01 / TEACHER NOTES

How many tiles make a border?

Suggested MYP Years 1-3 | 35 minutes | Patterns and algebra

Teaching purpose

The same picture supports several valid expressions, giving students a reason to explain equivalence rather than simply simplify algebra.

Expected findings / checked solution

Counts for n = 3, 4, 5 are 8, 12, 16. B = 4n - 4: four sides count each corner twice, so subtract four. Alternatively B = n^2 - (n - 2)^2. For n = 12, B = 44. The stated domain is whole numbers n >= 3.

Neutral teacher prompt

Which tiles does each part of your expression count?

Support

Allow physical counters and a partially drawn grid.

Extension

Generalise to an a by b rectangle with a, b >= 3, then to a border two tiles wide.

Suggested lesson rhythm

Launch for 5 minutes; explore for 20 minutes; compare approaches for 7 minutes; finish with a 3-minute exit response.

Formative evidence

Look for chosen methods, defined variables, independent checks and explanations. These are teaching activities, not IB-issued assessments or automatic criterion scores. Use current school assessment guidance for summative work.

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Does the order of discounts matter?

Suggested MYP Years 1-3 | 30 minutes | Percentages

Teaching purpose

A familiar shopping claim exposes additive reasoning and creates a useful bridge to multiplicative models.

Expected findings / checked solution

Offer A: 80 x 0.8 x 0.9 = 57.60. Offer B: 80 x 0.7 = 56. Offer B costs 1.60 less. The successive discount is 28%, since 0.8 x 0.9 = 0.72. Reversing percentage discounts gives the same final price when both apply to the current price and there are no intermediate rounding rules.

Neutral teacher prompt

What quantity is the second percentage calculated from?

Support

Use a 100-unit starting price before returning to 80.

Extension

For discounts a% and b%, derive the effective discount a + b - ab/100 percent.

Suggested lesson rhythm

Launch for 5 minutes; explore for 15 minutes; compare approaches for 7 minutes; finish with a 3-minute exit response.

Formative evidence

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Can a spinner game be fair?

Suggested MYP Years 1-3 | 40 minutes | Probability

Teaching purpose

Students distinguish observed results from a probability model and discover that fairness needs a precise definition.

Expected findings / checked solution

Expected scores after 80 spins are 50 for A and 30 for B, not guaranteed outcomes. With one point per win, four sectors of each colour is fair. With the original sectors, award A 3 points per blue and B 5 per gold: both expected scores per spin are 15/8. Experimental differences alone do not establish unfairness.

Neutral teacher prompt

Do you mean equal chances of scoring, equal expected points, or equal chances of winning a whole match?

Support

List all eight equally likely outcomes and begin with the colour redesign.

Extension

Explain why equal expected points need not give equal probabilities of winning a fixed-length match.

Suggested lesson rhythm

Launch for 5 minutes; explore for 25 minutes; compare approaches for 7 minutes; finish with a 3-minute exit response.

Formative evidence

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Which rectangle gives the most space?

Suggested MYP Years 1-3 | 35 minutes | Area and optimisation

Teaching purpose

A small set of accessible trials opens into a general argument and a discussion of domain restrictions.

Expected findings / checked solution

Possible pairs are (1,11), (2,10), (3,9), (4,8), (5,7), (6,6). Areas are 11, 20, 27, 32, 35, 36 square units. With side lengths x and 12 - x, area is $x(12 - x) = 36 - (x - 6)^2$, so the square maximises area even if positive non-integer lengths are permitted.

Neutral teacher prompt

How will you know you have found every distinct rectangle?

Support

Provide 24 unit strips and allow trial constructions.

Extension

Generalise to perimeter P: show the maximum area is $P^2/16$ for positive real side lengths.

Suggested lesson rhythm

Launch for 5 minutes; explore for 20 minutes; compare approaches for 7 minutes; finish with a 3-minute exit response.

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When should you switch plans?

Suggested MYP Years 2-4 | 40 minutes | Linear models

Teaching purpose

The recommendation must depend on the model and its domain, giving equations and graphs a practical purpose.

Expected findings / checked solution

A(t) = 6 + 2t and B(t) = 15 + 0.5t. Equality occurs at t = 6 hours, costing 18. A is cheaper for 0 <= t < 6; B for 6 < t <= 8. If both services charge each started hour, replace t with the ceiling of t (at t = 0 use zero); equality holds for 5 < t <= 6, and costs are step functions.

Neutral teacher prompt

What do the intercept and gradient mean in this situation?

Support

Start with a table at 0, 2, 4, 6 and 8 hours.

Extension

Design a third plan that is cheapest for some, but not all, times in the domain.

Suggested lesson rhythm

Launch for 5 minutes; explore for 25 minutes; compare approaches for 7 minutes; finish with a 3-minute exit response.

Formative evidence

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Can an average hide the story?

Suggested MYP Years 2-4 | 30 minutes | Statistics

Teaching purpose

Students must make and defend a statistical choice, rather than treat every average as an interchangeable calculation.

Expected findings / checked solution

The original total is 105, so the mean is 15 minutes and the median is 10. Replacing 45 with 15 gives a mean of 75/7, about 10.71; replacing it with 90 gives 150/7, about 21.43. In both cases the median remains 10. The median describes the centre of this skewed sample usefully, but the long journey is relevant and should not simply be deleted.

Neutral teacher prompt

What question does your chosen average answer, and what information does it conceal?

Support

Order the data physically using number cards.

Extension

Investigate the effect on mean and median of adding the same value to every observation.

Suggested lesson rhythm

Launch for 5 minutes; explore for 15 minutes; compare approaches for 7 minutes; finish with a 3-minute exit response.

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Does doubling length double everything?

Suggested MYP Years 2-4 | 40 minutes | Similarity and measurement

Teaching purpose

A concrete enlargement makes it possible to confront a common misconception using both diagrams and algebra.

Expected findings / checked solution

The original perimeter is 10 cm and area is 6 cm². At k = 2, 3, 4 the perimeters are 20, 30, 40 cm and areas are 24, 54, 96 cm². Perimeter scales by k; area by k². Twice the area needs k = square root of 2, about 1.414, giving dimensions about 4.243 cm by 2.828 cm.

Neutral teacher prompt

Can your diagram explain why there are two factors of k in the area?

Support

Use unit squares at k = 2 before making a table.

Extension

For similar boxes, compare volume and surface-area scale factors and discuss packaging material.

Suggested lesson rhythm

Launch for 5 minutes; explore for 25 minutes; compare approaches for 7 minutes; finish with a 3-minute exit response.

Formative evidence

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Which dice total should you choose?

Suggested MYP Years 2-4 | 40 minutes | Sample spaces

Teaching purpose

Comparing simulation with an explicit sample space makes the source of probability claims visible.

Expected findings / checked solution

There are 36 equally likely ordered outcomes. Counts for sums 2 through 12 are 1, 2, 3, 4, 5, 6, 5, 4, 3, 2, 1. Total 7 has probability 6/36 = 1/6 and maximises expected points. The expected number of sevens in 30 trials is 5; it is not a guaranteed count. Totals are not equally likely even though individual ordered die outcomes are.

Neutral teacher prompt

What are the equally likely outcomes: totals, individual faces, or ordered pairs?

Support

Provide an empty 6 by 6 grid with die values as row and column headings.

Extension

Choose rewards that give equal expected points for totals 2 and 7; compare risk as well as expectation.

Suggested lesson rhythm

Launch for 5 minutes; explore for 25 minutes; compare approaches for 7 minutes; finish with a 3-minute exit response.

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09 / TEACHER NOTES

How large can an open box be?

Suggested MYP Years 4-5 | 50 minutes | Quadratic area and cubic volume

Teaching purpose

A simple net connects spatial reasoning to functions, constraints and the precision of a recommendation.

Expected findings / checked solution

$V = x(20 - 2x)(30 - 2x)$ cm³. For $x = 1$ through 9, volumes are 504, 832, 1008, 1056, 1000, 864, 672, 448, 216. The integer maximum is 1056 at $x = 4$. Numerical optimisation on the continuous domain gives x about 3.924 cm and V about 1056.31 cm³. Zero and 10 are excluded because the box degenerates.

Neutral teacher prompt

How do you know your proposed maximum is the largest across the domain you are using?

Support

Build the $x = 2$ net and label each dimension before writing a formula.

Extension

Compare the integer optimum with the continuous optimum and evaluate the practical significance of the difference.

Suggested lesson rhythm

Launch for 5 minutes; explore for 35 minutes; compare approaches for 7 minutes; finish with a 3-minute exit response.

Formative evidence

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Which savings plan wins over time?

Suggested MYP Years 4-5 | 45 minutes | Linear and exponential models

Teaching purpose

Students compare two kinds of growth and must report a result that matches a discrete time model.

Expected findings / checked solution

A(n) = 100 + 20n and B(n) = 100(1.15)^n for whole n >= 0. They are equal at n = 0. At n = 4, A = 180 and B = 174.900625. At n = 5, A = 200 and B = 201.13571875. B first exceeds A at year 5. Compare years 1-3 as well to establish that it is the first crossing in the discrete domain. Real choices also depend on rates, fees, risk and terms.

Neutral teacher prompt

What is the percentage applied to each year, and why does that change the size of the increase?

Support

Build the first three years by repeated addition and multiplication.

Extension

Change the fixed bonus and percentage, then investigate which assumptions control the crossing year.

Suggested lesson rhythm

Launch for 5 minutes; explore for 30 minutes; compare approaches for 7 minutes; finish with a 3-minute exit response.

Formative evidence

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