# Knowing and understanding

MYP Year 3 | Original classroom assessment | 40 raw marks | Suggested time: 60 minutes

Name: _____ Class: _____ Date: _____

**Instructions:** Answer all eight questions. Show your method and give exact answers unless told otherwise. A calculator may be used throughout; write enough working to make your choices visible. Extra paper is allowed. Diagrams are not drawn to scale.

This assessment samples taught knowledge and its transfer to less familiar problems. Your teacher will use your working alongside the applicable Criterion A descriptors; the raw score is not an automatic level out of 8.

## 1. Number fluency [4 marks]

(a) Calculate 3/4 - 5/6. Give your answer as a fraction in simplest form. [2]
(b) Calculate $(-3)^2 - 2^3$. [2]

## 2. Algebra fluency [4 marks]

(a) Expand and simplify 3(2x - 5) - 2(x + 4). [2]
(b) Solve 5x - 7 = 2x + 11. [2]

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# Percentages and coordinates

Questions 3-4 | Select a method and show how you apply it.

## 3. Percentage changes [5 marks]

(a) A fictional shop discounts a $240 item by 15%, then adds an 8% tax to the discounted price. Calculate the final price. [3]
(b) After a 20% increase, a different price is $144. Find the price before the increase. [2]

## 4. A straight line [5 marks]

(a) A straight line passes through P(-2, 7) and Q(4, -5). Find its equation in the form y = mx + c. [3]
(b) Find the x-coordinate of the point on this line with y-coordinate -9. [2]

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# Geometry and data

Questions 5-6 | Choose suitable representations and check your answers.

## 5. A trapezium [5 marks]

A trapezium has parallel sides of lengths (x + 2) cm and (2x + 4) cm. Its perpendicular height is 6 cm and its area is 81 $cm^2$. Find x and the lengths of both parallel sides. Show how the area leads to your equation.

## 6. A missing data value [5 marks]

Five numbers are 4, 7, 9, 10 and k. Their mean is 9.
(a) Find k. [3]
(b) Find the median and range of the completed data set. [2]

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# Transfer your understanding

Questions 7-8 | These presentations may be less familiar. Show your reasoning.

## 7. Two number machines [6 marks]

Machine A multiplies its input by 3 and subtracts 2. Machine B divides its input by 2 and adds 5.
(a) An input x goes through B first, then A. Write and simplify the output. [2]
(b) The same input x goes through A first, then B. Write and simplify the output. [2]
(c) Can the two routes ever produce the same output for the same x? Justify your answer for every possible x. [2]

## 8. A square border [6 marks]

A square tile has side length 12 cm. A smaller square is centred inside it, with corresponding sides parallel, leaving a border of constant width. The smaller square has area 64 $cm^2$.
(a) Find the width of the border. [3]
(b) Find the area of the border. [1]
(c) A student says, "The border is four corner squares, so its area is four times the square of its width." Explain why this does not give the whole border area. [2]

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# Using this assessment

MYP Year 3 | Planning, administration and Criterion A evidence

## Purpose and prerequisites

Use after teaching fraction arithmetic, powers with negative bases, expansion, linear equations, percentage multipliers and reverse percentages, gradient and intercept, trapezium area, mean/median/range, square roots and compound algebraic operations. Year placement varies between schools; this is a suggested Year 3 assessment, not a universal IB syllabus or official IB paper.

Suggested administration: 60 minutes, calculator permitted throughout, normal classroom access arrangements, and extra working paper. Trial timing with your class. Keep this teacher guide separate from students. For a summative use, check that the taught content, challenge and access arrangements fit your cohort.

## Evidence of knowing and understanding

Look across the script for three connected features: the mathematics the student selects, how successfully it is applied, and the correctness of the resulting solutions. These are planning summaries, not reproduced official descriptors. Refer to the current licensed mathematics guide used by your school for the applicable year descriptors and best-fit judgment.

Q1-2 sample basic procedures. Q3-6 combine selection and application in familiar mathematical contexts. Q7-8 provide opportunities for transfer through composition and a composite area structure. Familiarity depends on prior teaching: an unfamiliar layout does not automatically make a task unfamiliar for your class, and a hard question is not automatically evidence for a top band.

## Raw marks and criterion levels are different

The eight questions total 40 raw marks: 4 + 4 + 5 + 5 + 5 + 5 + 6 + 6. Marks support feedback and consistent marking; do not divide by five or use percentage cutoffs to assign a level out of 8. A high total alone does not establish the quality or range of Criterion A evidence.

Moderate representative scripts against the applicable descriptors, considering selection, application and correctness across the tasks. Record where the evidence is secure, where it is inconsistent, and where more evidence is needed. Do not separately award Criterion C simply because working is requested; that requires its own planned assessment judgment.

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# Worked answers: questions 1-3

13 raw marks | Award the stated credit for equivalent correct methods.

## 1. Number fluency [4]

(a) 3/4 - 5/6 = 9/12 - 10/12 = **-1/12**. Award 1 for equivalent fractions with a common denominator and 1 for the simplified result. [2]
(b) $(-3)^2$ = 9 and $2^3$ = 8, so 9 - 8 = **1**. Award 1 for both powers evaluated correctly and 1 for the final result. [2]

## 2. Algebra fluency [4]

(a) 3(2x - 5) - 2(x + 4) = 6x - 15 - 2x - 8 = **4x - 23**. Award 1 for correct expansion and 1 for collecting terms. [2]
(b) 5x - 7 = 2x + 11 gives 3x = 18, so **x = 6**. Award 1 for a valid rearrangement and 1 for x = 6. A check gives 23 on both sides. [2]

## 3. Percentage changes [5]

(a) Discounted price = 240 x 0.85 = 204. Taxed price = 204 x 1.08 = **$220.32**. Award 1 for the discount multiplier or equivalent calculation, 1 for applying tax to the discounted price and 1 for the correct final price. [3]
(b) If p is the original price, 1.20p = 144. Thus p = 144 / 1.20 = **$120**. Award 1 for a valid reverse-percentage method and 1 for the answer. [2]

## Useful diagnostic feedback

Q1: distinguish $(-3)^2$ from $-3^2$. Q2: distribute the negative multiplier to both terms. Q3: a 15% reduction followed by an 8% increase is not a net 7% reduction; the percentage bases differ. Subtracting 20% of $144 does not reverse a 20% increase.

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# Worked answers: questions 4-6

15 raw marks | Geometry and statistics offer different evidence from algebra fluency.

## 4. A straight line [5]

(a) m = (-5 - 7)/(4 - (-2)) = -12/6 = -2. Substituting P gives 7 = (-2)(-2) + c, so c = 3. Hence **y = -2x + 3**. Award 1 for the gradient, 1 for finding c and 1 for the correct equation. [3]
(b) -9 = -2x + 3 gives -12 = -2x, so **x = 6**. Award 1 for substitution/rearrangement and 1 for the answer. [2]

## 5. A trapezium [5]

Area = (sum of parallel sides) x perpendicular height / 2.
81 = [(x + 2) + (2x + 4)] x 6 / 2 = 9x + 18.
9x = 63, so **x = 7**. The sides are **9 cm and 18 cm**.
Award 1 for selecting the trapezium area relationship, 1 for a correct substituted equation, 1 for a valid simplification/rearrangement, 1 for x = 7 and 1 for both side lengths with cm. [5]
Check: (9 + 18) x 6 / 2 = 81 $cm^2$.

## 6. A missing data value [5]

(a) A mean of 9 for five values requires total 5 x 9 = 45. Known values total 4 + 7 + 9 + 10 = 30. Hence **k = 15**. Award 1 for the required total, 1 for the known total or equivalent equation, and 1 for k = 15. [3]
(b) Sorted data: 4, 7, 9, 10, 15. **Median = 9; range = 15 - 4 = 11**. Award 1 for each. [2]

## Common misconceptions

Q4: gradient requires the same coordinate order in numerator and denominator. Q5: use the perpendicular height, and halve the sum of the parallel sides. Q6: do not divide the known four-number total by five and treat that as the completed mean; first reconstruct the required total.

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# Worked answers: questions 7-8

12 raw marks | Transfer opportunities; alternative valid approaches are welcome.

## 7. Two number machines [6]

(a) B first gives x/2 + 5; A then gives 3(x/2 + 5) - 2 = **3x/2 + 13**. Award 1 for correctly nesting the operations and 1 for simplifying. [2]
(b) A first gives 3x - 2; B then gives (3x - 2)/2 + 5 = **3x/2 + 4**. Award 1 for correct nesting and 1 for simplifying. [2]
(c) **No.** The difference is (3x/2 + 13) - (3x/2 + 4) = 9 for every x. Equating them also leads to the contradiction 13 = 4. Award 1 for the conclusion and 1 for a valid argument covering every x. Testing a few inputs alone earns no justification mark. [2]

## 8. A square border [6]

(a) The inner square side is sqrt(64) = 8 cm. The difference between outer and inner side lengths is 12 - 8 = 4 cm. This includes a border on **both** sides: 2w = 4, so **w = 2 cm**. Award 1 for inner side 8, 1 for recognising two border widths and 1 for width 2 cm. [3]
(b) Border area = $12^2$ - 64 = **80 $cm^2$**. [1]
(c) The four corner squares cover only 4 x $2^2$ = 16 $cm^2$. They omit four rectangular strips, each 8 cm by 2 cm, between the corners. Award 1 for identifying the missing side strips and 1 for a correct labelled sketch or dimensional explanation. Total 16 + 4 x 8 x 2 = 80 $cm^2$. [2]

## What the working reveals

In Q7, look for understanding of operation order rather than a memorised equation pattern. In Q8, look for a coherent spatial decomposition rather than numerical substitution into an unrelated formula. Accept a clear diagram or another valid argument; formal function-composition notation is not required.

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# Marking and moderation

Use the mark scheme consistently, then make a descriptor-based judgment.

## Agreed marking conventions

**Equivalent methods:** award the same credit for mathematically equivalent correct approaches. For questions that request working, an unsupported final answer earns only the explicit answer/result marks, not hidden method marks. Record evidence of strategy separately from raw credit.

**Error carried forward:** after one arithmetic slip, award later method credit for a valid consistent process, unless the error removes the assessed challenge. Final accuracy marks require the stated correct results. In Q4(b), allow the method mark for correct substitution into the student's line; reserve the final answer mark for $x = 6$. In Q6(b), accept the correct median/range of the student's own completed set if the earlier k error is carried through and the set is ordered correctly; flag the original error once.

**Units and rounding:** all answers can be exact. For Q3(a), accept \$220.32; \$220 alone loses the final accuracy mark. In Q5 the final side-length mark requires both values and cm. In Q8 the final width and area marks require cm and $cm^2$ respectively; do not repeatedly penalise the same unit omission in intermediate working.

## A short moderation record

For each script, note:
1. Selection: which questions show an independently chosen, suitable strategy?
2. Application: where is the method carried through successfully?
3. Correctness: how consistent are results across the range of tasks?
4. Transfer: what does Q7 or Q8 show, and was this actually unfamiliar for the student?
5. Descriptor judgment: which applicable year descriptor best fits the complete evidence, and why?

Use borderline scripts to agree interpretations before marking the whole class. If the class has already rehearsed the number-machine or square-border structures, replace or adapt a transfer task and solve the replacement before use. This one script is a sample of learning, not the whole annual assessment programme.

## Sources and permissions

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ibo.org/globalassets/new-structure/brochures-and-infographics/pdfs/myp-brief-mathematics-en.pdf

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