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Differentiation: Extending Maths to all.

Andrea O'Connor

Learning for today.

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- To discuss the what, how and why of differentiation in the mathematics classroom.

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- To provide examples of differentiated mathematics learning tasks which are low floor/ high ceiling and embed enabling and extending prompts.

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- To discuss the what, how and why of differentiation in the mathematics classroom.
- To provide examples of differentiated mathematics learning tasks which are low floor/ high ceiling and embed enabling and extending prompts.
- To enjoy rich colleagial discussion, sharing our own knowledge, understanding and experiences of differentiation.

Think, Pair, Share.

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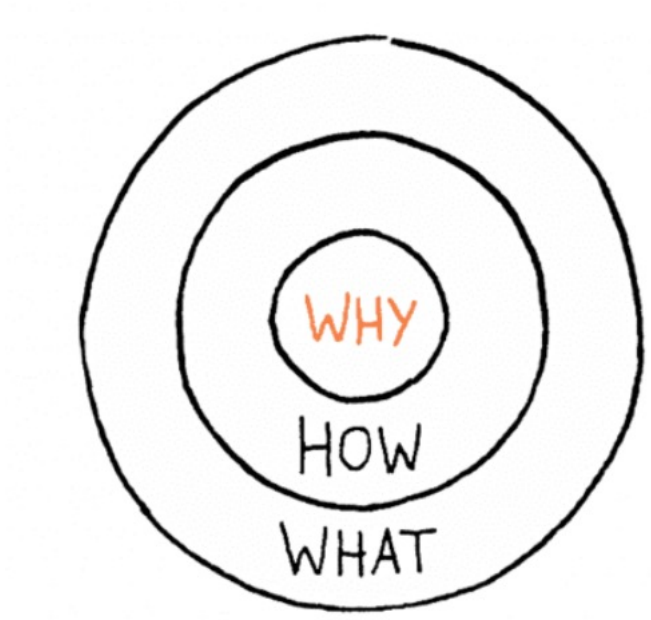
- Using the Golden Circle model discuss the **WHAT** , the **HOW** and the **WHY** of differentiation in your classroom.



Sinek, 2016.

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What would you see in a classroom with effective differentiation?

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- https://www.mentimeter.com/app/presentation/e4fa6d9989811c4abc13c0528bbd8d3a/7a8a972e81b6/edit

Differentiation.

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- **HOW?**
- A teacher is differentiating learning when teaching is adapted or modified by providing rich learning tasks which have a high floor/low ceiling and include enabling/extending prompts.
- **WHY?**
- To ensure optimal learning experiences are provided to all students.

Differentiation.

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"There are no rules for differentiating learning, but rather, it is a way of thinking about teaching and learning in the classroom".

Tomlinson,C., 2000; 2004.

Open-ended Maths Tasks

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- Open-ended maths tasks are the most engaging, interesting and provide an opportunity for creativity.
- They provide teachers opportunities to challenge, support and stretch students at the right level.

Tips for Planning

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- Be **informed by your data** both formative and summative.

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- Select rich learning tasks with a **low floor/high ceiling**.
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- **Enabling prompts** involve slight variations to the demand of the original task, this ensures access to original task when the learner is ready to move forward.
- **Extending prompts** are for those learners who have completed the main task, the prompts should encourage depth, abstraction and generalisation.

(Downton, 2022)

Examples of Enabling Prompts

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- Change the representation.
- Simplify the numbers.
- Pose a simpler or similar problem with fewer variables or fewer steps.
- Make the tasks more concrete.

Examples of Extending Prompts

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- Change the representation of results.
- Make the numbers more complex.
- Change the number of steps.
- Reason and justify your mathematical thinking.
- Questioning: What if the numbers were different?
- Create your own model/question/problem.

Seeing numbers inside Numbers.

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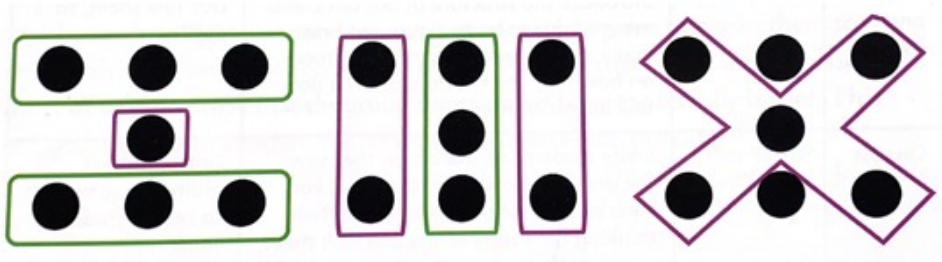
Differentiation planning sheet: Counting Yr F. (Mindset Mathematics K, 2020)

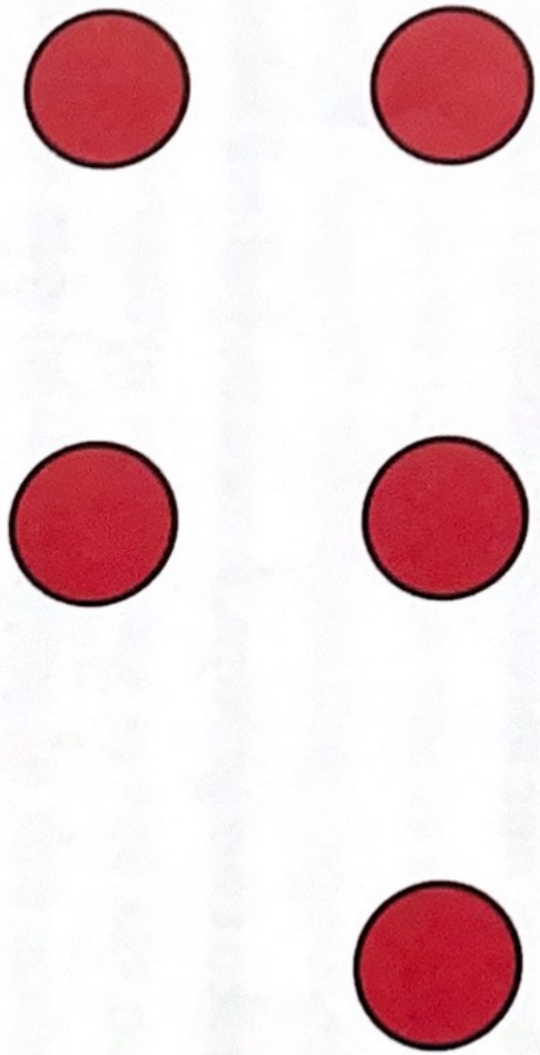
Key mathematical understandings	Task	Enabling prompt	Extending prompt	Consolidating Task
Students use visual and counting strategies to compare groups of dots in a game of *"Which Is More".*	**Launch:** Whole group: (Modelling the Task) Show students the Two Sets and ask "Which group has more". Ask the students to think then turn and talk. Students share their thinking. *How could we prove which group has more dots?* Ask students to share strategies. **Explore:** In pairs: Students play *Which is More?* Using the card decks. Partners make predictions visually about which group has more dots and then develop strategies to prove which has more. **Discuss:** Share how students could tell visually which had more dots and the strategies developed for proving which group had more.	Provide counters for students to cover, count and compare the dots They can then put their counters in a line to count and determine which side has more. Give simple representation.,	Ask students to create their own cards to add to the set. Provide more complex representation.	Students create their own set of cards to play "Which is More" using laminated squares.

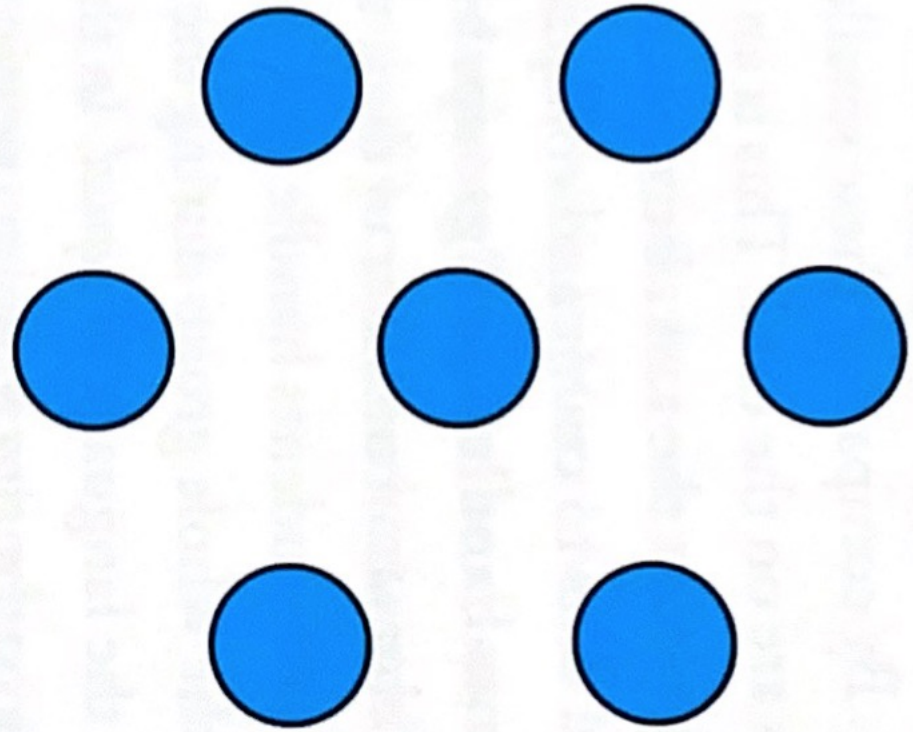
Ways to enable	Ways to extend
▪ Change the representation ▪ Make the numbers less complex ▪ Concrete materials	▪ Change the representation ▪ Make the numbers more complex ▪ Change the number of steps ▪ Convince me … ▪ Create your own

(A Downton, 2022)

How many ways can you see 7 dots.







Place-Value Skip Counting

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Differentiation planning sheet: Place Value Skip Counting Yr 2. (ReSolve Y2)

Key mathematical understandings	Task	Enabling prompt	Extending prompt	Consolidating Task
To explore the multiplicative place-value properties of numbers. Students learn to represent numbers up to 1000 as multiples of 100s, 10s and 1s. For example, 664 = (6 × 100) + (6 × 10) + (4 × 1).	Whole group: (Modelling the Task) The teacher uses a set of cards with 1, 10 and 100 printed on them and asks students to skip count according to the number printed on the card. The cards are shuffled and again skip counted according to the number on the card. Students are asked to consider why they reach the same total when the cards are presented in a different order. In pairs: Students then explore the relationship between the cards and the place-value property of the final number in the count.	Students can be provided with 1s and 10s before including 100s. Concrete materials (MAB) can be used to keep the count. Whiteboards can be used to keep track of counting.	Provide bundles of cards where renaming is required. For example: 664= (5 x 100) + (15 x 10) + (14 X 1) Students can be provided with 1000s or 0.1s. Students check for accuracy: By skip counting backwards. Would we expect to finish on zero?	Students count more than ten cards each of 100s, 10s and 1s. When exploring the place value of the number, the cards no longer neatly represent the place value parts. Students are asked to regroup; that is, group ten 10s together to form one 100 or ten 1s together to form one 10.

Ways to enable	Ways to extend
▪ Change the representation ▪ Make the numbers more complex ▪ Pose a simpler or similar problem with fewer variables or fewer steps	▪ Change the representation ▪ Make the numbers more complex ▪ Change the number of steps ▪ Convince me … ▪ What if the numbers were different .. ▪ Create your own

(A Downton, 2022)

Geometric Art- Using Equivalent Fractions

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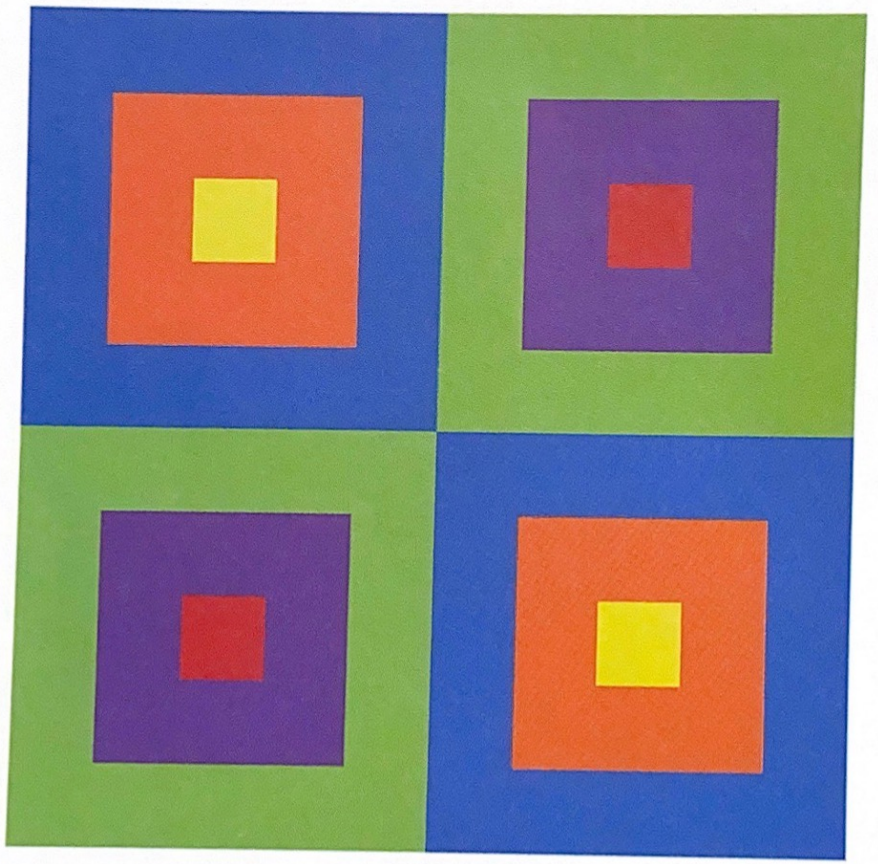
Differentiation planning sheet: Picking paintings Apart- L5 (Mindset Mathematics, Jo Boaler)

Key mathematical understandings	Task	Enabling prompt	Extending prompt	Consolidating Task
To explore colours in geometric art, to build understanding of fraction equivalence to visualise the need for common denominators when adding and subtracting fractions.	Using geometric art,develop ways of finding the fraction of the area of a painting covered by two or more colours. Discuss the methods students used for joining fractions represented in different colours. Name the reason for using the same size pieces (a common denominator) when joining.	Provide more simple geometric art pieces requiring a fewer number of colours to be added. (Stacks). Provide explicit instruction at the point of need.	Provide more complex geometric art pieces requiring a greater number of colours to be added. (Patches)	Building on student understanding of adding and subtracting fractions in geometric art, students create 'good' and 'close' fake Mondrial paintings, which when 3 colours are added are close to a half (but not exactly). Students are required to justify why their paintings are a 'close' flake.

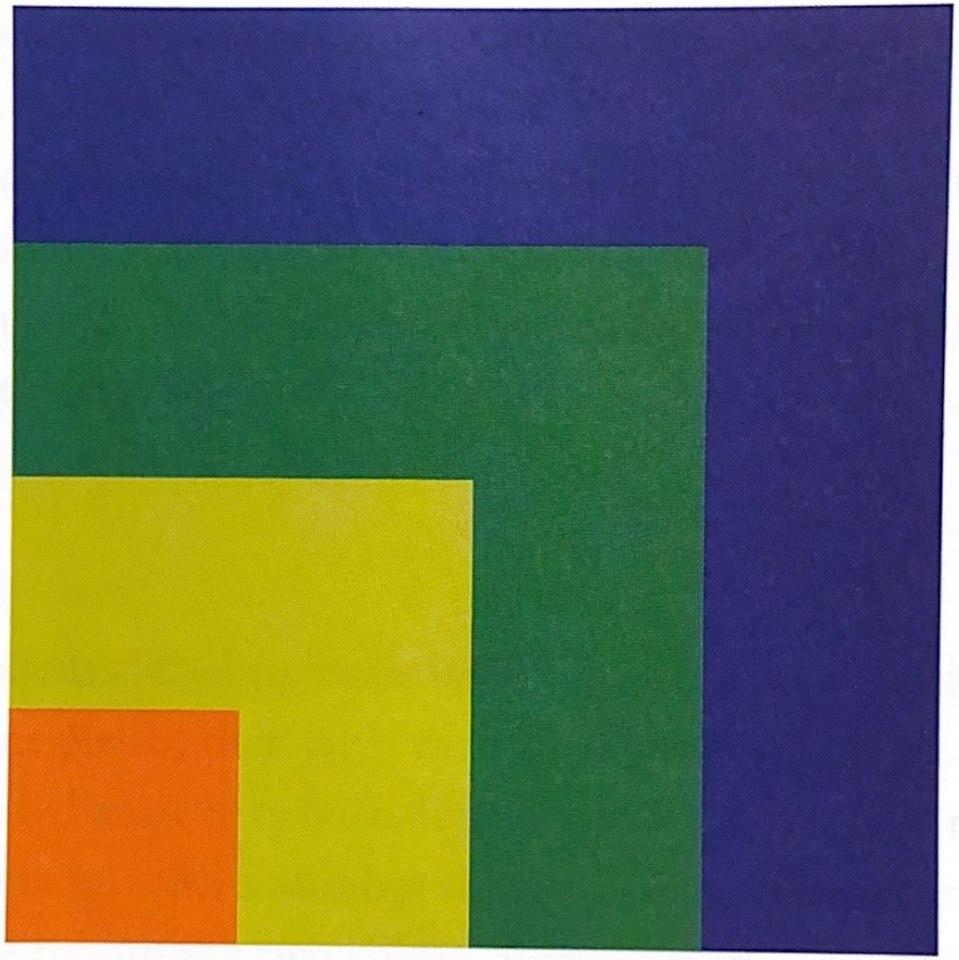
Ways to enable	Ways to extend
▪ Change the representation ▪ Make the numbers more complex ▪ Pose a simpler or similar problem with fewer variables or fewer steps	▪ Change the representation ▪ Make the numbers more complex ▪ Change the number of steps ▪ Convince me … ▪ What if the numbers were different .. ▪ Create your own

(A Downton, 2022)

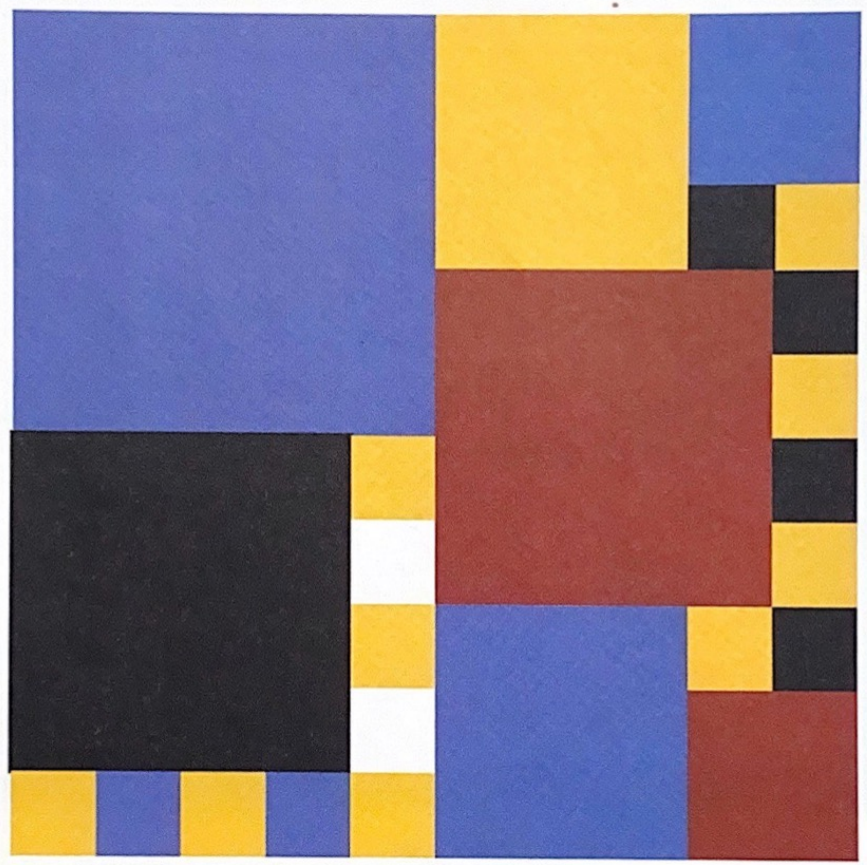
What fraction of the painting is purple and green?



What fraction of the painting is yellow and orange?

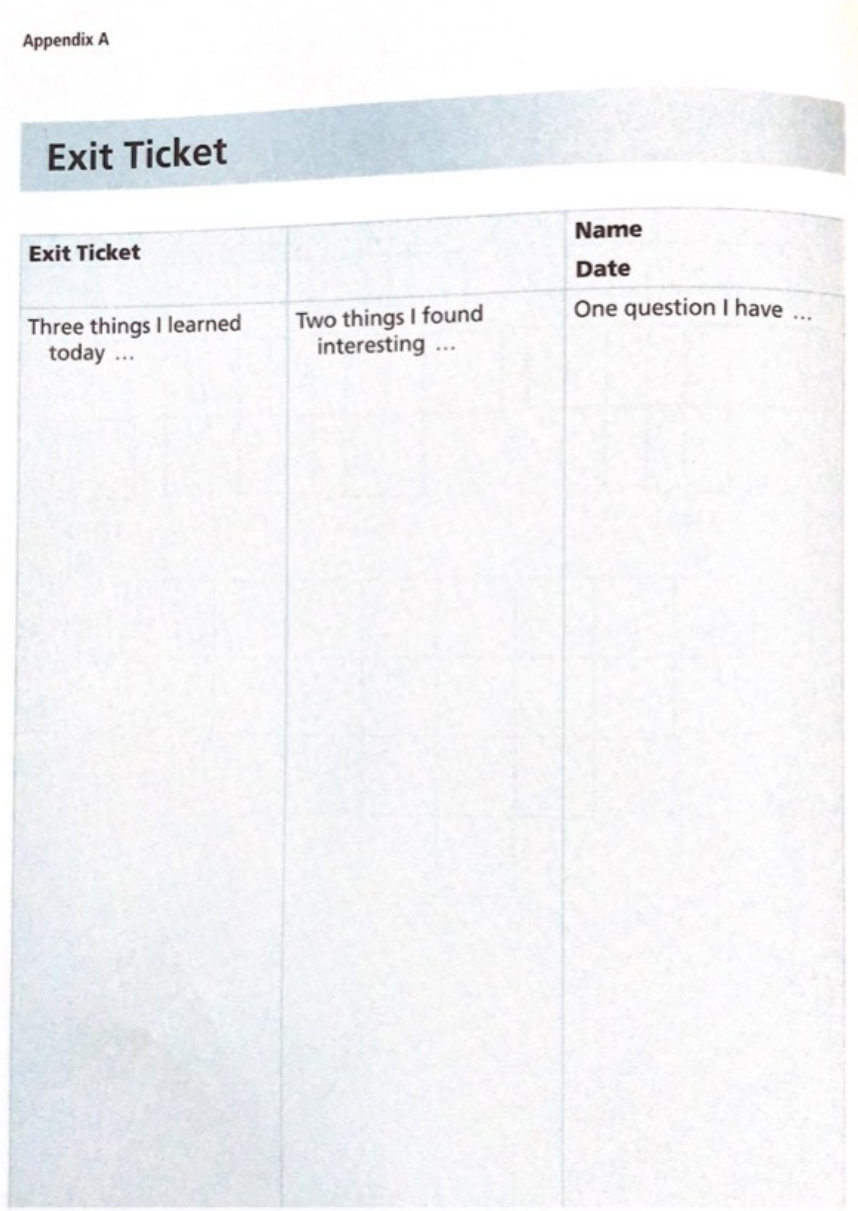


What fraction of the painting is red, blue, and yellow?



Assessment Ideas- Exit Ticket

- Students are able to reflect on their learning using a clear criteria.
- Provides teacher an instant feedback on where to next with learners.
- Boaler, 2016.



Appendix A

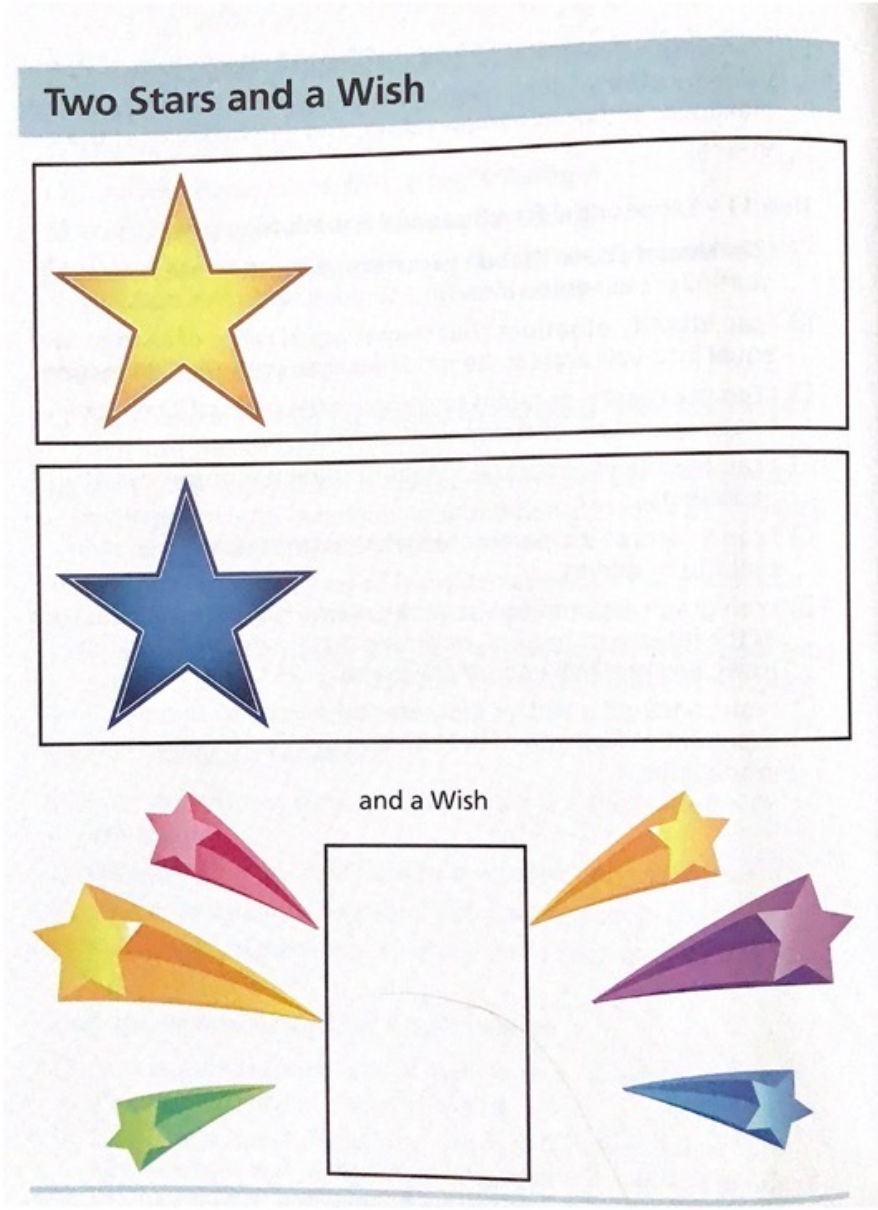
Exit Ticket

Exit Ticket		**Name** **Date**
Three things I learned today …	Two things I found interesting …	One question I have …

Peer Assessment- 2 Stars & a wish

- Peers are able to provide feedback either with or without criteria, to select 2 things they've done well and 1 area to improve.

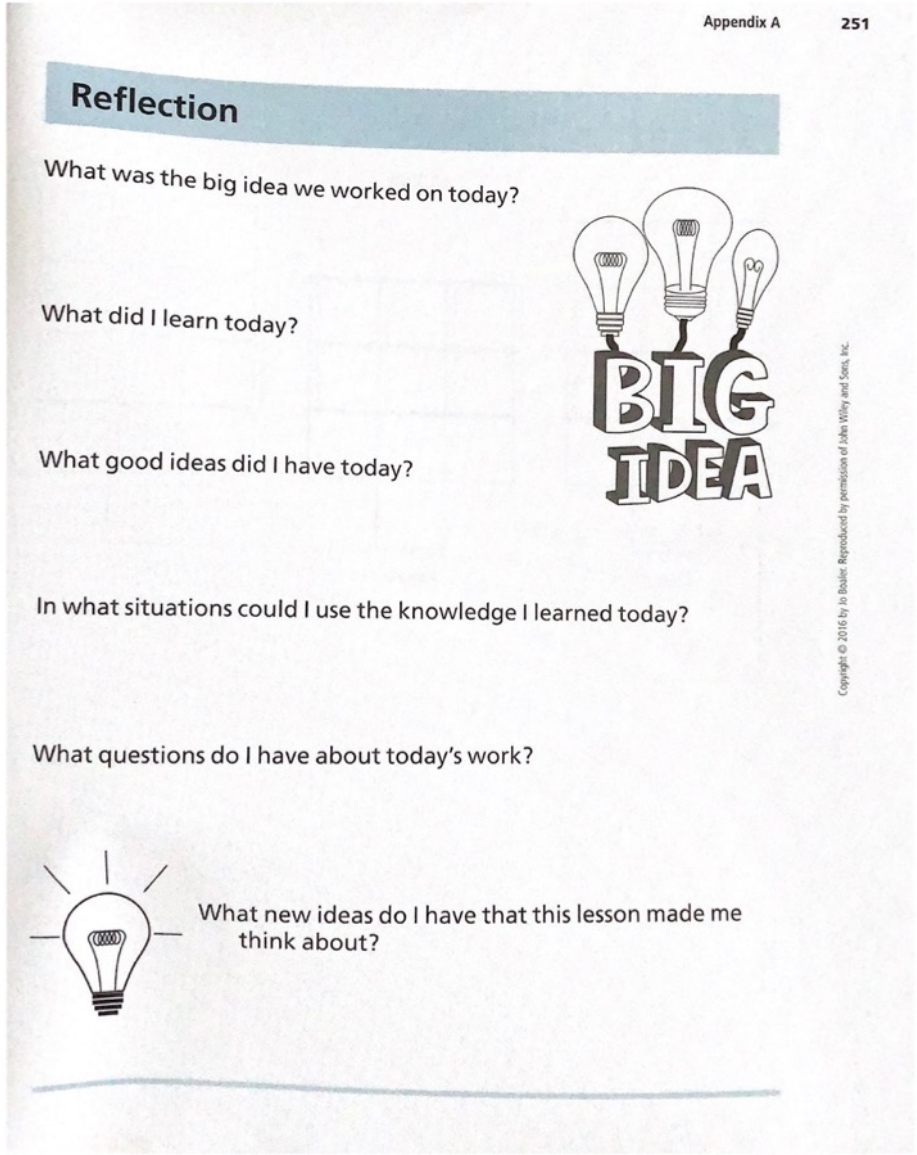
Boaler, 2016.



Group Reflection- Big Ideas

- An effective way for students to become knowledgable about the ideas they are learning is to provide reflection time at the end of lessons.

(Boaler, 2016)



Appendix A 251

Reflection

What was the big idea we worked on today?

What did I learn today?

What good ideas did I have today?

In what situations could I use the knowledge I learned today?

What questions do I have about today's work?

What new ideas do I have that this lesson made me think about?

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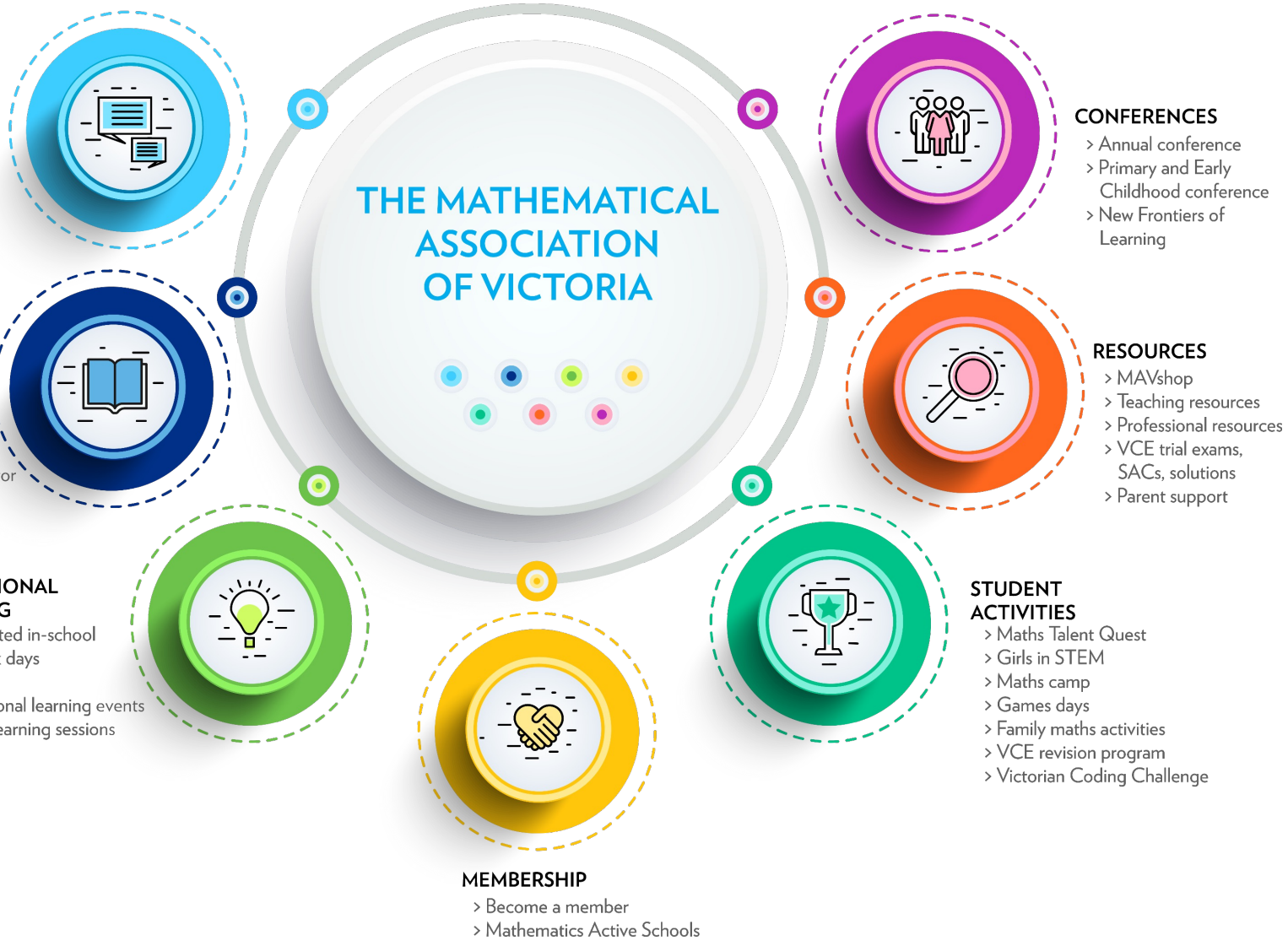

COMMUNICATION
- > Website
- > Publications
- > Matrix newsletter
- > Advocacy
- > News page
- > Public events

CONFERENCES
- > Annual conference
- > Primary and Early Childhood conference
- > New Frontiers of Learning

PUBLICATIONS
- > Prime Number (Primary journal)
- > Vinculum (Secondary journal)
- > Common Denominator (Magazine)

RESOURCES
- > MAVshop
- > Teaching resources
- > Professional resources
- > VCE trial exams, SACs, solutions
- > Parent support

PROFESSIONAL LEARNING
- > Contracted in-school
- > Network days
- > VCE
- > Professional learning events
- > Virtual learning sessions

STUDENT ACTIVITIES
- > Maths Talent Quest
- > Girls in STEM
- > Maths camp
- > Games days
- > Family maths activities
- > VCE revision program
- > Victorian Coding Challenge

MEMBERSHIP
- > Become a member
- > Mathematics Active Schools