $-1 < r < 1$

Sum to infinity

Only a GP with $-1 < r < 1$ has a sum to infinity.

Recurring decimal

0.444… = 0.4 + 0.04 + … = 0.4/(1 − 0.1) = 4/9.

Real life

Savings that grow by a % each year form a GP.

FORMULA / KEY TERMS

- AP: $T_n = a + (n - 1)d$
- AP: $S_n = n/2\ [2a + (n - 1)d]$
- GP: $T_n = ar^{n-1}$, $S_n = a(1 - r^n)/(1 - r)$
- GP: $S\infty = a/(1 - r)$, $|r| < 1$

COMMON MISTAKE

❌ "$T_n = a + nd$."

✅ It is $(n - 1)d$: the first term has no d added. $T_1 = a$.

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

1. For the AP 3, 7, 11, …, find T_{20} and S_{20}.
2. Find the sum to infinity of 16, 8, 4, …
3. Write 0.444… as a fraction.

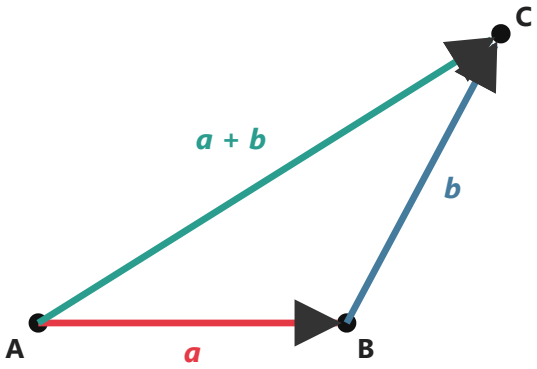
Vectors

Magnitude
The length of the vector, written |a| or |AB→|.

Negative
BA→ = −AB→: same length, opposite way.

Parallel
a = kb. If they share a point, the points are collinear.

Triangle law of addition



AB→ + BC→ = AC→

Vector: size + direction
Magnitude = length of AB→
−a: same size, opposite direction
Parallel: a = kb (k is a scalar)
xi + yj: magnitude $\sqrt{(x^2 + y^2)}$
Unit vector = vector ÷ its magnitude

Parallelogram law
Put both vectors tail to tail; the diagonal is the sum.

Cartesian
a = xi + yj, also written as a column (x over y).

Unit vector
Length 1 in the same direction: â = a ÷ |a|.

FORMULA / KEY TERMS
- |xi + yj| = $\sqrt{(x^2 + y^2)}$
- â = (xi + yj) ÷ $\sqrt{(x^2 + y^2)}$
- AB→ = OB→ − OA→
- Parallel: a = kb

COMMON MISTAKE
❌ "AB→ = OA→ − OB→."
✅ AB→ = OB→ − OA→ (end − start).

QUICK CHECK (worked answers at the back, page 21)
1. Find |3i + 4j| and its unit vector.
2. a = 2i + 3j and b = 4i + kj are parallel. Find k.
3. OP→ = 2i + j and OQ→ = 5i + 5j. Find PQ→ and |PQ→|.

Solution of Triangles

Sine rule

Use when you know a side and its opposite angle.

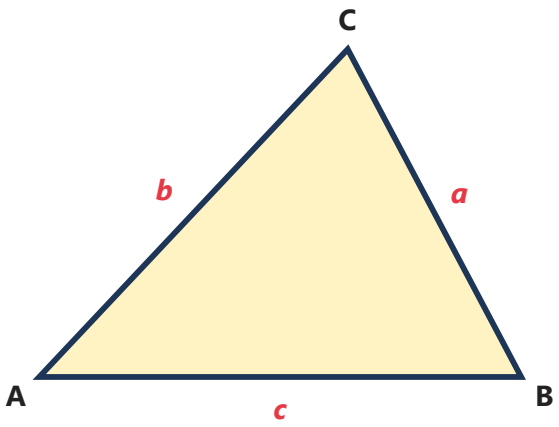
Cosine rule

Two sides and the angle BETWEEN them, or all three sides.

Ambiguous case

Two sides + a non-included acute angle may give TWO triangles.

Any triangle ABC



side a is opposite angle A

Sine rule: $a/\sin A = b/\sin B = c/\sin C$
(2 angles + 1 side, or 2 sides + angle NOT between)
Cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$
(2 sides + angle between, or 3 sides)
Area = $\frac{1}{2}ab \sin C$
Heron: $\sqrt{(s(s-a)(s-b)(s-c))}$, $s = (a + b + c)/2$

Area

½ × two sides × sine of the angle between them.

Heron

All three sides known: area from s = half the perimeter.

3-D problems

Find the right triangle inside the solid and label it first.

FORMULA / KEY TERMS

- $a/\sin A = b/\sin B = c/\sin C$
- $a^2 = b^2 + c^2 - 2bc \cos A$
- Area = $\frac{1}{2}ab \sin C$
- Angles in a triangle add to 180°

COMMON MISTAKE

❌ "Use the sine rule with two sides and the angle between them."

✅ That needs the COSINE rule: the known angle is not opposite a known side.

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

1. In △ABC, a = 7 cm, b = 8 cm, C = 60°. Find c.
2. Find the area of the triangle in question 1.
3. A = 40°, B = 60°, a = 10 cm. Find b.

Worked Answers (1/2)

Form 4 Chapter 1: Functions

1. $fg(x) = f(x^2) = 2x^2 + 3$. $f(2) = 7$, so $gf(2) = g(7) = 49$.
2. $y = 2x + 3 \rightarrow x = (y - 3)/2$, so $f^{-1}(x) = (x - 3)/2$.
3. $f(1) = |1 - 4| = |-3| = 3$.

Form 4 Chapter 2: Quadratic Functions

1. $b^2 - 4ac = 0 \rightarrow p^2 - 36 = 0 \rightarrow p = \pm 6$.
2. $2(x^2 - 4x) + 5 = 2[(x - 2)^2 - 4] + 5 = 2(x - 2)^2 - 3$. Minimum value -3 at $x = 2$.
3. $(x - 3)(x + 2) < 0 \rightarrow -2 < x < 3$.

Form 4 Chapter 3: Systems of Equations

1. $x^2 - 1 = 5 - x \rightarrow x^2 + x - 6 = 0 \rightarrow (x + 3)(x - 2) = 0$. $x = 2, y = 3$; $x = -3, y = 8$.
2. (1) − (2): $2y = 4 \rightarrow y = 2$. Then $x + z = 4$ and $2x - z = -1$; add: $3x = 3 \rightarrow x = 1, z = 3$.
3. $x = 1 + 2y \rightarrow (1 + 2y)y = 3 \rightarrow 2y^2 + y - 3 = 0 \rightarrow (2y + 3)(y - 1) = 0$. $y = 1, x = 3$; $y = -3/2, x = -2$.

Form 4 Chapter 4: Indices, Surds and Logarithms

1. $32 = 2^5 \rightarrow x + 1 = 5 \rightarrow x = 4$.
2. $3 + 2 = 5$.
3. $6/\sqrt{3} = 6\sqrt{3}/3 = 2\sqrt{3}$. $x + 2 = 3^2 = 9 \rightarrow x = 7$.

Form 4 Chapter 5: Progressions

1. $a = 3, d = 4$. $T_{20} = 3 + 19(4) = 79$. $S_{20} = 20/2\ (3 + 79) = 820$.
2. $a = 16, r = ½$. $S\infty = 16 \div (1 - ½) = 32$.
3. $a = 0.4, r = 0.1$: $0.4 \div 0.9 = 4/9$.

Form 4 Chapter 6: Linear Law

1. $Y = y/x, X = x$. Gradient = a, Y-intercept = b.
2. Gradient $= (9 - 5) \div (3 - 1) = 2 = a$. $5 = 2(1) + c \rightarrow c = 3 = b$.
3. $\log b = 0.3 \rightarrow b = 10^{0.3} = 1.995$. $\log a = 0.5 \rightarrow a = 10^{0.5} = 3.162$.

Form 4 Chapter 7: Coordinate Geometry

1. $P = ((2\times2 + 1\times8)/3, (2\times1 + 1\times10)/3) = (12/3, 12/3) = (4, 4)$.
2. $m = -½$. $y - 3 = -½(x - 4) \rightarrow y = -½x + 5$.
3. $(x - 1)^2 + (y - 2)^2 = 9 \rightarrow x^2 + y^2 - 2x - 4y - 4 = 0$.

Form 4 Chapter 8: Vectors

1. $\sqrt{(9 + 16)} = 5$. Unit vector $= (3i + 4j)/5$.
2. $b = 2a \rightarrow 4 = 2(2), k = 2(3) = 6$.
3. $PQ\rightarrow = (5 - 2)i + (5 - 1)j = 3i + 4j$. $|PQ\rightarrow| = 5$.

Form 4 Chapter 9: Solution of Triangles

1. $c^2 = 49 + 64 - 2(7)(8)\cos 60° = 113 - 56 = 57 \rightarrow c = 7.55$ cm.
2. $½(7)(8) \sin 60° = 28 \times 0.866 = 24.25$ cm^2.
3. $b = 10 \sin 60° \div \sin 40° = 8.660 \div 0.6428 = 13.47$ cm.

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