Fluency: Years 7-8

What can you recall?
This is about remembering/identifying mathematical, names, shapes, symbols, facts, processes and formulas that are important to know when working with mathematical ideas.

Can you choose and use your mathematics flexibly?
To be able to choose and use mathematics efficiently students need to be able to recall processes and facts. Choosing and using is about selecting (age appropriate) processes, facts and mathematical language appropriate to the context.

Pedagogical questions:
- How could you record that mathematically?
- How could you… (eg calculate that)?
- How could you use a calculator to…?
- Can you remember a way to…?
- What is the value of…?
- What is the formula for…?
- What is the name of…?
- What is the value of… (a calculation that you would expect automatic recall of, eg times tables, some square numbers, square roots of perfect squares, some powers of 10 (eg 10²=100, 10³=1000)…)?
- What is the formula for…?
- What is the name of…?
- What is the symbol for…?
- How many…?
- How much…?

Examples
What formula can be used to calculate the area of a rectangle/a triangle?
Name the parts of a circle.
What is the value of 3/4 - 1/3?

Problem solving: Years 7-8

How can you interpret?
This is about creating meaning from the problem that has been presented or created by the student in response to curiosity about real world applications of mathematics that are relevant to the student. It is useful to have the students describe (in their own words) what they have been asked to do. Descriptions of the task could be oral or written, as appropriate for the students and the task.

In what ways can you model and plan?
This is about describing a problem mathematically. Across years 7 to 10, ideas are represented using models, diagrams and symbols. There is an increasing emphasis on abstract symbolic representation. It is important for students to think about how they will attempt to solve the problem, rather than rushing into taking measurements or making calculations without first thinking about how helpful that will be.

Pedagogical questions:
- What processes could you try?
- How might you start?
- Can you represent the problem as a picture or by using equipment?
- What information could you put in a diagram to support your thinking?
- What strategies have you used in the past when you have been stuck?
- Speak to a peer. Ask them to show you what they are trying.

Examples
How much…?
How many…?

Examples
Calculate how many centimetre squares there are in a metre square. Calculate how many metres square there are in a kilometre square. Kym was driving to a concert. She used 1/4 of a tank of fuel to get there, but she took a different route home and used 1/3 of a tank of fuel. If the tank was full before she left home but she took a different route home and used 1/3 of a tank of fuel to get there, but she took a different route home and used 1/3 of a tank of fuel, what fraction of a tank does Kym have left?

Pedagogical questions:
- What processes could you do?
- How might you start?
- How could you test your idea?
- What would you do differently now?
- What are you being asked to find out, demonstrate or prove?
- What information is helpful?
- What information is not useful?
- What information could you put in a diagram to support your thinking?
- What processes could you try?
- What processes could you use a calculator to…?
- What could you try?
- Would you like to change your mind?
- Would you use a different strategy next time?
- What would you do differently now?
- How reliable was this strategy?
- How could you order from most to least steep?
- How could you record that mathematically?
- How could you use a calculator to…?
- What information is helpful?
- What information is not useful?
- What additional information would be useful?
- How could you test your idea?
- How might you start?
- Can you represent the problem as a picture or by using equipment?
- What strategies could you use in the past when you have been stuck?
- Speak to a peer. Ask them to show you what they are trying.

Problem solving: Students benefit from working in a problem solving context in many aspects of the curriculum.

Pedagogical questions:
- What is the value of 3/4 - 1/3?
- How could you test your idea?
- How might you start?
- Can you represent the problem as a picture or by using equipment?
- What information could you put in a diagram to support your thinking?
- What strategies have you used in the past when you have been stuck?
- Speak to a peer. Ask them to show you what they are trying.

Examples
What is the formula for…?
What is the name of…?
What is the value of…?

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What is the name of…?
What is the value of…?

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Examples
What is the formula for…?
What is the name of…?
What is the value of…?
Overview

Bringing it to life - essence meets content

Understanding: Years 7-8

What patterns/connections/relationships can you see?
This is about noticing and using characteristics in number, algebra, measurement, geometry, probability and data. This is about representing the patterns/relationships/rules in abstract ways, using variables. It is about identifying relationships so that we are able to reason (see reasoning: inference and generalisation) and make predictions. Noticing similarity and difference helps students to build conceptual understanding.

Can you answer backwards/ inverse questions?
This is about working flexibly with a concept.

Can you represent or calculate in different ways?
This is about representing quantities in different ways and beginning to represent situations algebraically. This is also about finding different ways to calculate the answer to computation problems. These problems may include the use of any of the four operations with rational numbers and integers.

Pedagogical questions:

- How are these… (values/shapes/angles/questions/graphs/ words/expressions/equations) the same as each other?
- How are these… (values/shapes/angles/questions/graphs/ words/expressions/equations) different to each other?
- What is the connection between…?
- Which is the odd one out?
- What if… (change something), is it still…?
- Estimate…
- Which is greater/bigger/larger/larger/longest?
- Which is less/smaller/shorter/shallower?

Pedagogical questions:

- If the answer is… what might the question have been?
- What’s missing in this number sentence from this group in this pattern?

Pedagogical questions:

- What is another way…?
- What is another way to represent that?
- What is another way to work that out?
- What is another way to do that calculation?

Pedagogical questions:

- Prove that…
- Convince me, yourself, someone who thinks differently…
- Don’t ask me if you are correct, tell me when you KNOW you are correct, and tell me HOW you know.
- What else could it be?
- Why is that the best way to show…?

Examples

How are these expressions the same as each other? 3a - b = 3a + b = 3a - 10
What’s the connection between the graphs of:
y = 2x and y = 2x + 1?
What’s different about the equations? What’s different about the graphs?

Connect to reasoning: Inference
Now that you have noticed these connections, what can you infer?

In what ways can you prove…?
This is really about convincing yourself and others about your mathematical thinking.

In what ways can you communicate?
This is about making thinking visible and sharing your ideas using mathematical terminology, diagrams and symbolic representations (including simple algebraic representations). It is important to evaluate different ways to communicate the same idea.

Pedagogical questions:

- What’s the best way to record your results and why?
- How come…?
- Explain it/why? (to somebody who hasn’t been involved in the learning).
- Can you show me how that works?
- Why did you choose to…?
- How does your formula show…?
- Why would… (a graph/a formula/a diagram) be useful/not helpful?
- Why is it not… (followed by an incorrect name or process)?
- Why can’t I… (followed by an incorrect name or process)?

Examples

You have shown the angle sum of a triangle to be 180 degrees and the angle sum of any quadrilateral to be 360 degrees. Can you make a statement about the angle sum of any polygon? Is there a rule that always works? Can you write an algebraic expression relating the number of sides that the polygon has and the total of the internal angles?

Connect to reasoning: Inference
Now that you know… can you represent or check the other cases?

Examples

You are thinking of a number. I doubled it and subtracted 6. The answer is 36. Represent that algebraically.

Pedagogical questions:

- What’s the correct way to check that?
- What’s the best way to show that?

Examples

Try these questions: 102° - 92° = 90° - 82° = 72° - 62° =
What do you notice about the answers to these questions?
What can you infer from these observations about the case when the difference between the square numbers is two, so that the questions become: 102° - 92° = 90° - 82° = 72° - 62° = etc?
What do you think now? Is it possible to make a generalisation? Do you need more information? How could you test your idea?

Reasoning: Years 7-8

Pedagogical questions:

- Now that you know… can you work out…?
- I’m thinking of… (a number/a shape) and I’m going to give you some clues… Can you work out what my number/shape is?
- I’m thinking of… (a number/a shape) and I’m going to give you some clues… Can you work out what the possible answers are?
- I’m thinking of… (a number/a shape) and you can ask questions to help you to work out what it is, but I can only answer yes or no.
- You could use sentence structures such as: If (assumption) then…
- Because I know… I also know…

Examples

0! = 64
I’m thinking of a number. When my number has been divided by one third the total of the internal angles?

Examples

Example:

Connect to problem solving: Model and plan
How can you test your idea?

Examples

Example:

103, 79, 15, 89, 94
See connection to reasoning.

How can you test your idea?

Examples

Example:

Calculate the average of this data set in three different ways:

Convince me that the angle sum of any triangle is 180 degrees. Use this to show the angle sum of any quadrilateral.

Examples

Communications of mathematical ideas can be emphasised in any proficiency, with any content.

Examples

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