ELEMENT 2.4

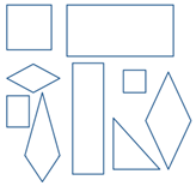
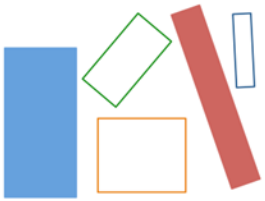
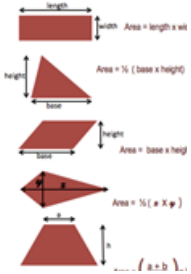
Domain 2 - Create Safe Conditions for Rigorous Mathematics Learning

Element 2.4 - Challenge students to achieve high standards with appropriate support

The following suggestions for practice are extracts from the 'Transforming Tasks' module on the Leading Learning resource:

Strategy From Information to Understanding

Technique **Compare and contrast:** Ask students to identify similarities and differences.

Level	Before	After
Primary	Rectangles can look different. Can you recognise different types of rectangles? Colour all 5 rectangles. 	These shapes are all rectangles. What's the same about all of the rectangles? What's different about them? Would it help if you cut the shapes out and moved them around? Do rectangles need to be long and thin? Do rectangles need to have sides that are horizontal/vertical? 
Secondary	A review of area calculations: Using these formulae, find the area of the shaded regions in the exercise below. 	**A review of area calculations:** 1. Label the dimensions that you might measure to calculate the area of each of these polygons and write the formula that you would use. 2. Check with a partner to see if you have the same/different ideas about: a. the dimensions that you would measure. b. how they would be used in the formula. 3. What's the same about each of the formulae? What's different about them? (Did you notice that all formulae involve multiplication of two lengths? The triangle and kite also involve a multiplication by ½. Why?) 4. What's the same about the dimensions that you have labelled? What's different about them? (Did you notice that the dimensions are always perpendicular to each other. Why? 

How do you think the technique Compare and contrast might support *Element 2.4 - Challenge students to achieve high standards with appropriate support?*

There are many ways to articulate this relationship. One response to this question has been provided on the next page.

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How does the technique Compare and contrast support *Element 2.4 - Challenge students to achieve high standards with appropriate support?*

Learning to compare and contrast supports students to make connections and see relationships. Once students can make connections and see relationships, they can be challenged to generalise. Being able to generalise is reflective of having deep conceptual understanding. Hence, challenging students to compare and contrast supports them to step closer to conceptual understanding.

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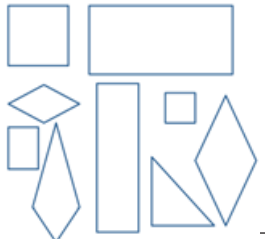
Element 2.4 - Challenge students to achieve high standards with appropriate support

The following suggestions for practice are extracts from the 'Transforming Tasks' module on the Leading Learning resource:

Strategy From Information to Understanding

Technique **Make connections and find relationships:** Have students make meaning by asking them to connect pieces of information.

Level	Before	After
Primary	Shapes worksheet Colour the squares blue and the rectangles red 	I'm thinking of a shape and it has 4 sides. What might it look like? Share your ideas. • What if it has 4 straight sides? Does that make you think differently about what you could have drawn before or what the shape might be now? Share your ideas. • What if it has four straight sides and it's a long thin shape. What do you think now? Could it be a square? This structure may help you to explain your thinking: • Because I know... I also know… • If … then...
Secondary	Scientific notation is a way of writing numbers when they are too big or too small to be written in decimal form. A number written in scientific notation is written as a number between 1 and 10 and multiplied by a power of 10. Eg: • $700 = 7 \times 10^2$ • $530\,000\,000 = 5.3 \times 10^8$ **Copy and complete:** a. $73\,000 = \ldots \times 10^4$ b. $25\,300\,000 = 2.53 \times \ldots$ c. etc	Use your smartphone calculator (or observe what happens on a shared device) when you calculate: 5,200,000 x 2,300,000. Now rotate your device. Can you see two different views? **Discuss** 1. What do you think is happening here? 2. What connections can you see? 3. What do you think ' e+13' might mean? Test out your ideas on some other values. 4. If 'Screen 2' was showing '530 000 000', What might 'Screen 1' show? 5. If 'Screen 1' was showing '2.53e+7', What might 'Screen 2' show? Find out about 'Scientific notation'.  Screen 1  Screen 2 A smartphone calculator has been used for these screenshots. (In screen 2 the device has been rotated)

How do you think the technique Make connections and find relationships might support *Element 2.4 - Challenge students to achieve high standards with appropriate support?*

There are many ways to articulate this relationship. One response to this question has been provided on the next page.

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Element 2.4 - Challenge students to achieve high standards with appropriate support

How does the technique Make connections and find relationships support *Element 2.4 - Challenge students to achieve high standards with appropriate support?*

When teachers support students to think deeply, we also support them to achieve high standards.

The Primary Years example asks students to connect pieces of information to an appropriate visual representation. Notice that this example releases information in a manner that drives the students to make new connections and revise their visual representation several times.

The Secondary Years example asks students to identify the connection between two values that are evidently equal, but are represented in two different ways. In this case connecting the two different representations drives the new learning.

Another way to drive students to make connections and identify relationships is to ask, 'Which might be the odd one out?', for a given collection of values/shapes/graphs etc. Further examples can be found in the 'Bringing it to Life' tool on the Leading Learning resource. (http://www.acleadersresource.sa.edu.au/index.php?page=bringing_it_to_life)

Using questions that focus on making connections and finding relationships is one technique that can support students to engage with challenging thinking.

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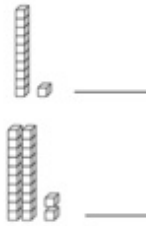
Domain 2 - Create Safe Conditions for Rigorous Mathematics Learning

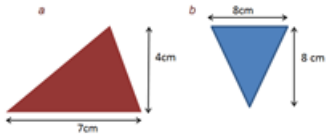
Element 2.4 - Challenge students to achieve high standards with appropriate support

The following suggestions for practice are extracts from the 'Transforming Tasks' module on the Leading Learning resource:

Strategy From Information to Understanding

Technique Generalise: Ask students to construct general rules by identifying patterns.

Level	Before	After
Primary	Write each number and find it on your 100s chart:  Build each number using MAB blocks: 17 26	Choose one row (or part of a row) in your 100s chart, eg 23, 24, 25, 26. Make each of those numbers in that row using MAB blocks. Make sure that you have exchanged as many ones blocks as you can for 10s rods. 1. Explain how the number 24 relates to the blocks representation? Further support: How does the '2' part of the number 24 relate to the blocks that you have used? How does the '4' part of the number 24 relate to the blocks that you have used? 2. Repeat for 25, then 26 etc. Does this connection work for the next number (25) and the next number (26)? 3. Look at another number on this row. Do you know how many 10s and how many ones blocks you will need to represent that number? Explain to a partner how you know. 4. Would your rule/explanation work on the next row and the next row? Would your rule always work?Why?



How do you think the technique Generalise might support *Element 2.4 - Challenge students to achieve high standards with appropriate support?*

There are many ways to articulate this relationship. One response to this question has been provided on the next page.

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How does the technique Generalise support *Element 2.4 - Challenge students to achieve high standards with appropriate support?*

Carefully constructed questions that support students to generalise, support development of conceptual understanding. 'Conceptual understanding frequently results in students having less to learn because they can see deeper similarities between superficially unrelated situations.' (Adding It Up) This deeper understanding supports learners to achieve high standards.

Mathematics is full of rules, so it offers a wealth of opportunities for teachers of Primary and Secondary Years curriculum, to challenge and support students to generalise.

The Secondary Years 'before' task delivers a rule to students, stealing from them the opportunity to establish the rule for themselves. The 'after' transformation task leaves intact the opportunity for students to practise generalisation and to experience for themselves that algebra is a powerful way to express relationships. Leaving 'intact' natural opportunities for students to establish rules for themselves, supports all students to achieve high standards.