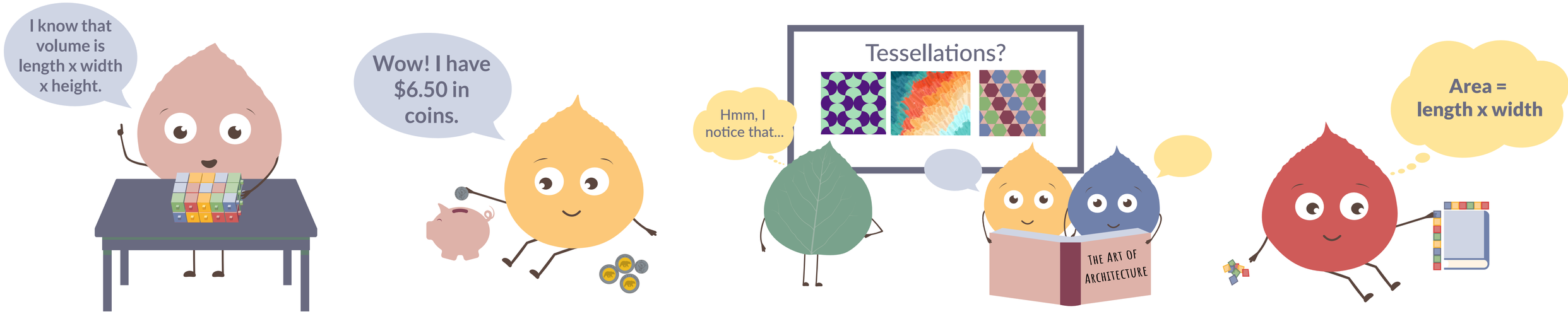
Resources to Support the Teaching and Learning of Math Verbs

Alberta 4-6 Curriculum (2023)



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"Students will gain the knowledge and skills to form the foundations for successful and fulfilling lives, and make meaningful contributions to their communities and the world." (Ministerial Order: Vision for Student Learning, 2020)

This resource was developed to help provide clarification, context and support for teaching the verbs in Alberta Education's K-3 Math Curriculum (2022). When educators explicitly teach and model the student actions within the Learning Outcomes and Skills and Procedures, they provide the foundation for learners to develop competence. As students practice these skills and engage in multiple learning experiences, both within and across subject areas, they will retain and be able to apply understanding from year to year.

This slide deck of resources includes:

- A *Glossary of Definitions* for each of the student actions found within the Learning Outcomes and Skills and Procedures.
- A *Video Recording* to introduce the resource.
- Illustrated *Definition Cards* for each verb.
- *Teacher Toolkits* for selected verbs.

  Teacher Toolkits are identified by an * in the Glossary and by "view toolkit" in the slide deck. They include additional information for teachers about the verb, a table with location within the Math curriculum and illustrative examples. When deciding which verbs would be supported with a toolkit, consideration was given to the type of student action involved, the complexity of the thinking process, whether it is found within a learning outcome, and/or teacher request for clarification within a mathematical context.

This resource was created by ARPDC Professional Learning Leads.
Research-based practices, subject area expertise, extensive teaching experience, and analysis of numerous resources were foundational to the development of these documents.

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References

Ministerial Order
https://www.alberta.ca/ministerial-order-on-student-learning

Acknowledgements
Queensland Curriculum and Assessment Authority

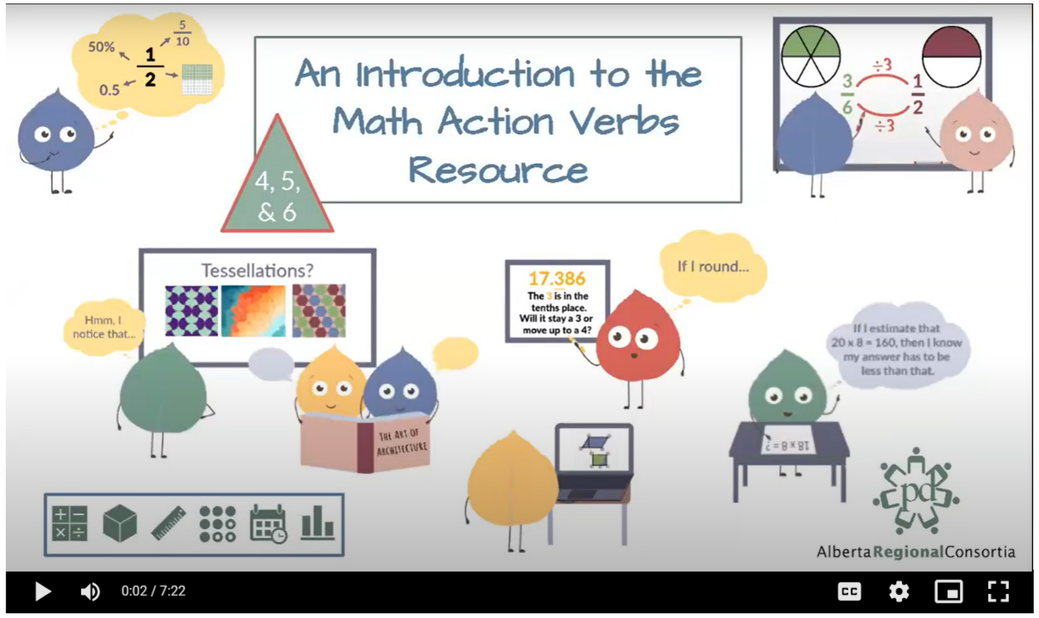
NorthWest Evaluation Association
https://acrobat.adobe.com/link/review?uri=urn:aaid:scds:US:77b947f5-25b9-3170-932c-beb714b5bf75

Alberta Directing Verbs
https://www.alberta.ca/system/files/custom_downloaded_images/ed-mathematics-directing-words.pdf

Additional Resources and references related to the illustrative examples are found within the toolkits.

Resources to Support the Teaching and Learning of Math Verbs

Alberta 4-6 Curriculum (2023)



(click to watch video)

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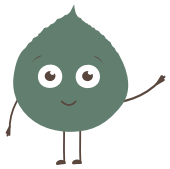
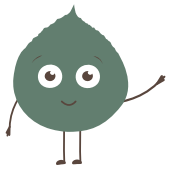


Glossary for Student Action Verbs ~ Alberta's 4-6 Math Curriculum

This interactive glossary and associated resources were developed to help provide clarification, context and support for teaching of the verbs in Alberta Education's 4 - 6 Math Curriculum (2022).

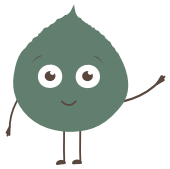
Grades found as LO	Grades found within Ss & Ps	Verb	Definition *Indicates that there is a hyperlinked toolkit.
4, 5, 6	4, 5, 6	add	To combine two or more addends (numbers/qualities) together to get a sum.
4, 5, 6	6	analyze*	To consider in detail in order to find meaning and determine relationships, patterns, similarities, differences, etc.
4, 6	4, 5	apply*	To use (mathematical knowledge).
	4, 5, 6	assess	To determine (or decide) something after consideration.
5		calculate	To determine (the amount or number of something) mathematically.
	5	categorize	To assign to a category.
	4, 5	classify	To arrange into groups based on one or more attributes or properties.
	6	collect	To gather data and/or information, etc., from people or sources.
4		communicate	To convey knowledge and understanding to another.
	4, 5, 6	compare	To consider the qualities of two or more things or sets, in order to discover similarities or differences.
	6	compose	To form, combine, or put together.
	4, 6	convert	To change a value or expression from one form to another.
	5	count	To name the numbers in a stable order and/or determine a quantity.



Glossary for Student Action Verbs ~ Alberta's 4-6 Math Curriculum

This interactive glossary and associated resources were developed to help provide clarification, context and support for teaching of the verbs in Alberta Education's 4 - 6 Math Curriculum (2022).

Grades found as LO	Grades found within Ss & Ps	Verb	Definition *Indicates that there is a hyperlinked toolkit.
	4, 5, 6	create	To use knowledge, reasoning and understanding to put elements together to form something new or original.
	6	demonstrate	To show or express understanding through one's actions.
	4, 5, 6	describe*	To communicate (orally or in writing) qualities, attributes, details and/or features of something.
4, 5	4, 5, 6	determine*	To find an answer using a reasonable strategy, procedure, and/or calculation.
	5	discuss	To exchange ideas, thoughts, facts, etc.
4, 5	4, 5, 6	divide	To separate a total (quotient) into equal groups to determine the number of groups or how many are in each group.
5		employ	To use.
	4	engage	To take part/be involved in.
5	4, 5	estimate	To come close, or be similar to, a number, calculation, quantity, or measurement.
4	4, 5, 6	evaluate*	To determine the value of. (Note: definition is specific to mathematics)
	4, 5	examine	To carefully and in detail consider the nature and characteristics of something to find out more about it.
4, 6	4, 5, 6	explain*	To describe the how or why of something; give the cause or reason for.



Glossary for Student Action Verbs ~ Alberta's 4-6 Math Curriculum

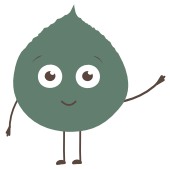
This interactive glossary and associated resources were developed to help provide clarification, context and support for teaching of the verbs in Alberta Education's 4 - 6 Math Curriculum (2022).

Grades found as LO	Grades found within Ss & Ps	Verb	Definition *Indicates that there is a hyperlinked toolkit.
4, 6	4, 5, 6	express*	To convey knowledge and understanding.
	5	formulate	To develop possibilities, after considering facts and details appropriate to the given context.
	5	generalize	To become aware of a pattern, relationship, or rule and recognize that it can be applied to a similar context or situation.
	4, 5, 6	identify	To recognize by naming and/or indicating.
	5	indicate	To recognize by identifying.
4, 5, 6	4, 5, 6	interpret*	To use reasoning and knowledge to make sense of, and draw meaning from, a text, set of data, visual, graph, etc.
5, 6	4, 5, 6	investigate*	To use a process of inquiry or exploration to gain deeper understanding.
	4, 5	justify	To use relevant reasons and evidence to indicate why a conclusion has been made.
	5, 6	locate	To indicate a specific place or position.
	4	measure	To determine the size, amount, or degree of something, using standard or non-standard units.
	4. 5, 6	model	To represent a concept or situation in a concrete, pictorial, or symbolic way.

Glossary for Student Action Verbs ~ Alberta's 4-6 Math Curriculum

This interactive glossary and associated resources were developed to help provide clarification, context and support for teaching of the verbs in Alberta Education's 4 - 6 Math Curriculum (2022).

Grades found as LO	Grades found within Ss & Ps	Verb	Definition *Indicates that there is a hyperlinked toolkit.
4, 5	4, 5, 6	multiply	To combine groups of equal size to determine the product.
	4, 5, 6	order	To arrange in a sequence.
	5	organize	To arrange (data, information, objects, etc..). NOTE: in other subject areas the examples may be different.
	6	predict	To form a likely answer using inference that is based on current understanding.
	6	rearrange	To change the order, arrangement or position of something.
	4	recall	To remember or retrieve from one's mind.
	4, 5, 6	recognize	To be aware of, and acknowledge, features of information.
5, 6	4, 5, 6	relate*	To show a connection or relationship between two or more things.
4, 5	4, 5, 6	represent*	To convey mathematical ideas using manipulatives, diagrams, models, signs, symbols, etc.
	4, 5	round	To make a number simpler while keeping its value close to what it was.
	4	select	To choose after consideration.
	4, 5	show	To make visible through actions, words, representations, symbols, etc.
	4, 6	simplify	To reduce to a simpler or easier to use form or expression.



Glossary for Student Action Verbs ~ Alberta's 4-6 Math Curriculum

This interactive glossary and associated resources were developed to help provide clarification, context and support for teaching of the verbs in Alberta Education's 4 - 6 Math Curriculum (2022).

Grades found as LO	Grades found within Ss & Ps	Verb	Definition *Indicates that there is a hyperlinked toolkit.
6	4, 5, 6	solve*	To find a solution or an answer.
4, 5, 6	4, 5, 6	subtract	To find the difference between two numbers or quantities.
	4, 5	verify	To confirm the answer or solution.
	4, 6	visualize	To make one's thoughts, ideas, and images visible to oneself or others.
	4, 5, 6	write	To record using writing (words, symbols, etc.).

ADD

Student Action Verbs

4 - 6

Alberta Math Curriculum

To combine two or more addends (numbers/quantities) together to get a sum.

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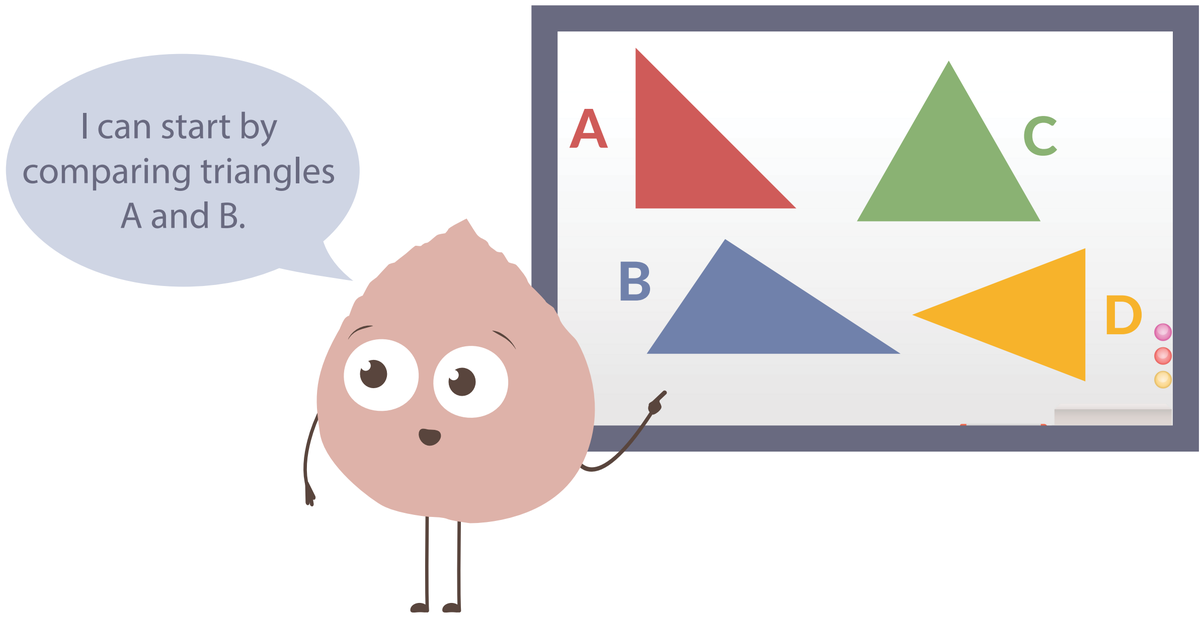
ANALYZE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To consider in detail in order to find meaning and determine relationships, patterns, similarities, differences, etc.



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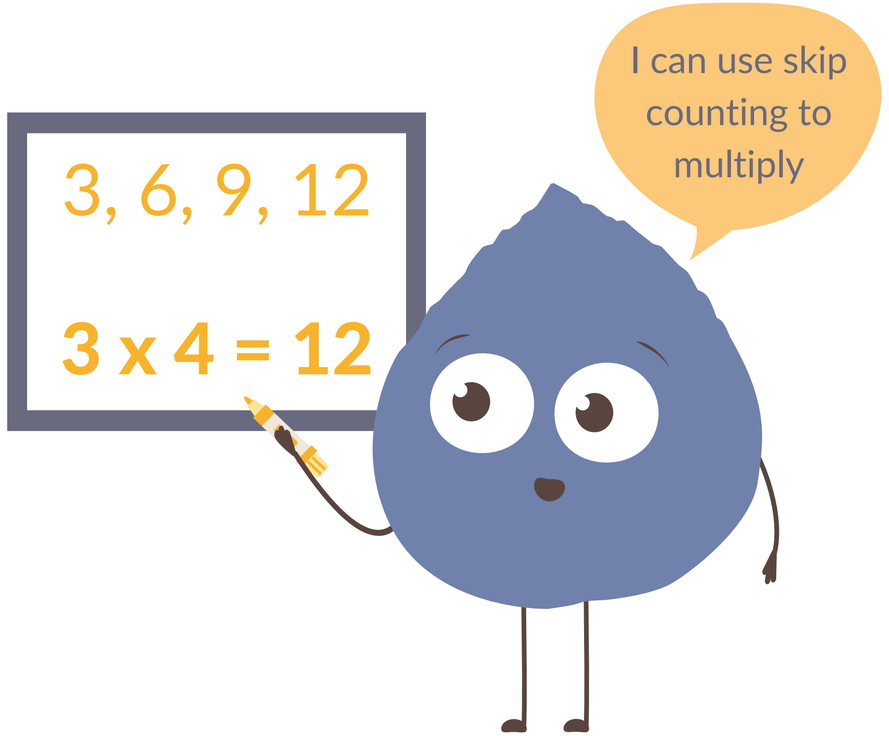
APPLY

Student Action Verbs

4 - 6

Alberta Math Curriculum

To use (mathematical knowledge).



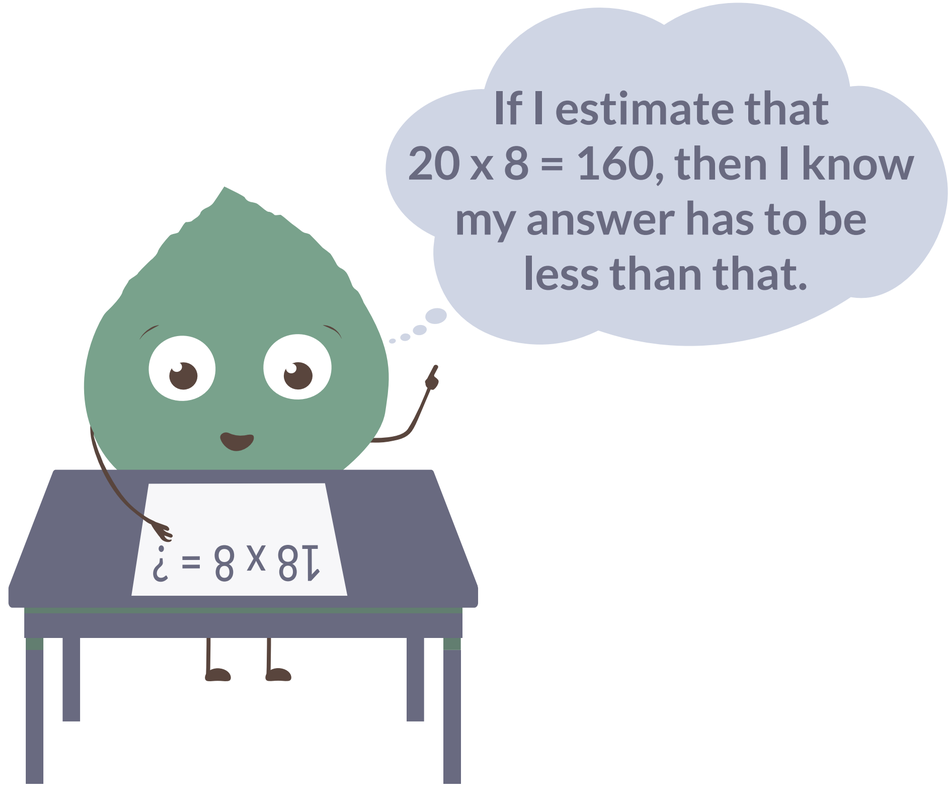
ASSESS

Student Action Verbs

4 - 6

Alberta Math Curriculum

To determine (or decide) something after consideration.



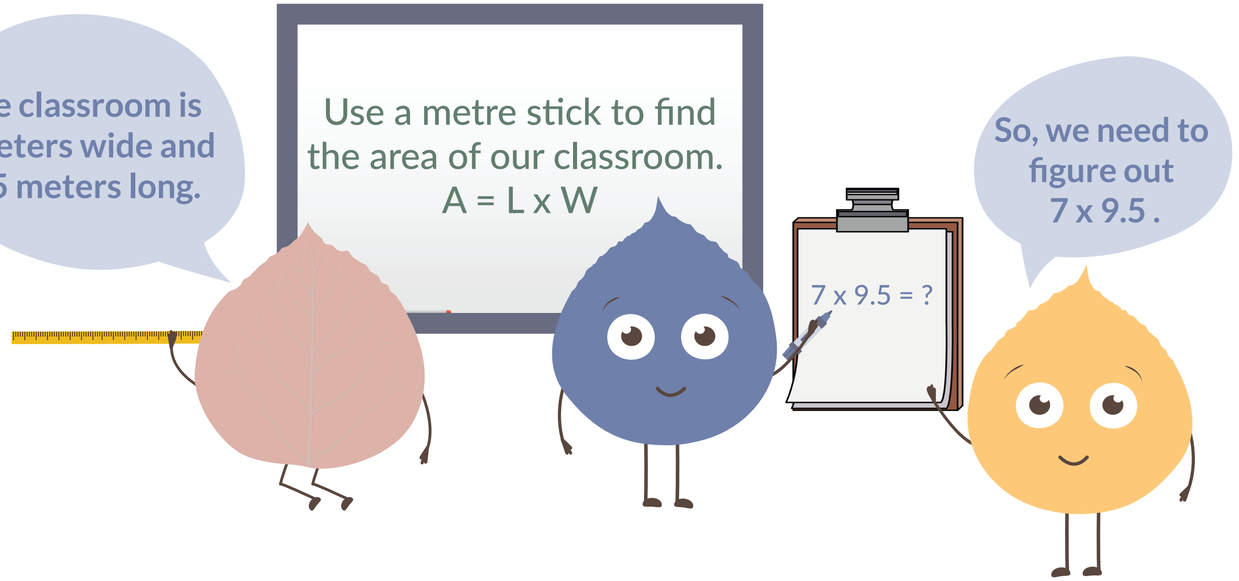
CALCULATE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To determine (the amount or number of something) mathematically.



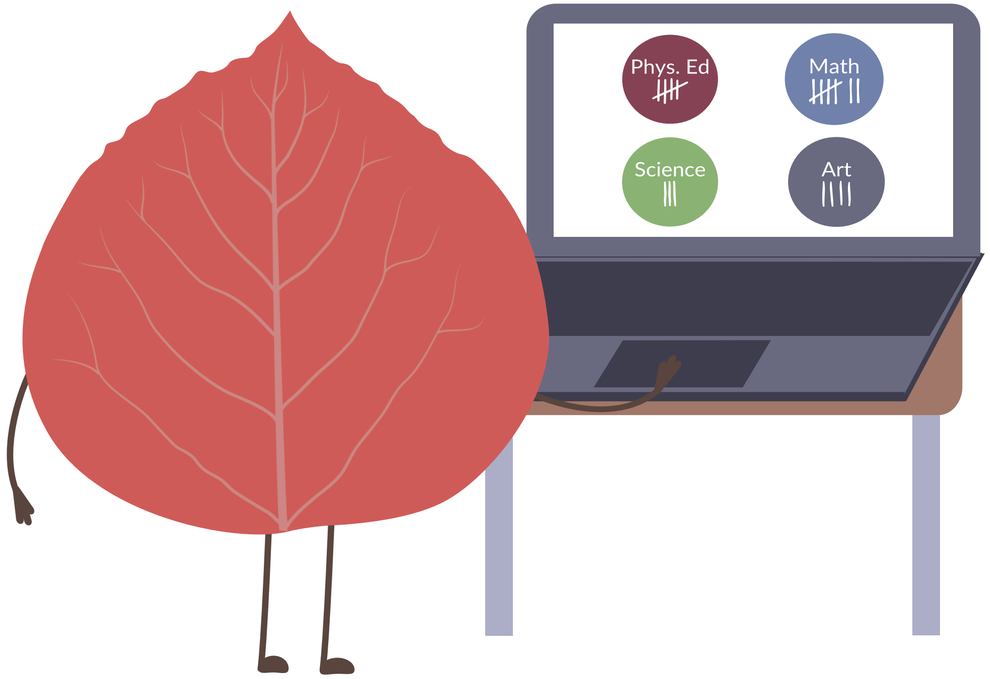
CATEGORIZE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To assign to a category.



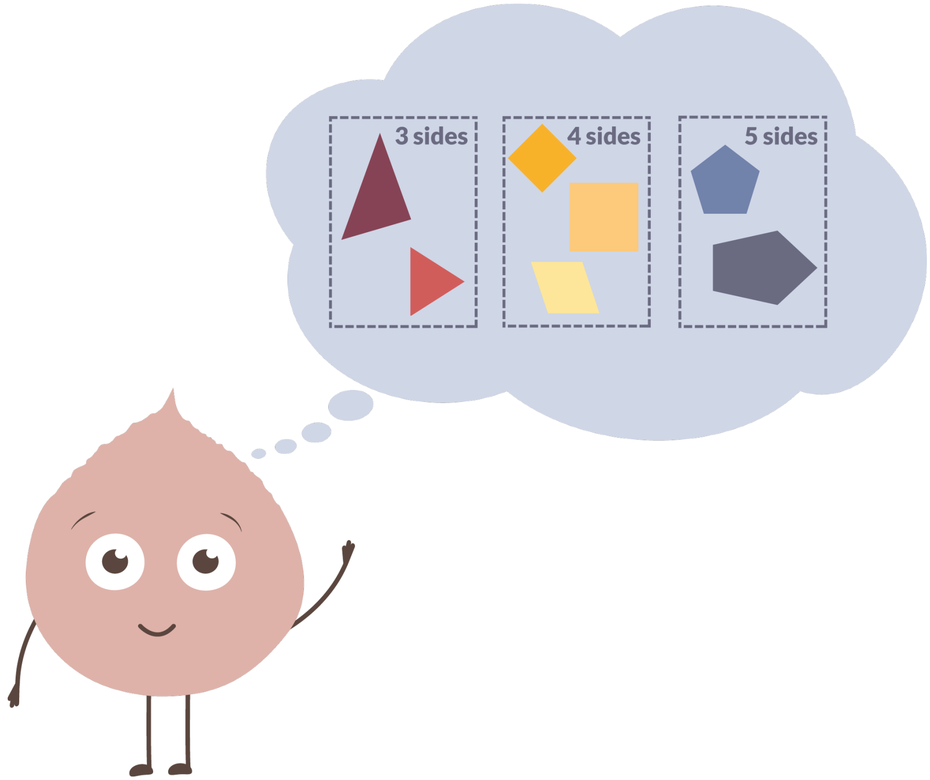
CLASSIFY

Student Action Verbs

4 - 6

Alberta Math Curriculum

To arrange into groups based on one or more attributes or properties.



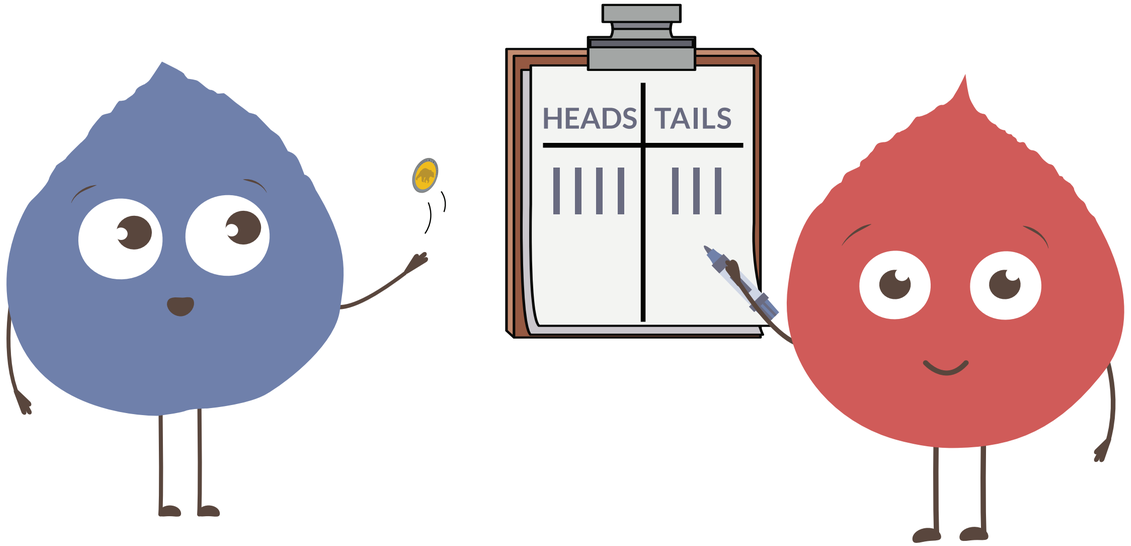
COLLECT

Student Action Verbs

4 - 6

Alberta Math Curriculum

To gather data and/or information, etc., from people or sources.



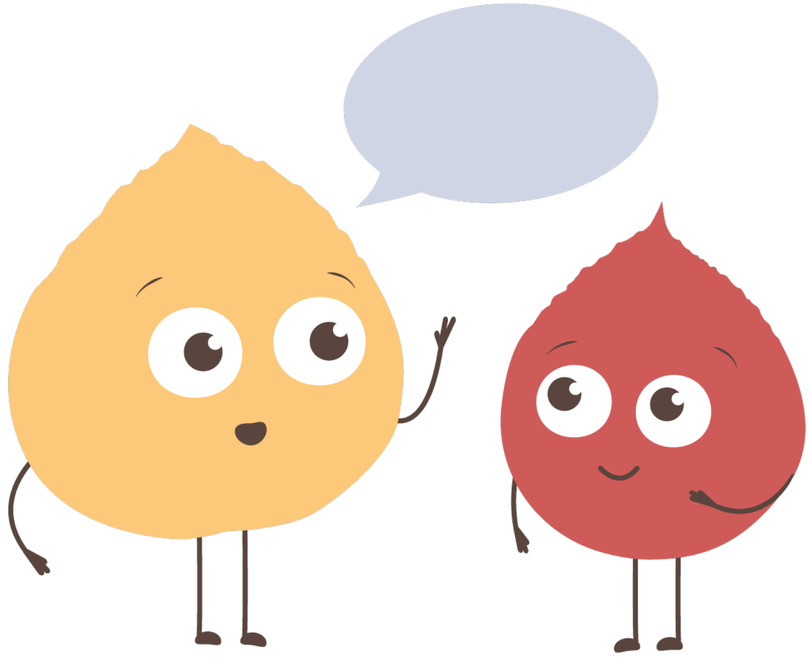
COMMUNICATE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To convey knowledge and understanding to another.



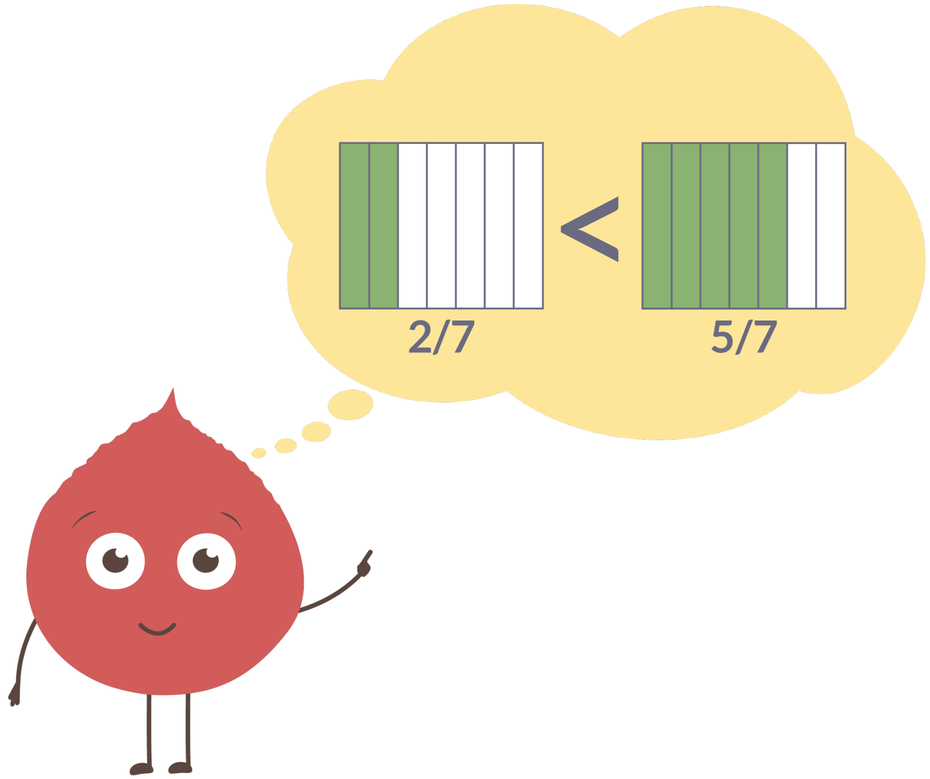
COMPARE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To consider the qualities of two or more things or sets, in order to discover similarities or differences.



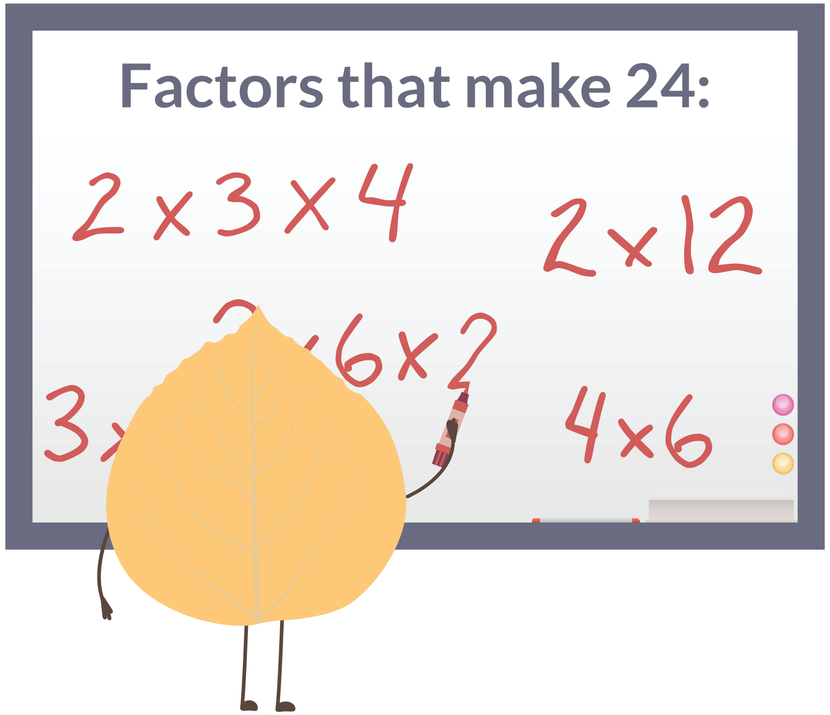
COMPOSE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To form, combine, or put together.



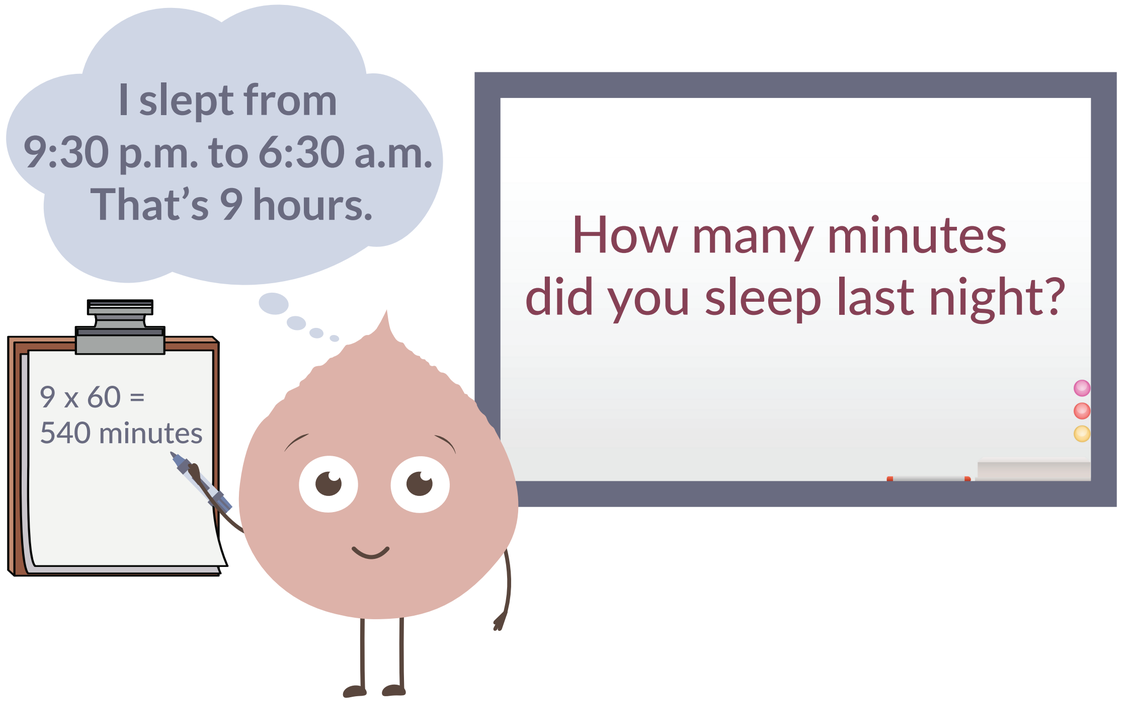
CONVERT

Student Action Verbs

4 - 6

Alberta Math Curriculum

To change a value or expression from one form to another.



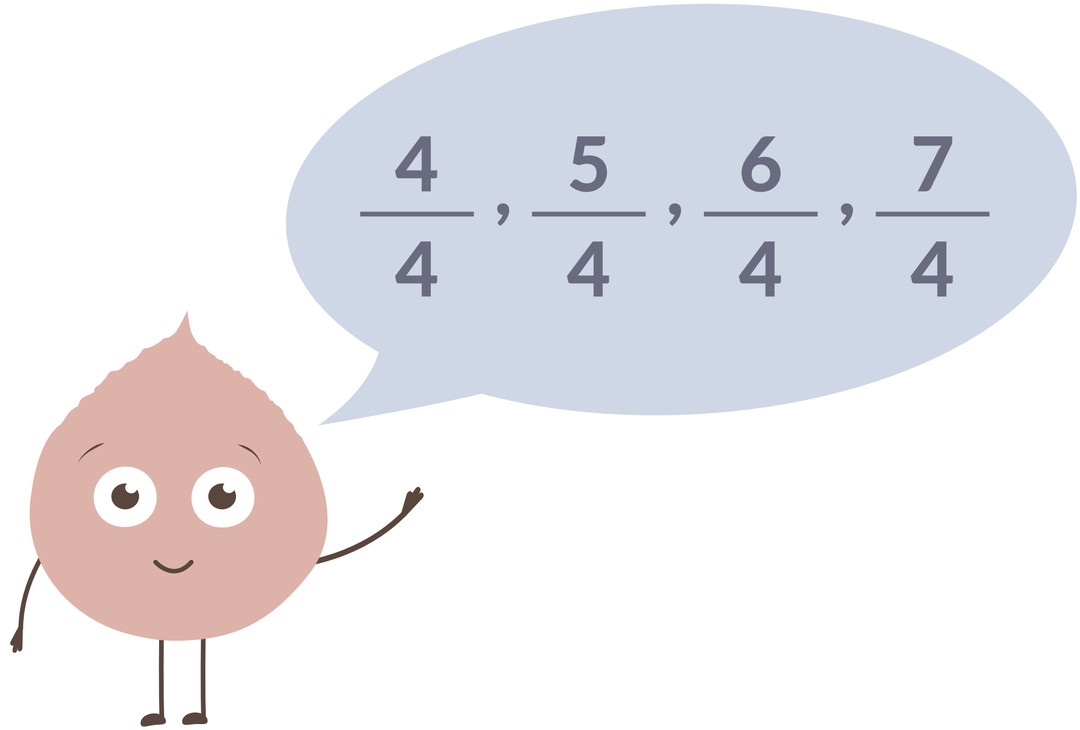
COUNT

Student Action Verbs

4 - 6

Alberta Math Curriculum

To name the numbers in a stable order and/or determine a quantity.



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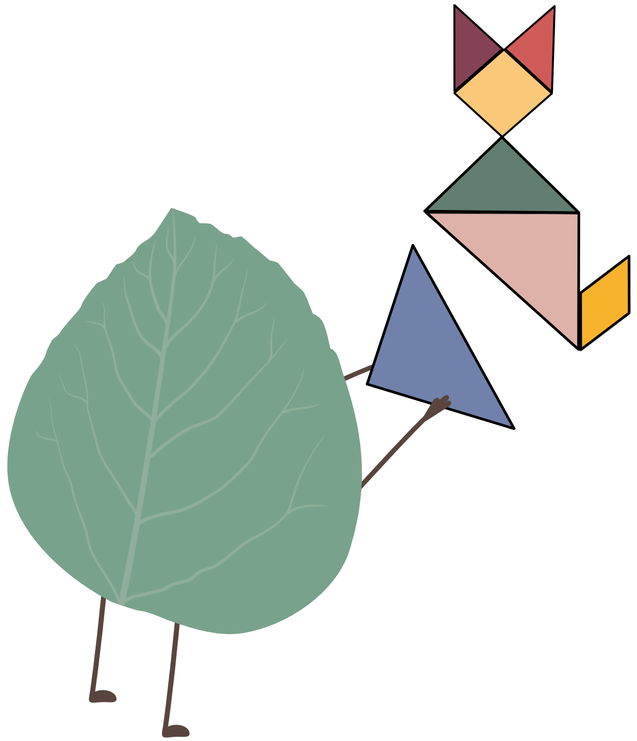
CREATE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To use knowledge, reasoning and understanding to put elements together to form something new or original.



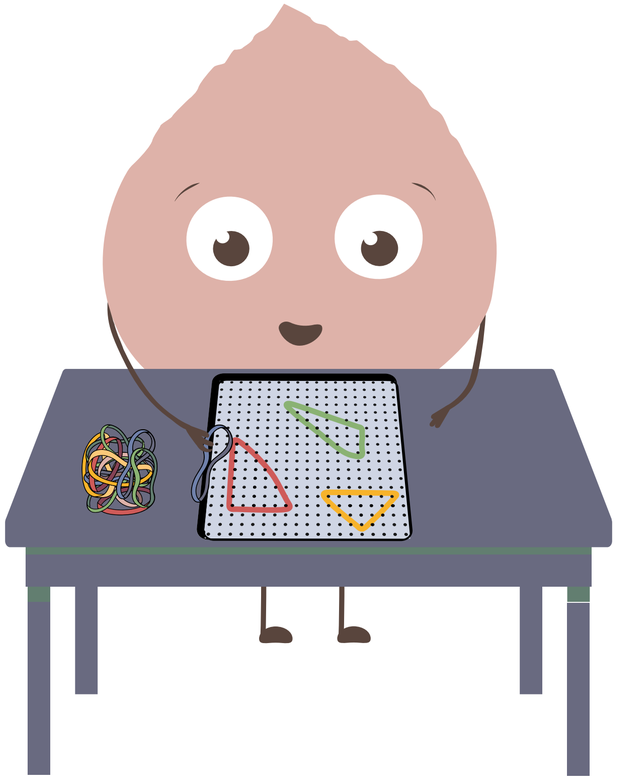
DEMONSTRATE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To show or express understanding through one's actions.



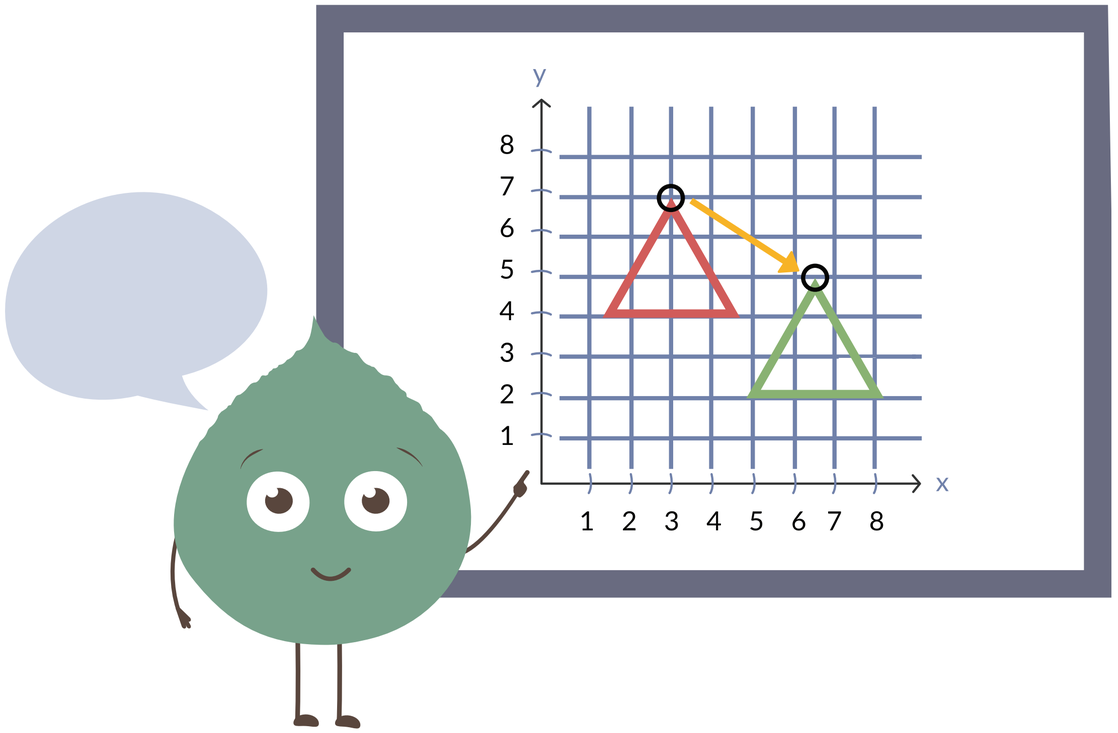
DESCRIBE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To communicate (orally or in writing) qualities, attributes, details and/or (orally or in writing) qualities, attributes, details and/or features of something.



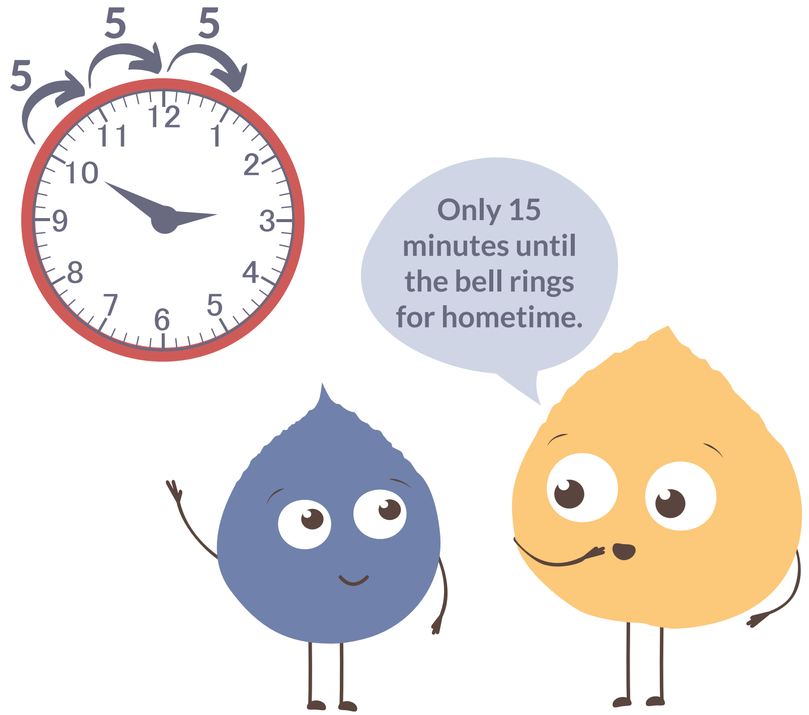
DETERMINE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To find an answer using a reasonable strategy, procedure, and/or calculation.



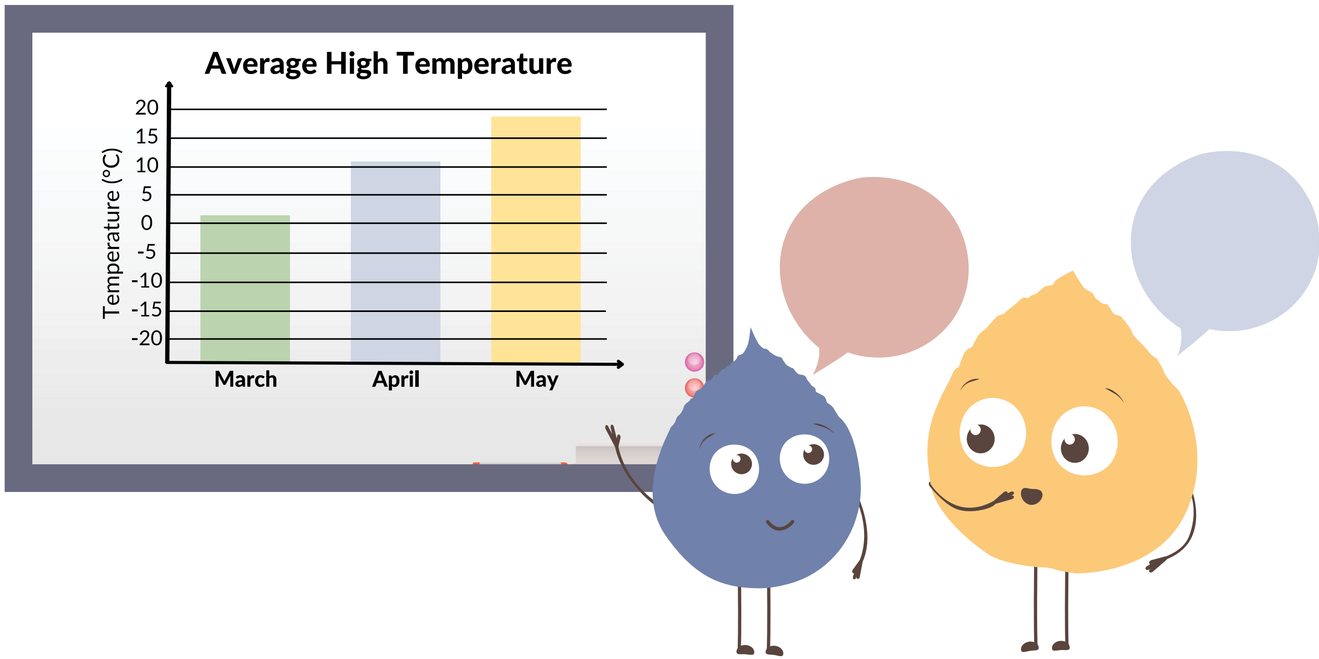
DISCUSS

Student Action Verbs

4 - 6

Alberta Math Curriculum

To exchange ideas, thoughts, facts, etc.



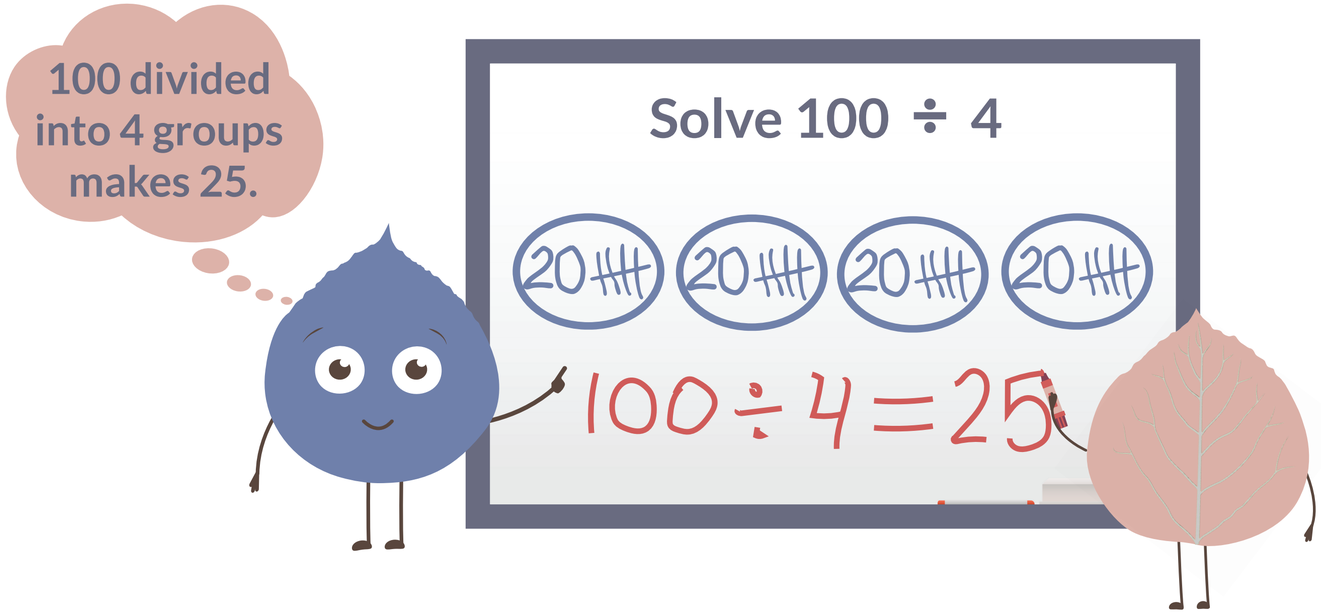
DIVIDE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To separate a total (quotient) into equal groups to determine the number of groups or how many are in each group.



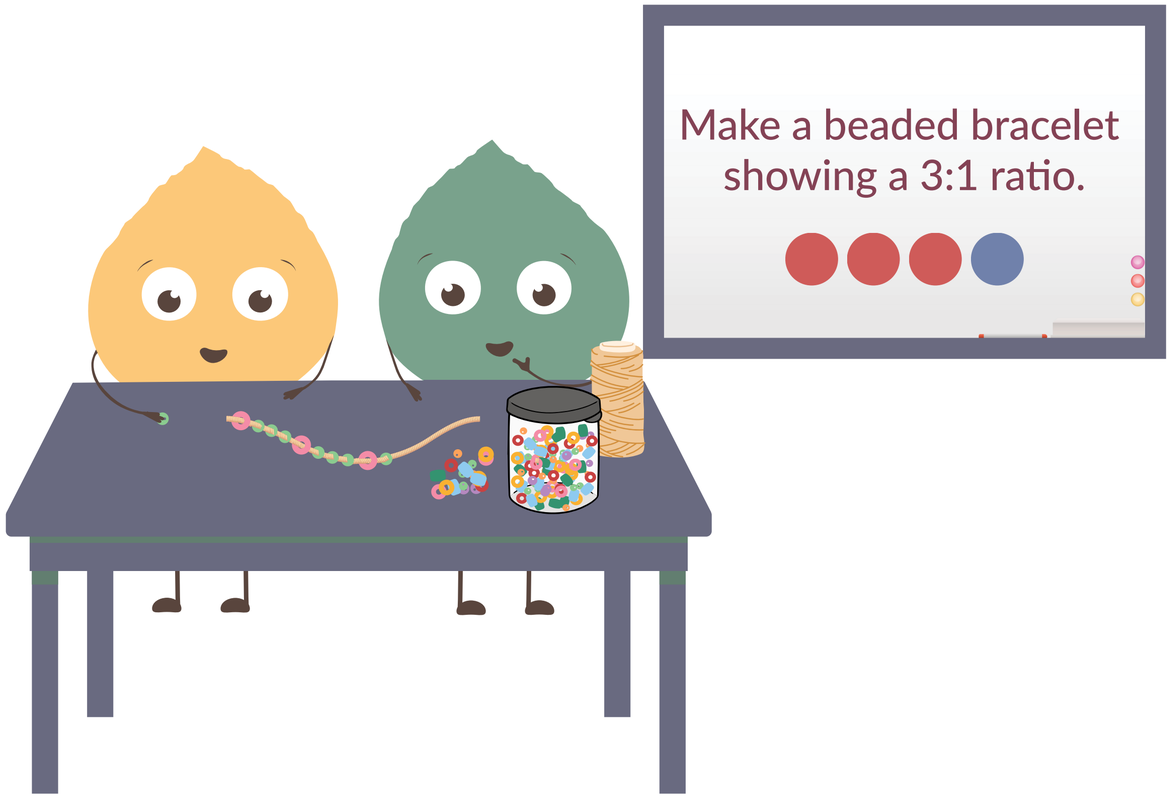
EMPLOY

Student Action Verbs

4 - 6

Alberta Math Curriculum

To use.



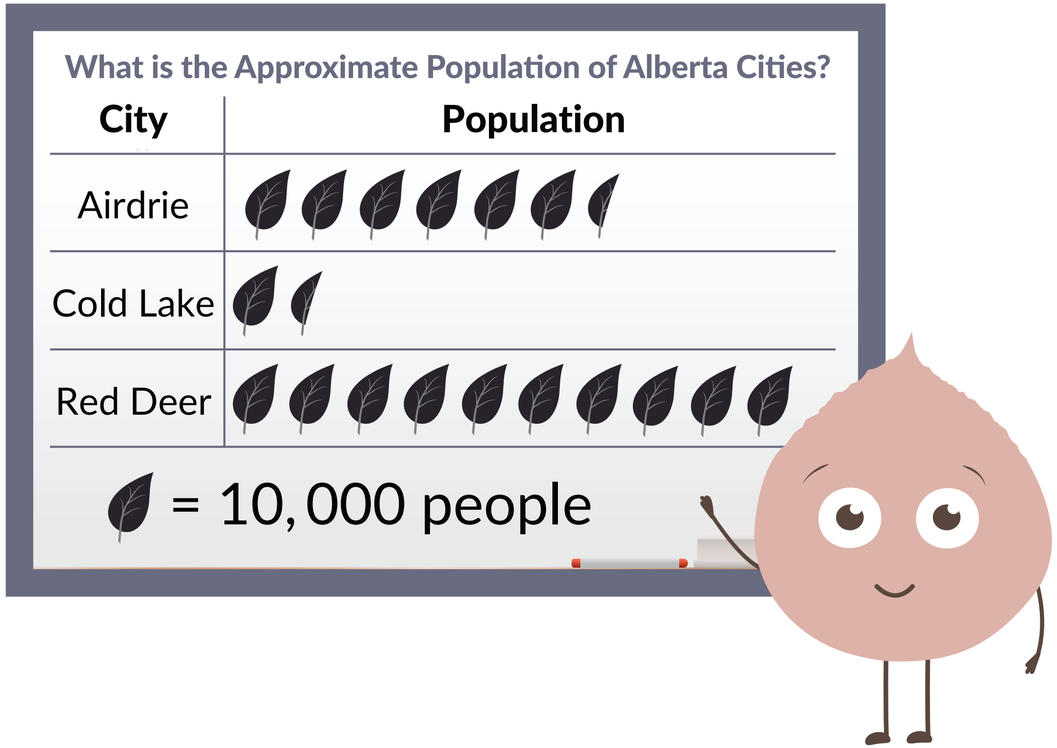
ENGAGE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To take part/be involved in.



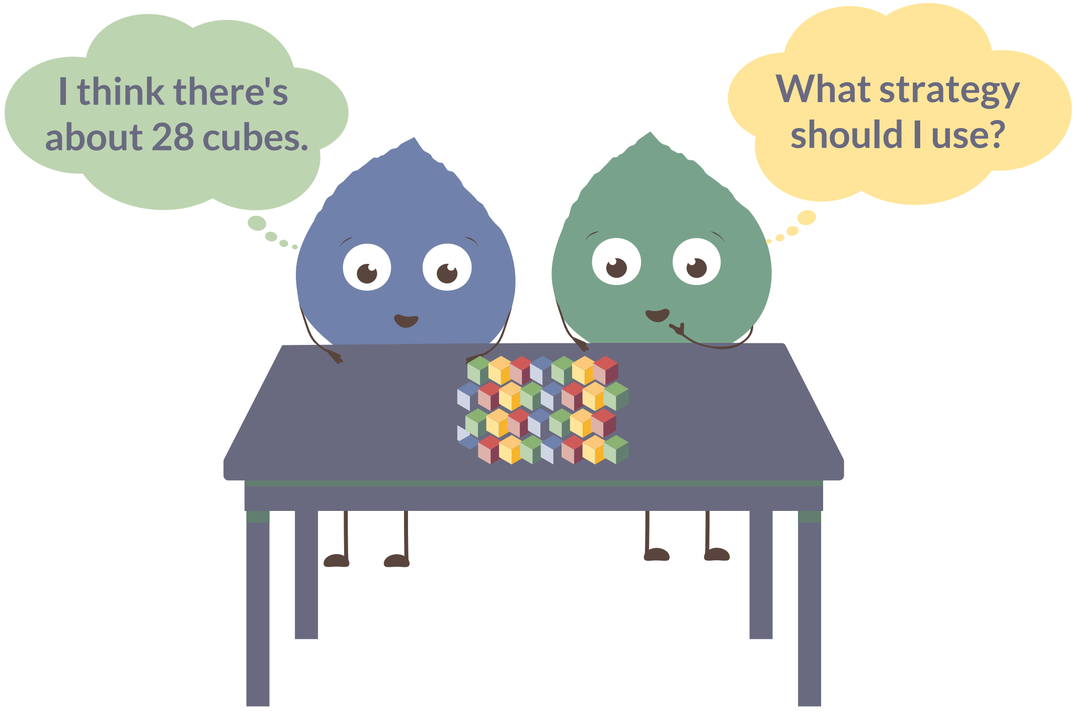
ESTIMATE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To come close, or be similar to, a number, calculation, quantity, or measurement.



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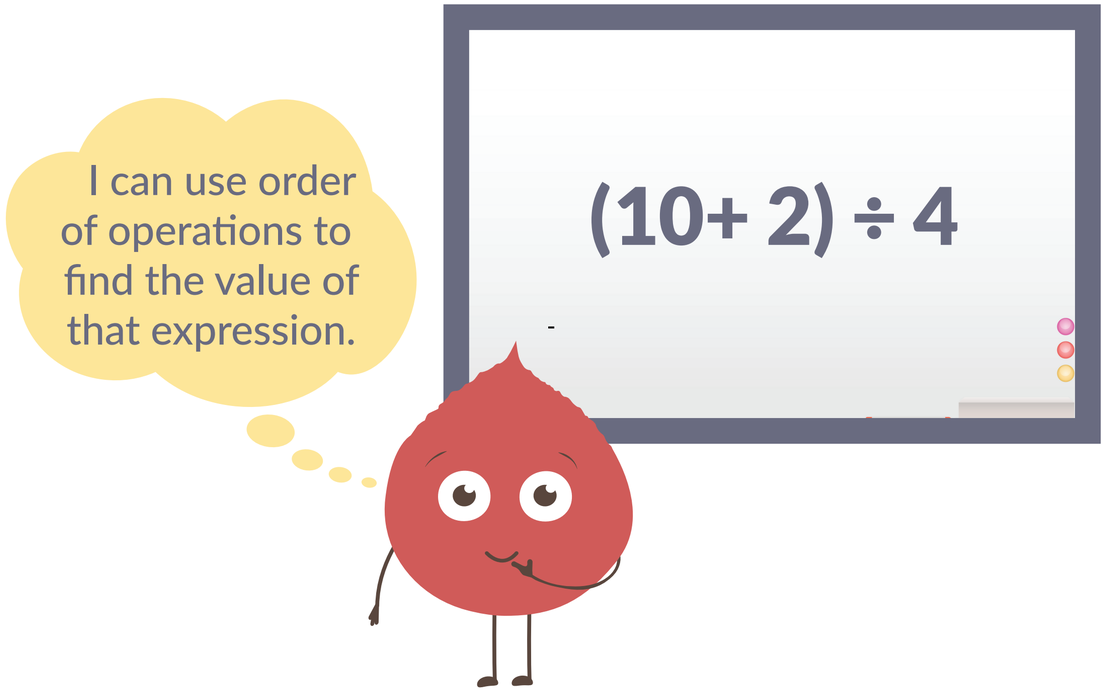
EVALUATE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To determine the value of.



(Note: This definition is specific to Mathematics.)

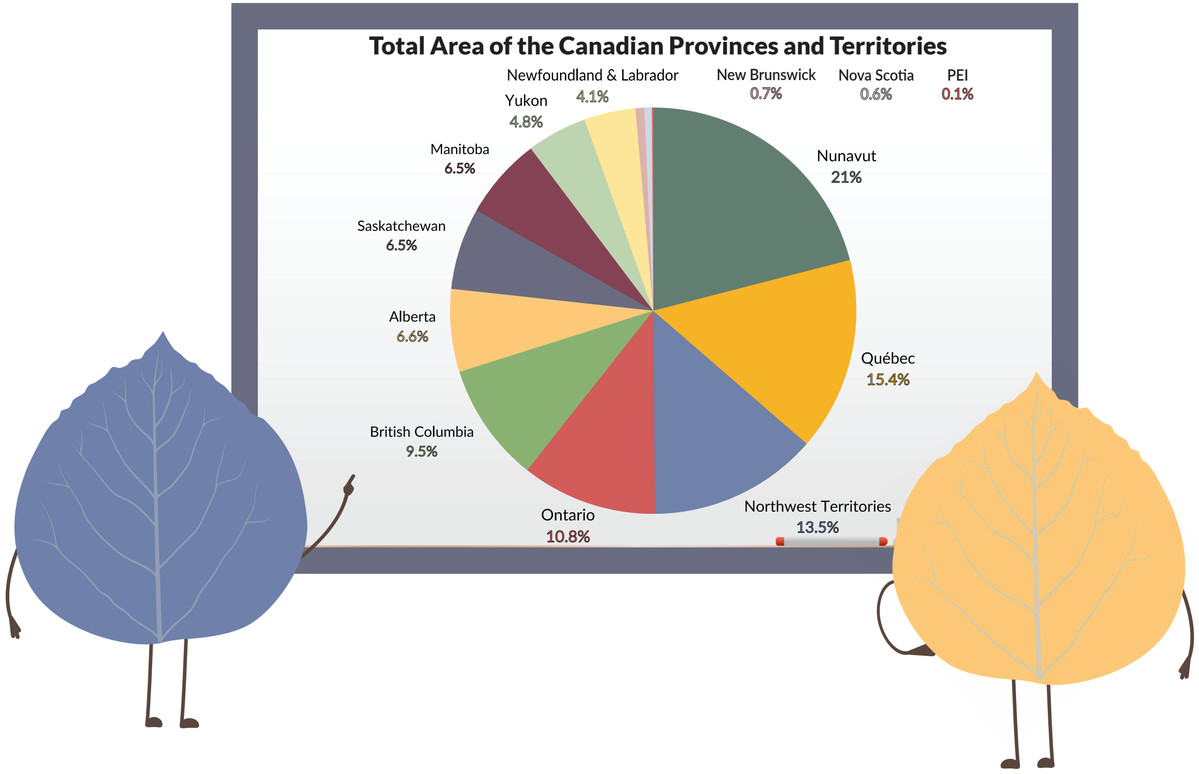
EXAMINE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To carefully and in detail consider the nature and characteristics of something to find out more about it.



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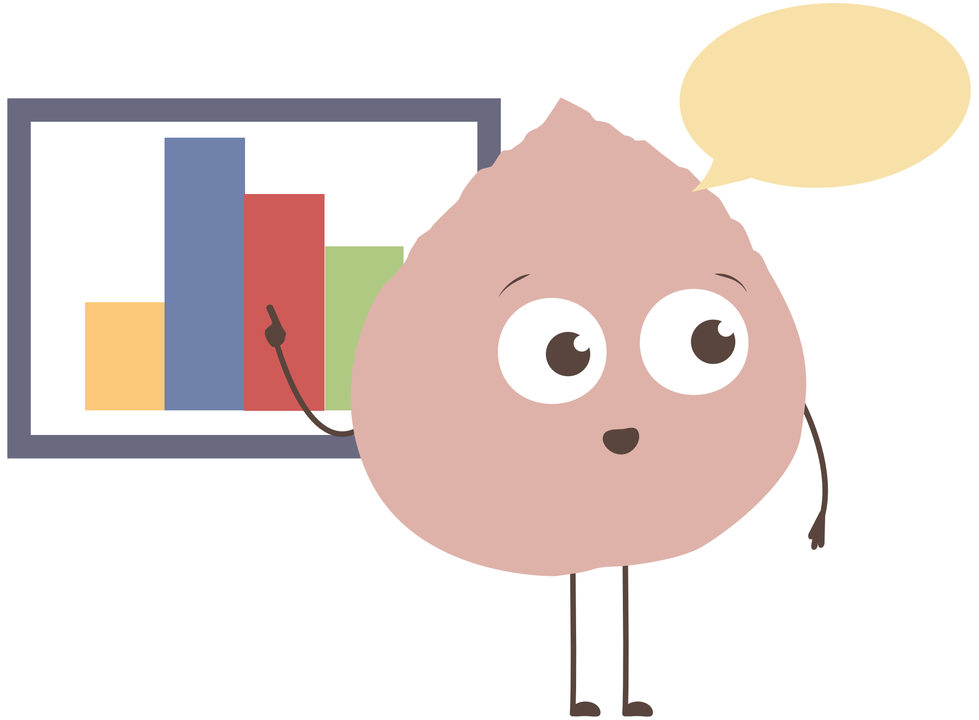
EXPLAIN

Student Action Verbs

4 - 6

Alberta Math Curriculum

To describe the how or why of something; give the cause or reason for.



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EXPRESS

Student Action Verbs

4 - 6

Alberta Math Curriculum

To convey knowledge and understanding.

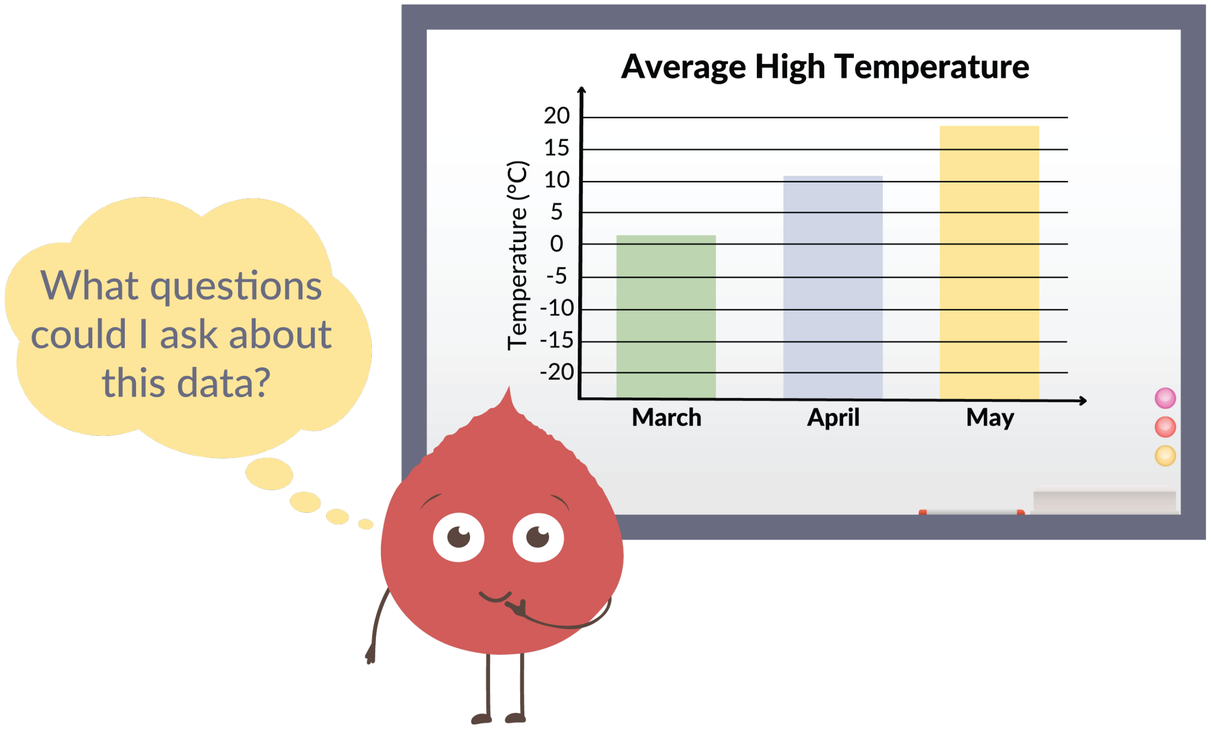
FORMULATE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To develop possibilities, after considering facts and details appropriate to the given context.



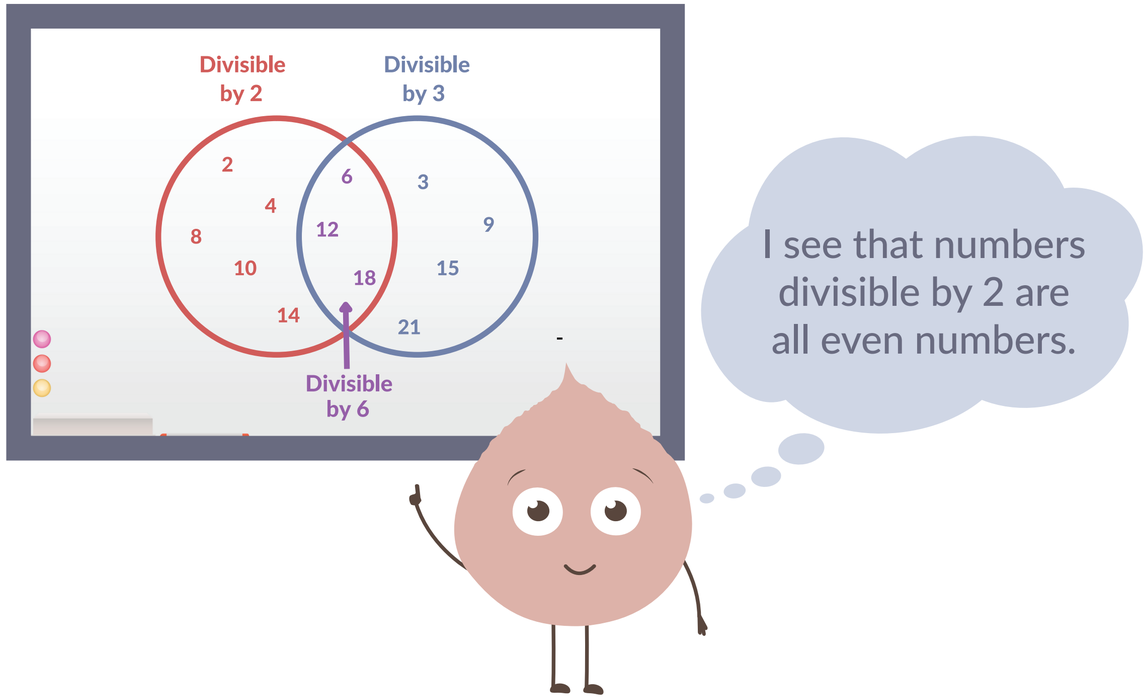
GENERALIZE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To become aware of a pattern, relationship, or rule and recognize that it can be applied to a similar context or situation.



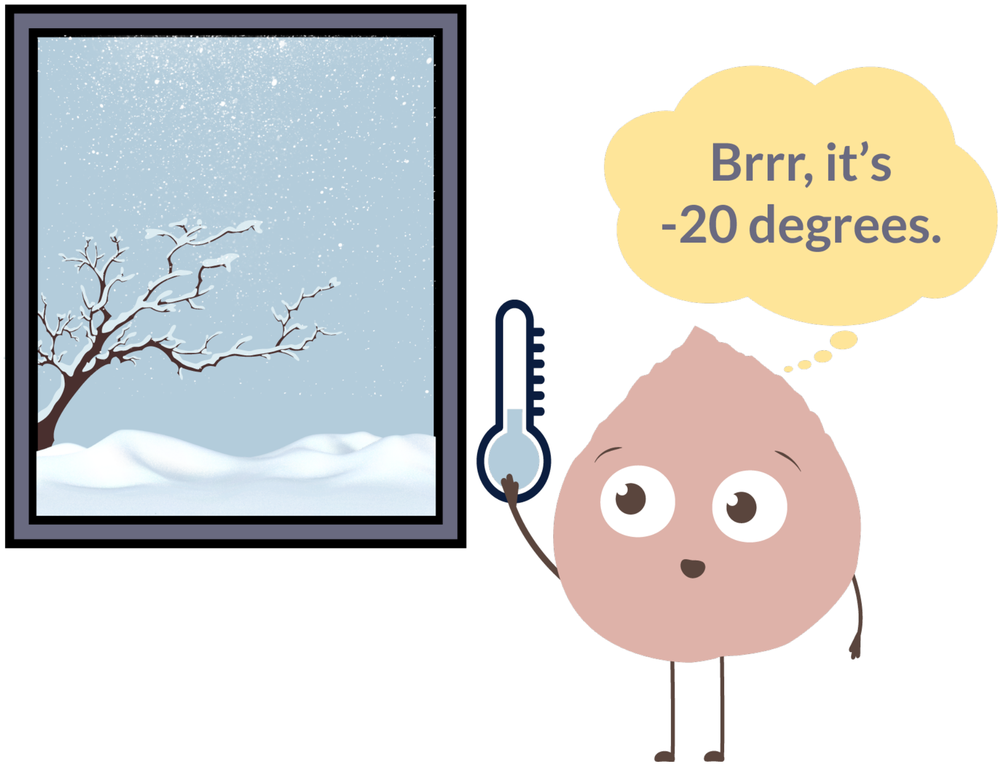
IDENTIFY

Student Action Verbs

4 - 6

Alberta Math Curriculum

To recognize by naming and/ or indicating.



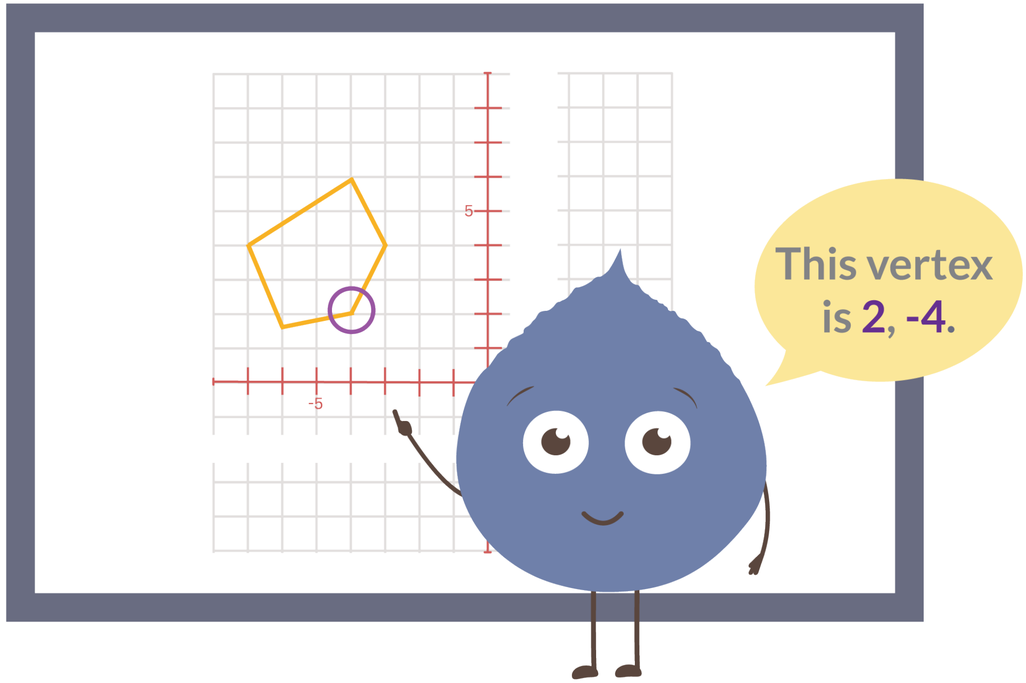
INDICATE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To recognize by identifying .



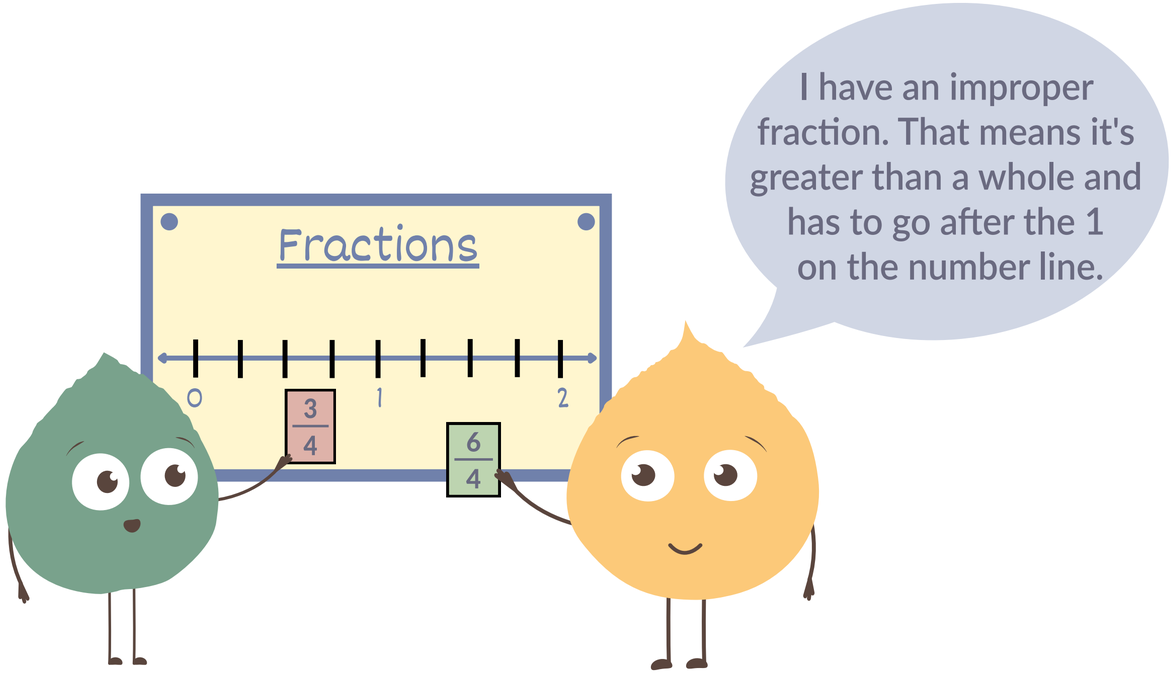
INTERPRET

Student Action Verbs

4 - 6

Alberta Math Curriculum

To use reasoning and knowledge to make sense of, and draw meaning from, a text, set of data, visual graph, etc.



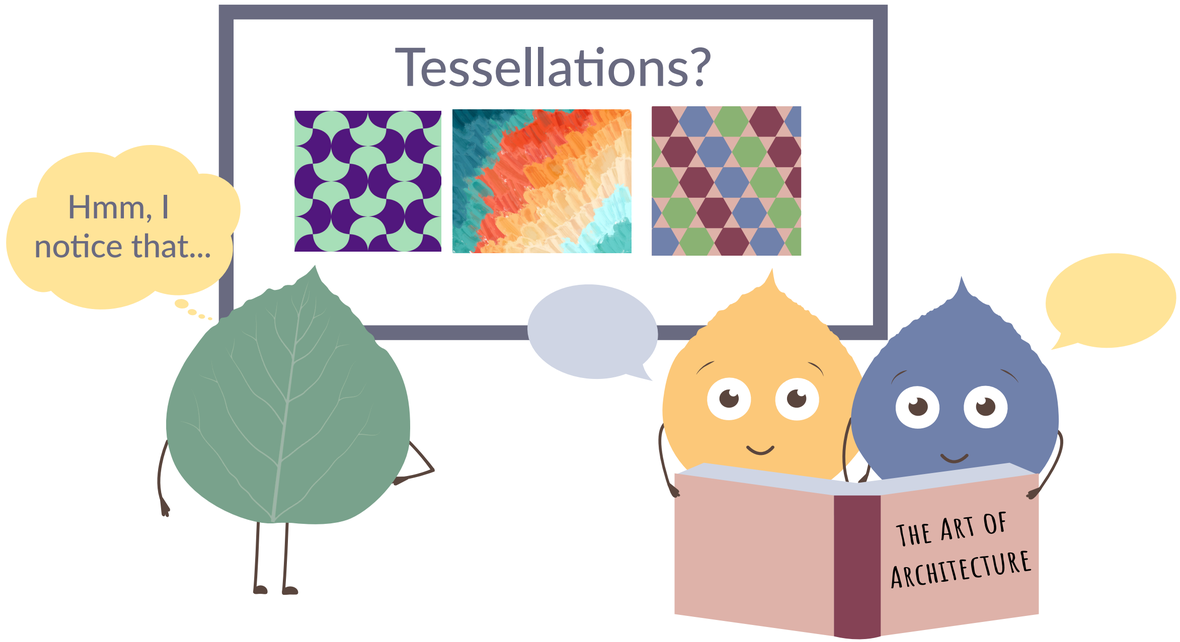
INVESTIGATE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To use a process of inquiry or exploration to gain a deeper understanding of a concept.



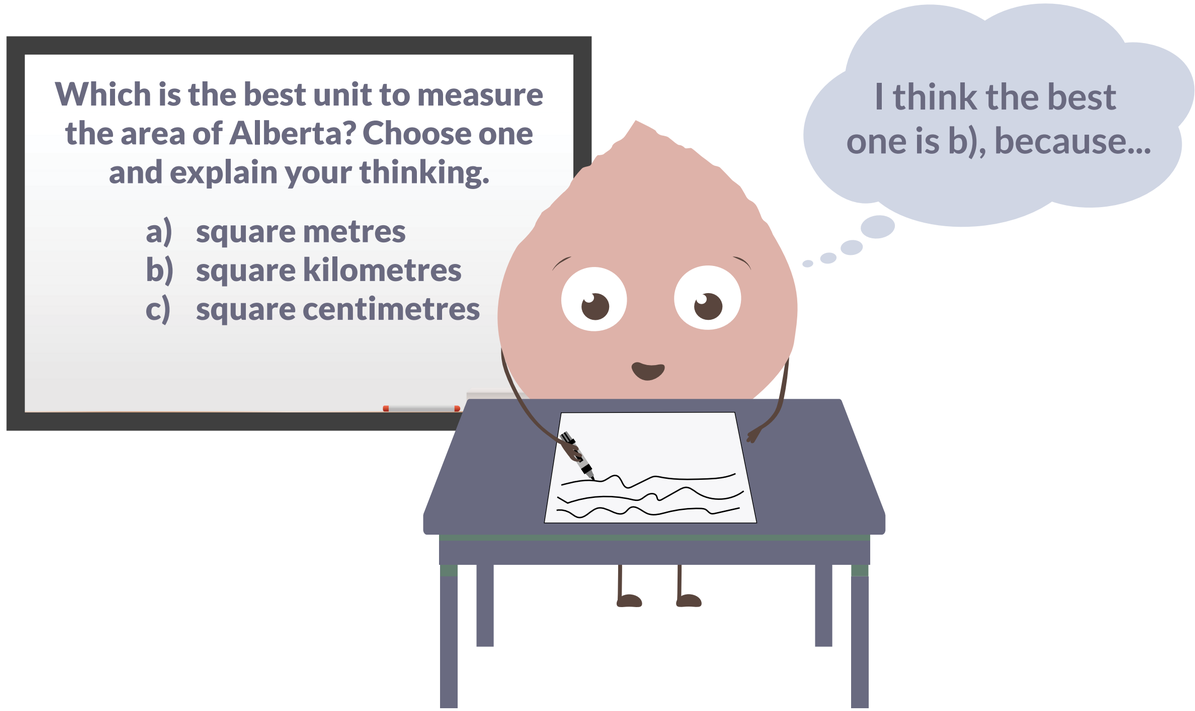
JUSTIFY

Student Action Verbs

4 - 6

Alberta Math Curriculum

To use relevant reasons and evidence to indicate why a conclusion has been made.



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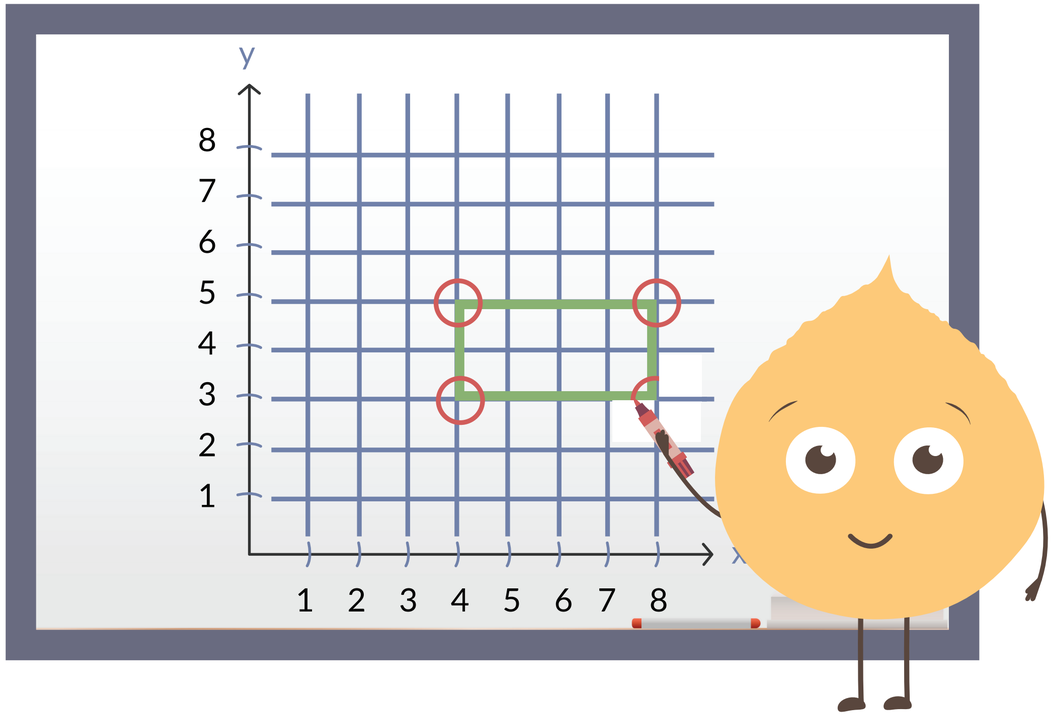
LOCATE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To indicate a specifc place or position.



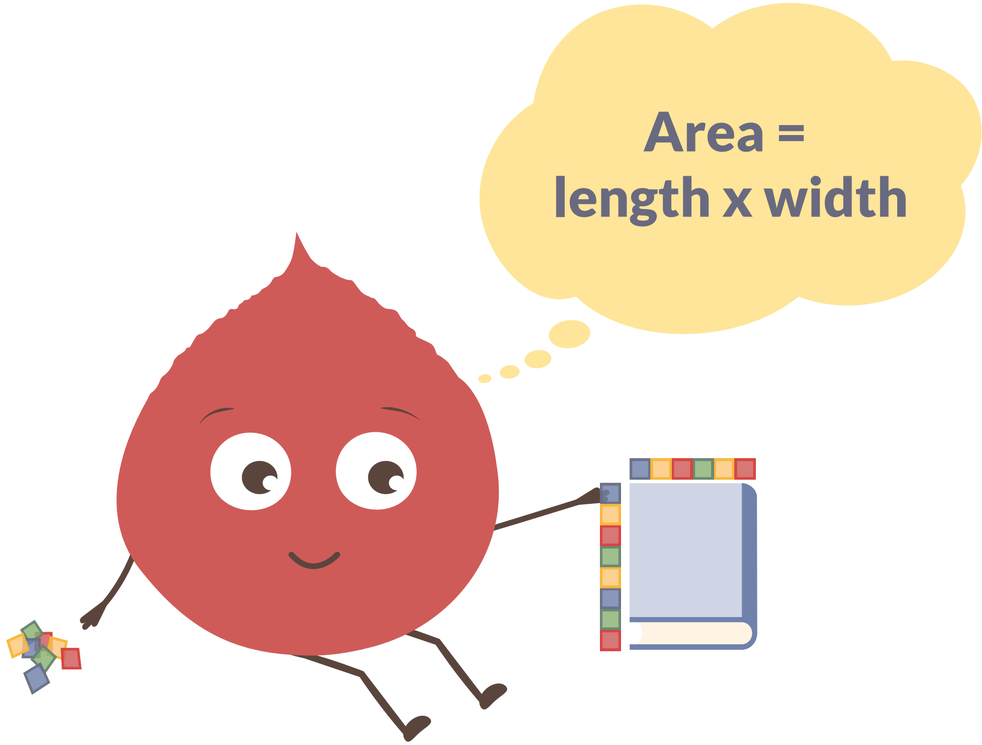
MEASURE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To determine the size, amount, or degree of something, using standard or non-standard units.



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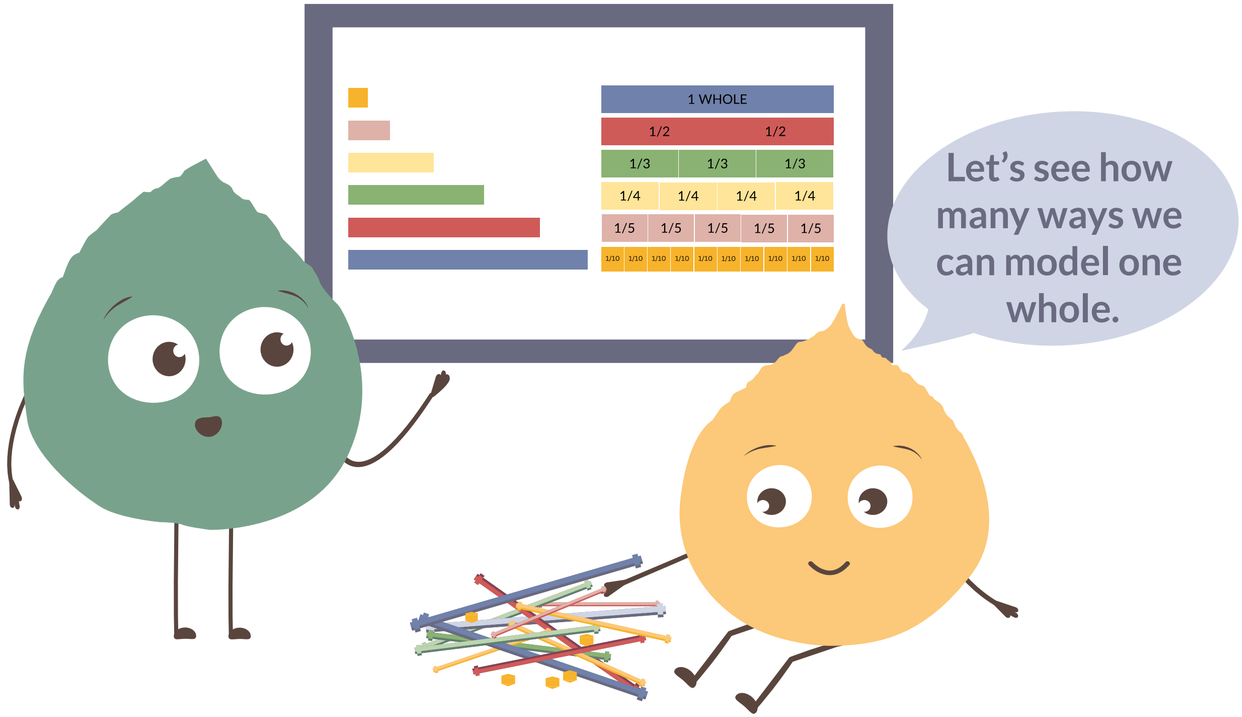
MODEL

Student Action Verbs

4 - 6

Alberta Math Curriculum

To represent a concept or situation in a concrete, pictorial, or symbolic way.



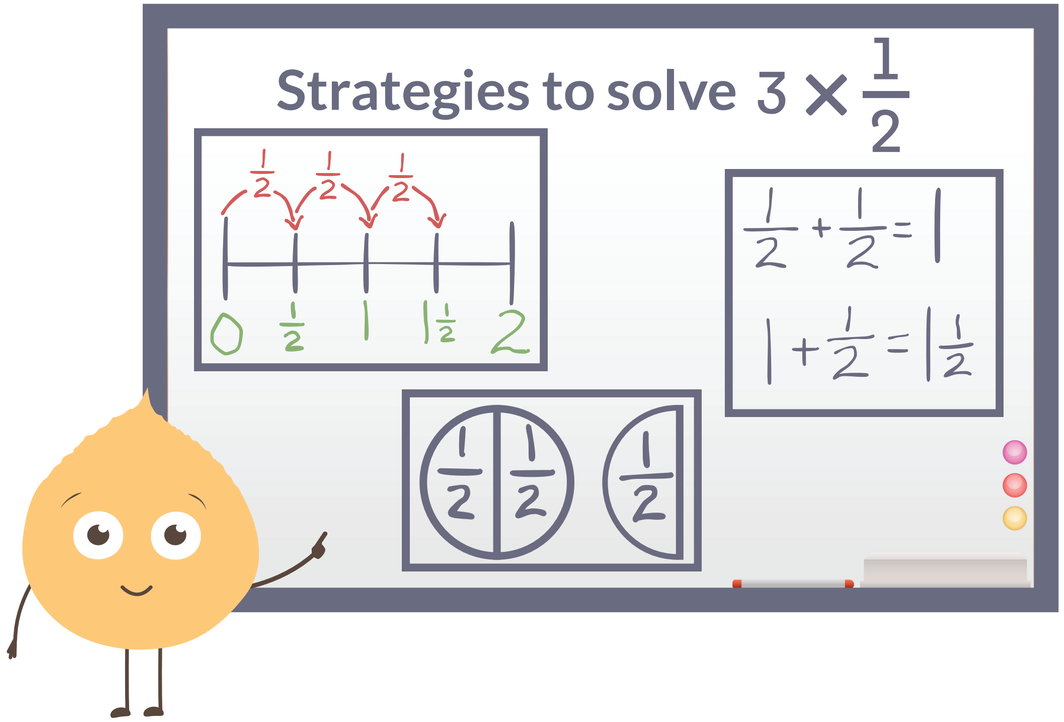
MULTIPLY

Student Action Verbs

4 - 6

Alberta Math Curriculum

To combine groups of equal size to determine the product.



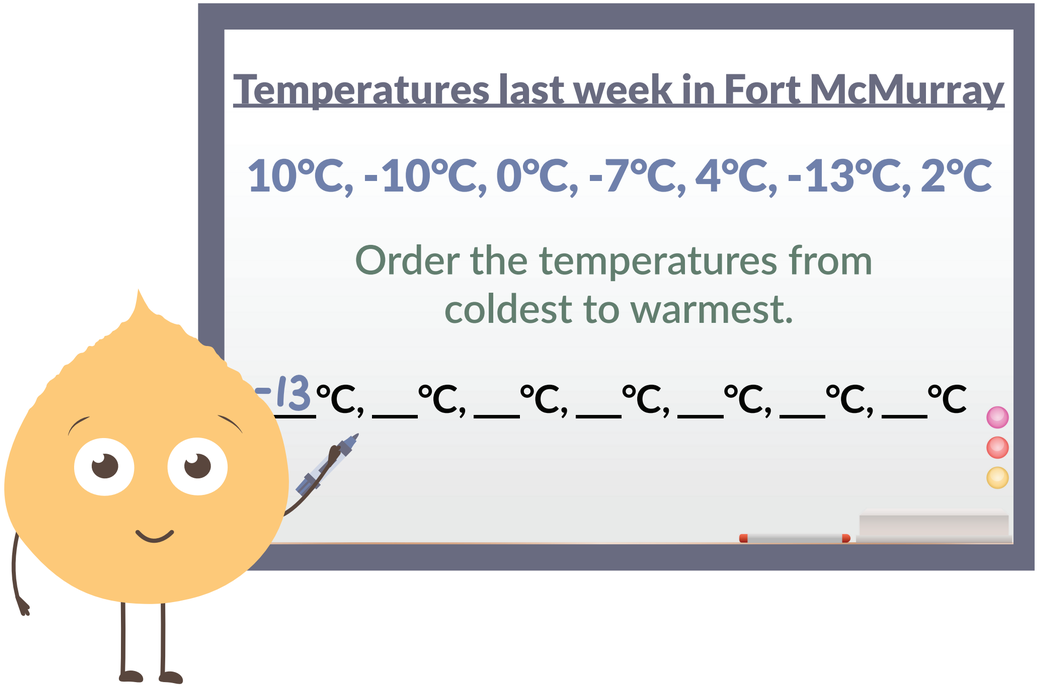
ORDER

Student Action Verbs

4 - 6

Alberta Math Curriculum

To arrange in a sequence.



ORGANIZE

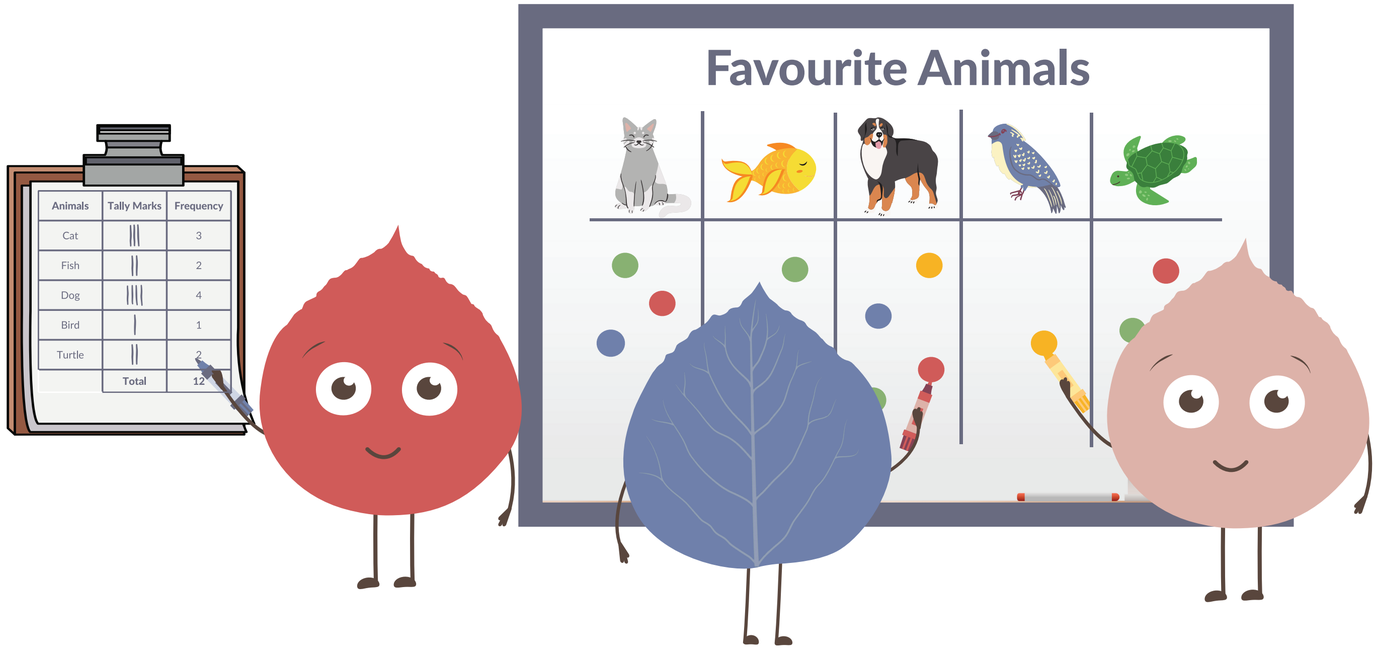
Student Action Verbs

4 - 6

Alberta Math Curriculum

To arrange (data, information, objects, etc..).

NOTE: in other subject areas the examples may be different.



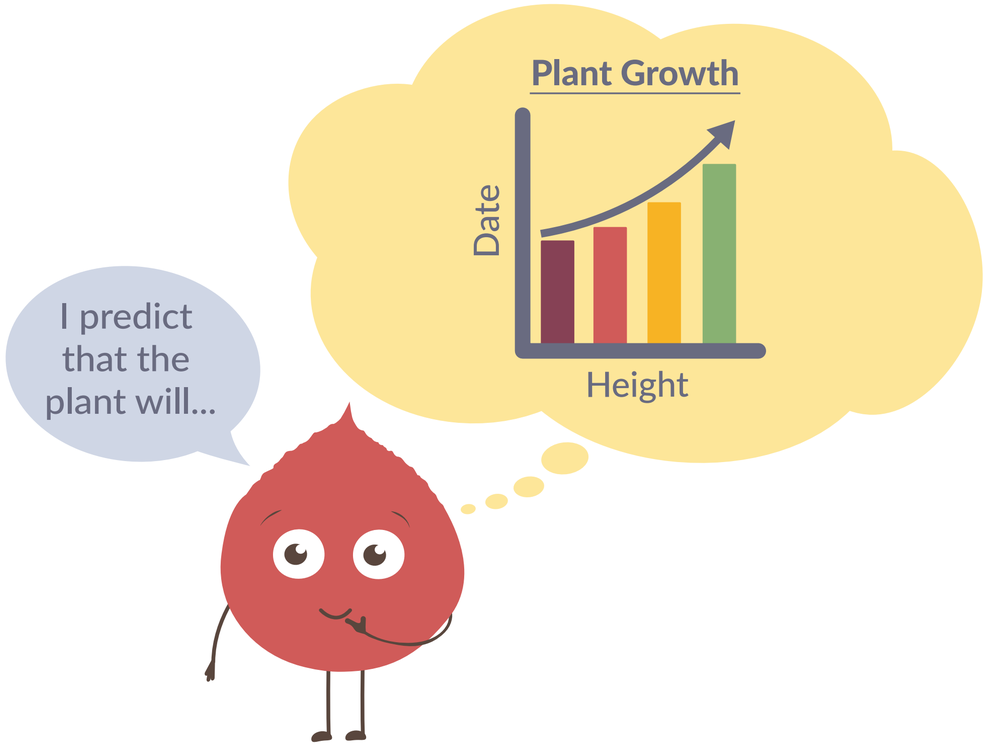
PREDICT

Student Action Verbs

4 - 6

Alberta Math Curriculum

To form a likely answer using inference that is based on current understanding.



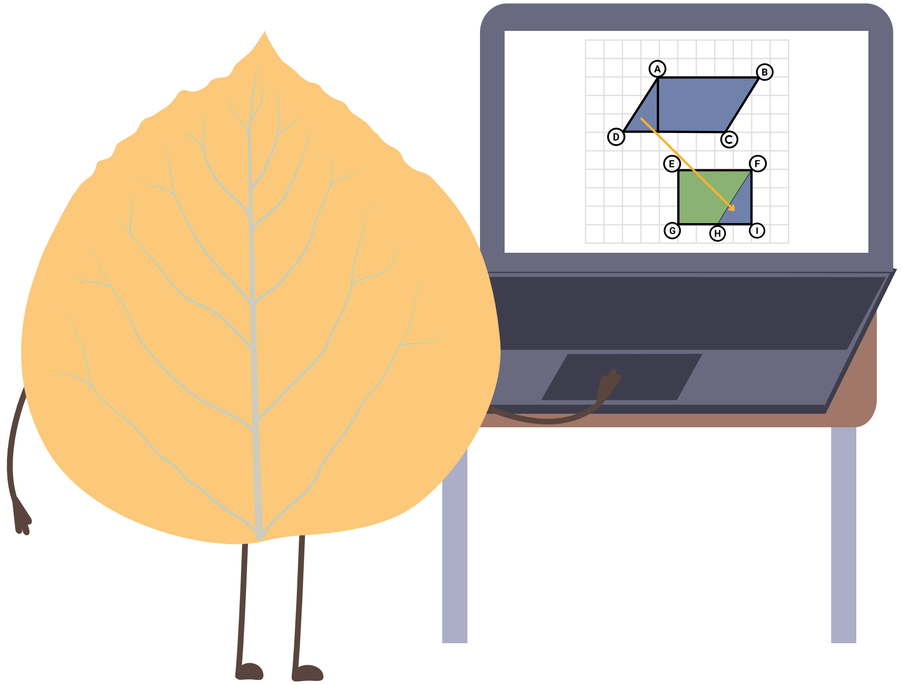
REARANGE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To change the order, arrangement or position of something.



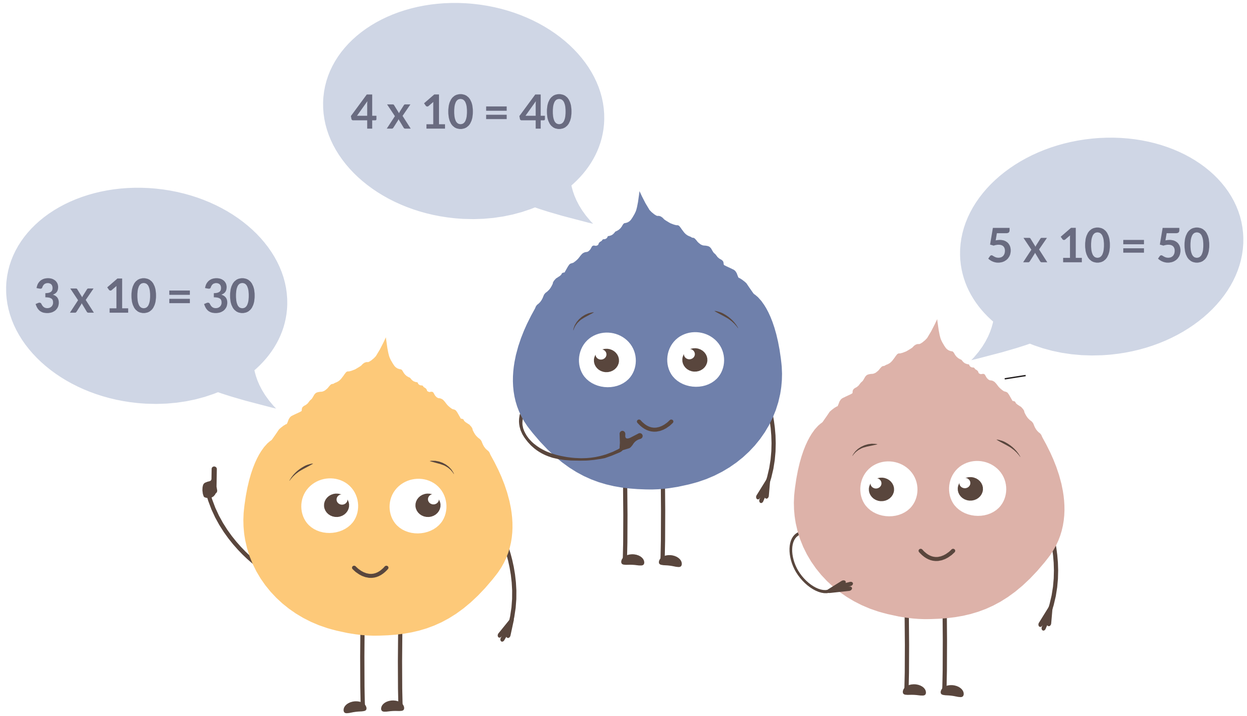
RECALL

Student Action Verbs

4 - 6

Alberta Math Curriculum

To remember or retrieve from one's mind.



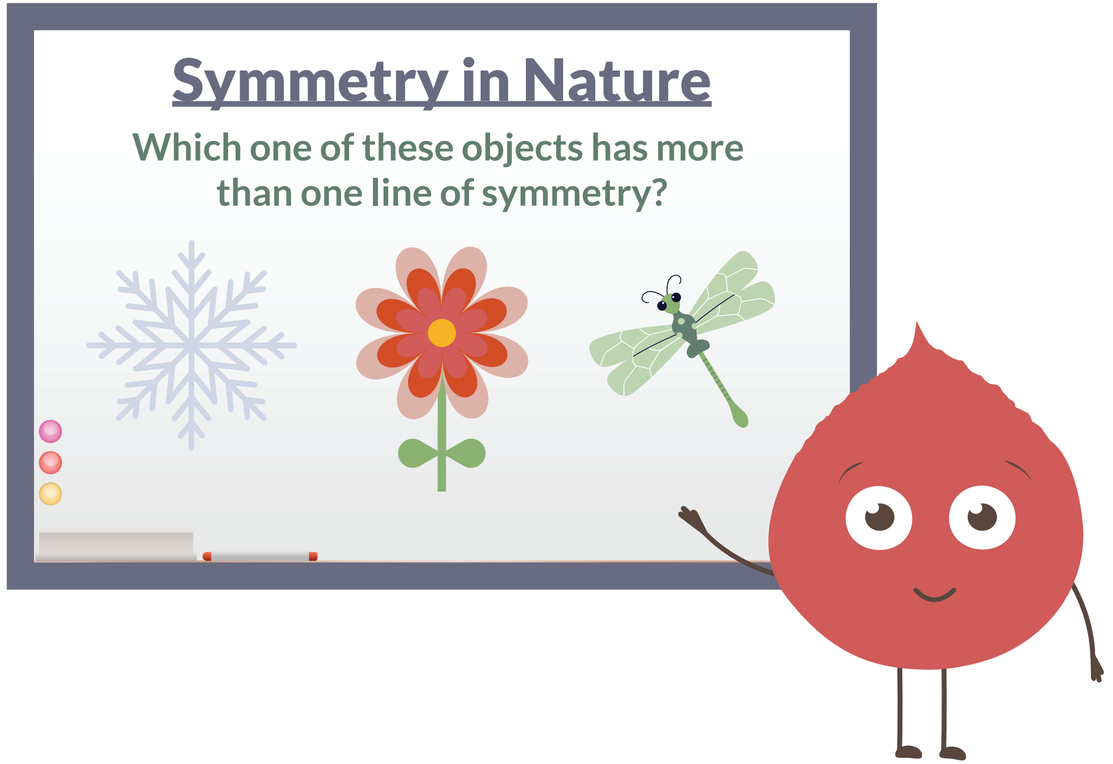
RECOGNIZE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To be aware of, and acknowledge, features of information.



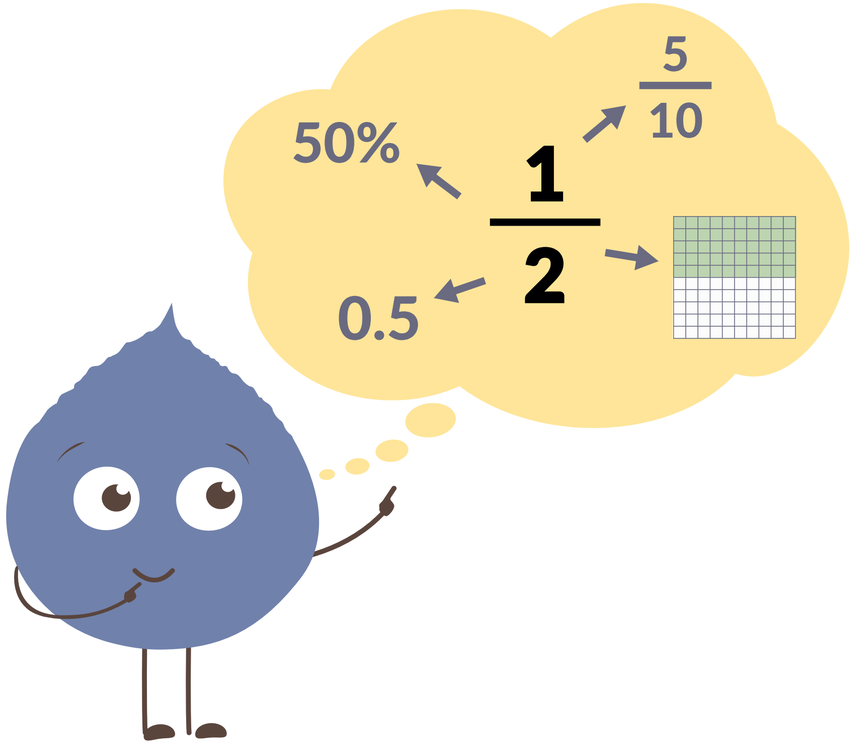
RELATE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To make a connection between two or more things.



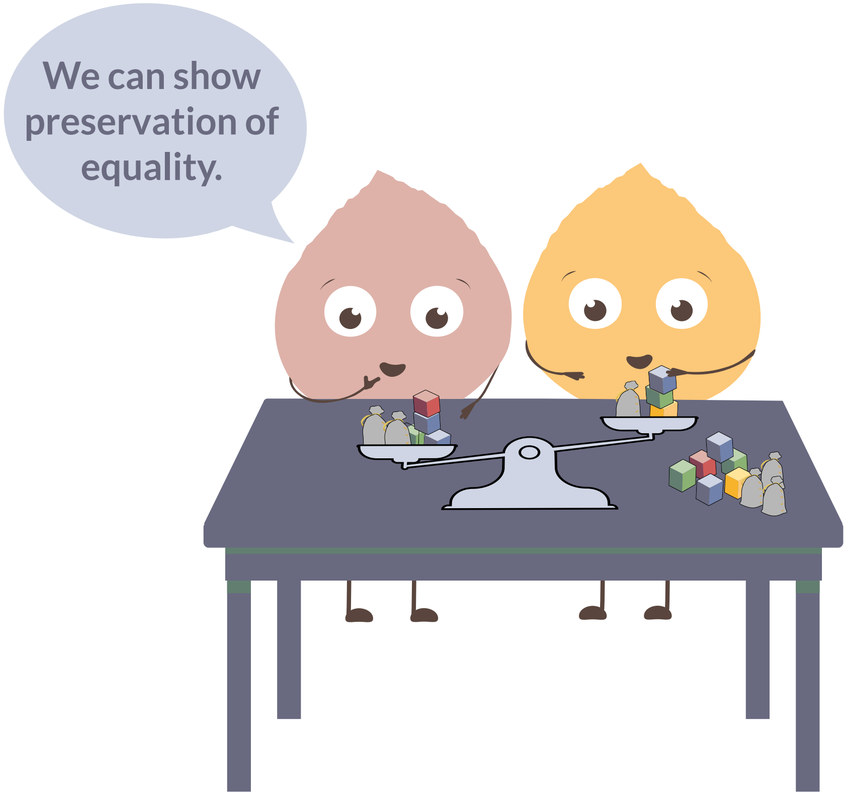
REPRESENT

Student Action Verbs

4 - 6

Alberta Math Curriculum

To convey understanding through pictures, diagrams, models, manipulatives, symbols, words, etc.



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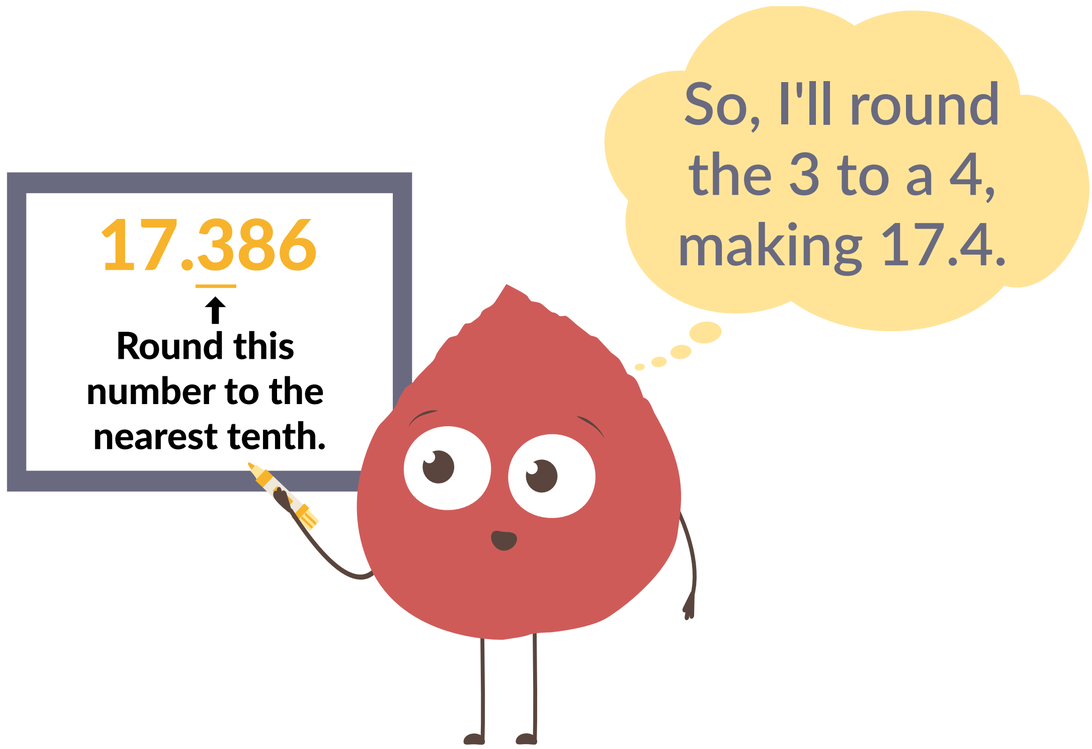
ROUND

Student Action Verbs

4 - 6

Alberta Math Curriculum

To make a number simpler while keeping its value close to what it was.



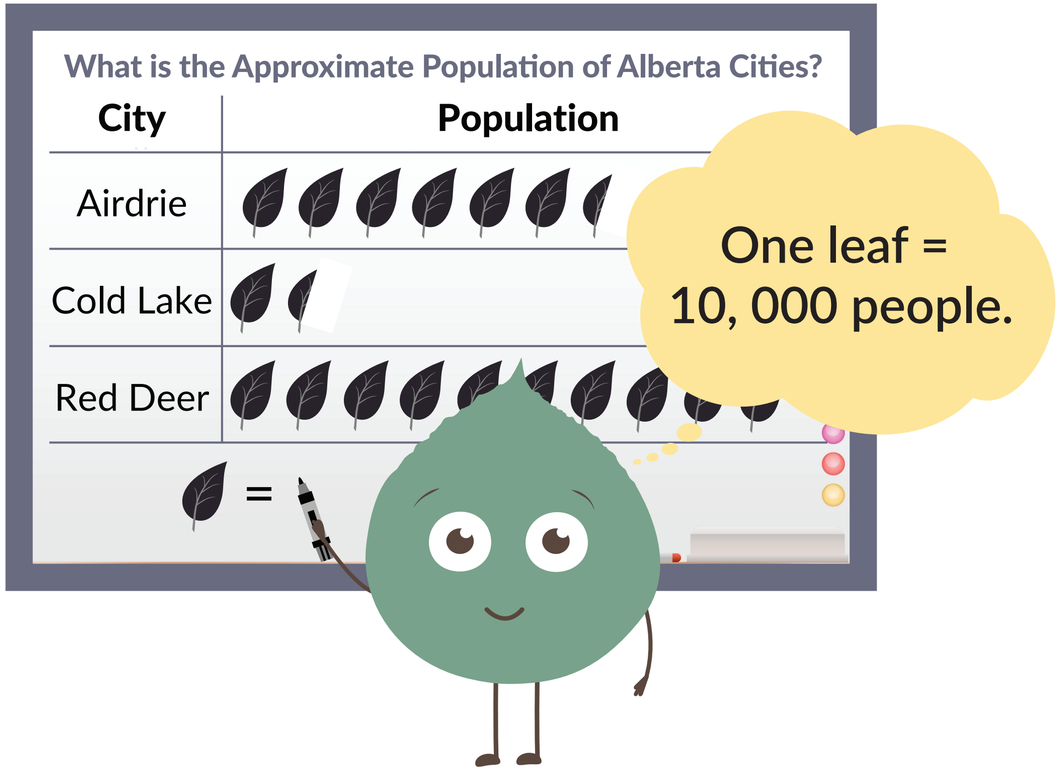
SELECT

Student Action Verbs

4 - 6

Alberta Math Curriculum

To choose after consideration.



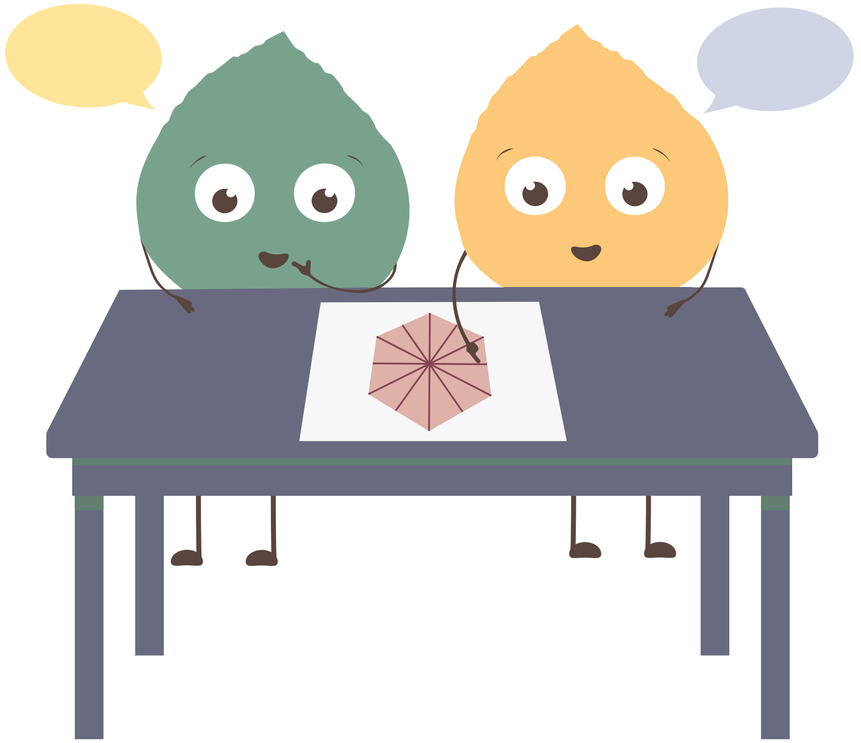
SHOW

Student Action Verbs

4 - 6

Alberta Math Curriculum

To make visible through actions, words, representations, symbols, etc.



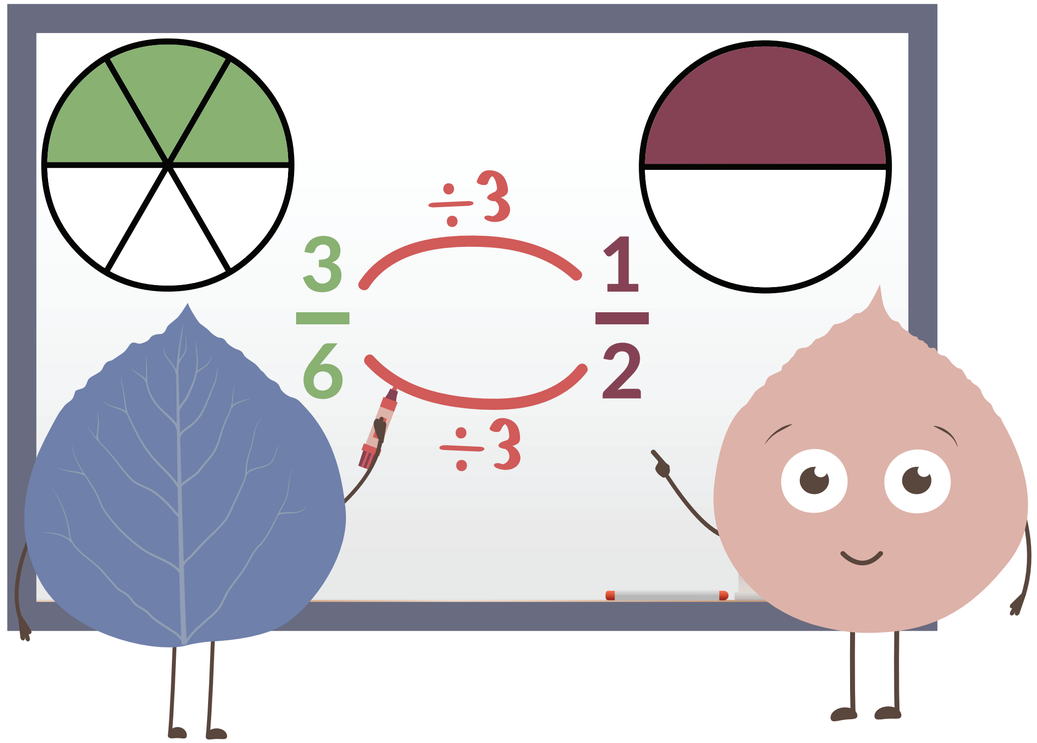
SIMPLIFY

Student Action Verbs

4 - 6

Alberta Math Curriculum

To reduce to a simpler or easier to use form or expression



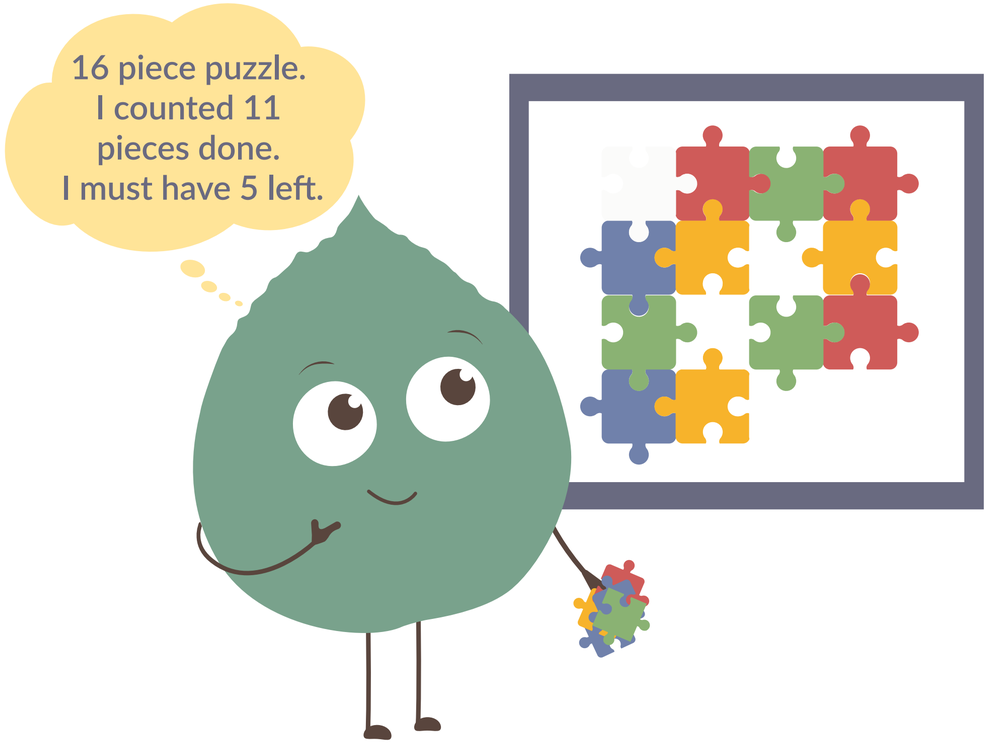
SOLVE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To find a solution or an answer.



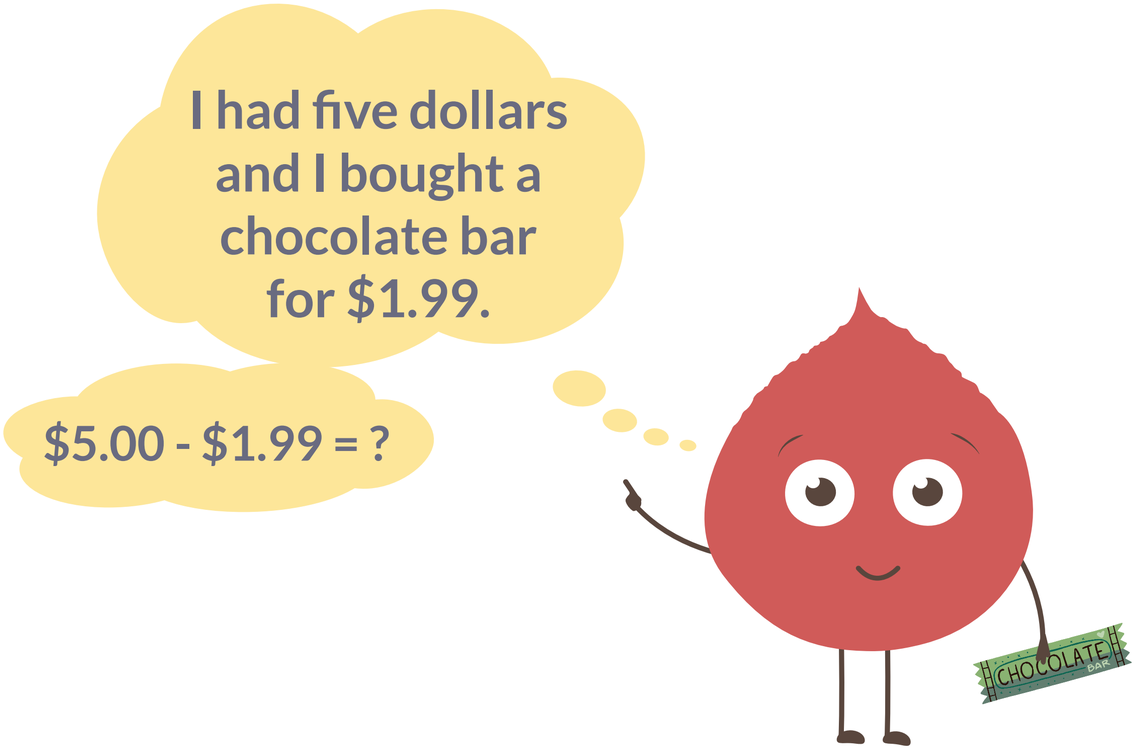
SUBTRACT

Student Action Verbs

4 - 6

Alberta Math Curriculum

To find the difference between two numbers or quantities.



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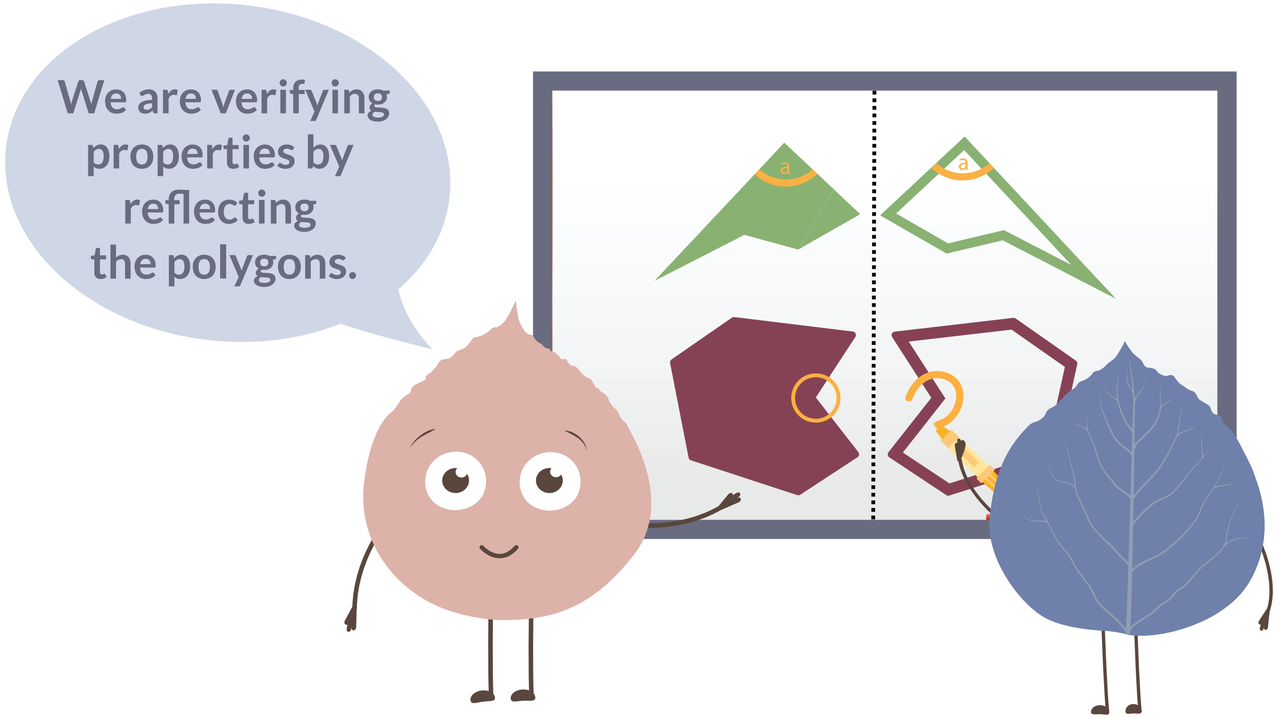
VERIFY

Student Action Verbs

4 - 6

Alberta Math Curriculum

To confirm the answer or solution.



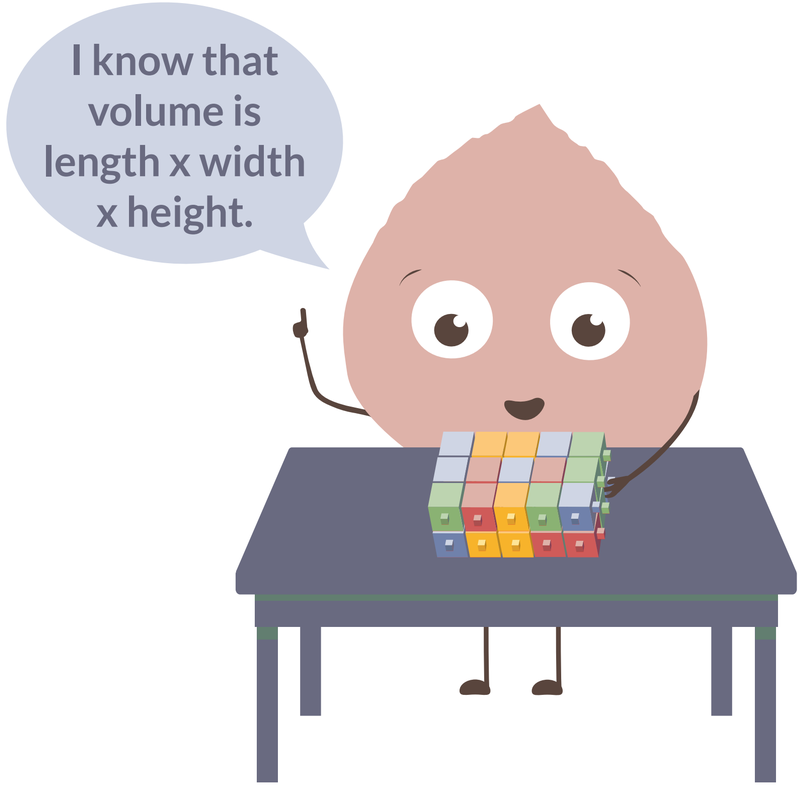
VISUALIZE

Student Action Verbs

4 - 6

Alberta Math Curriculum

To make one's thoughts, ideas, and images visible to oneself or others.



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WRITE

Student Action Verbs

4 - 6

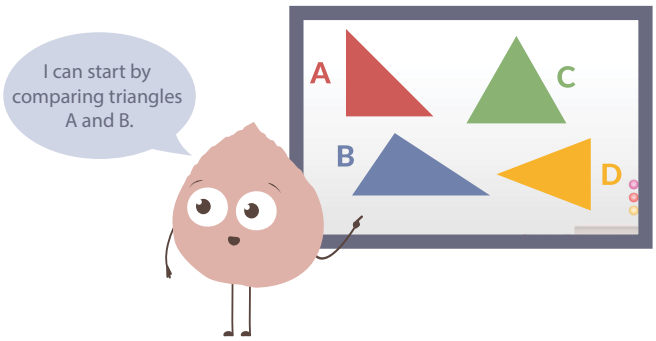
Alberta Math Curriculum

To record using writing (words, symbols, etc.).

ANALYZE

4 - 6

To consider in detail in order to find meaning and determine relationships, patterns, similarities, differences, etc.



Analyzing requires students to find meaning within information given through text, numerical data, images and other auditory or visual stimuli. It involves pulling ideas and objects apart, looking closely at the elements or features and then reorganizing the ideas by similarities and differences, patterns and relationships. Additionally, ***analyzing*** trends over time provides students with opportunities to find patterns and relationships that can be used to draw conclusions.

The table below shows where analyze is included as student action within Alberta's 4-6 Math curriculum.

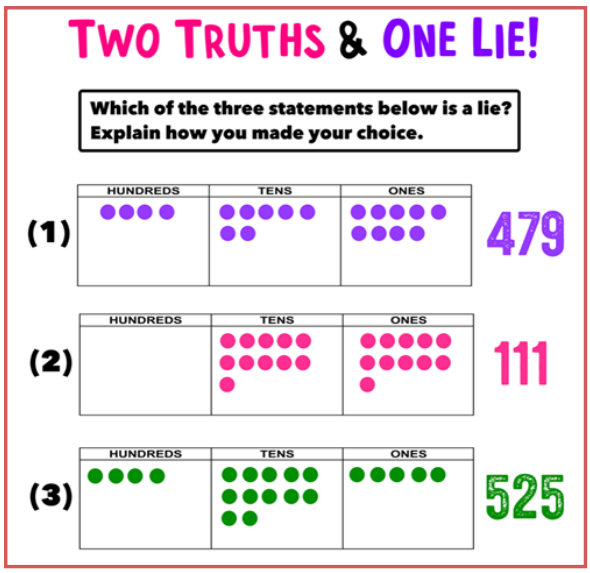
Grade Level	Learning Outcomes	Skills & Procedures
Grade 4	Students **analyze** and explain geometric properties.	
Grade 5	Students **analyze** patterns in place value. Students **analyze** frequency in categorical data.	
Grade 6	Students **analyze** numbers using prime factorization and exponentiation. Students **analyze** shapes through symmetry and congruence. Students **analyze** areas of parallelograms and triangles.	**Analyze** relative frequency statistics from experiments with different sample sizes.

To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

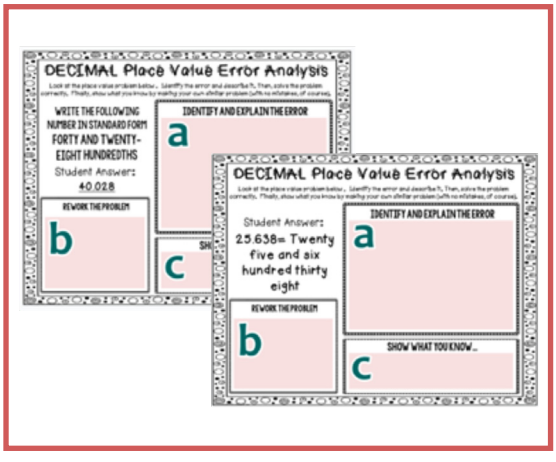
Illustrative Examples

Learning Outcome 5N1: Students *analyze* patterns in place value.

1. This "Two Truths & One Lie" task may seem simple but requires the student to analyze and give careful thought to the amounts indicated by dots of colour in the chart. This can be a whole class math talk or partner warm-up activity where students **analyze** the relationship between the amounts in each place on the table and consider when to incorporate regrouping. This task is from MashupMath.



2. Decimal Place Value Error Analysis



This error analysis task requires students to **analyze** the response given to a decimal place value question. This task is complex; as part of the **analyzing** process, they must determine and correct the error, as well as create their own similar problem. The examples shown here are from a resource created by Teaching with a Mountain View. These could be posted online as slides for students to work within or questions could be shared on the board, and students use math journals to complete each of the sections.

   a. Identify and explain the error.
   b. Solve the problem correctly, and
   c. Make your own similar problem (which will be shared later with a classmate), and answer it.

To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

Illustrative Examples

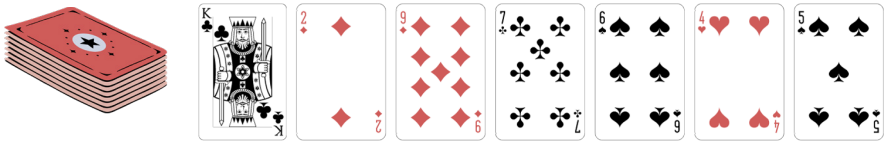
3. Play " Who's Got the Highest?"

   This game, and the follow-up questions, allows students to practice analyzing the value of digits in a given number. It is versatile, easy to differentiate and can be played with the whole class, in partners or in small groups.

   Materials : A deck of cards per 2 students. The 10's and face cards can be removed entirely or keep certain ones, such as the Ks or Qs, to represent zeros.

   Directions: In their Math journal, students draw a specific set of lines, depending on which place values you want students to focus on for that lesson. (In the example below, you will note students are practicing with a 7-digit number, including decimals to the thousandths.)

   Partners alternate selecting one card at a time. Each student can decide where they want to write that digit. Their goal is to make the largest number possible. Once the number is written, it cannot be moved.



Student C.

7 2 0 9 . 4 6 5

Student P.

9 7 5 4 . 0 6 2

When all the cards are drawn, each student uses their own 7-digit number to answer questions in their journal:

- Which is the value of the digit with the least value?
- Which is the value of the digit with the greatest value?
- What is the value of the digit in the tenths place?
- Which digit is in the place 10 times the value of the hundreds place? etc…
- What would your number be if you rounded to the nearest thousandth or tenth? etc

Variations:

a. Once all the cards have been drawn, students may exchange any two digits to the right of the decimal to make their original number larger.

b. Have the students create the smallest number with the cards drawn.

c. Have students share their numbers with another group.

   - Estimate the difference between the largest and smallest numbers in their groups to the nearest _____ (whatever place the teacher says.)
   - Order the numbers from smallest to largest.
   - Round to the nearest hundredth, etc.

To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

Additional Resources

What is Place Value?

Manitoba Education Math Support pages 3 -14

Explanation of a Math project called "PlaceValue Detective" with activities specifically related to analyzing

Teaching with a Mountain View (Note that the resources on this site are only intended as examples of the type of questions to ask or tasks types; they are from the US and do not all align with Alberta curriculum.)

References

Manitoba Education. (n.d.). Grade 6 Mathematics Support Document for Teachers. http://www.edu.gov.mb.ca/k12/cur/math/support_gr6/full_doc.pdf

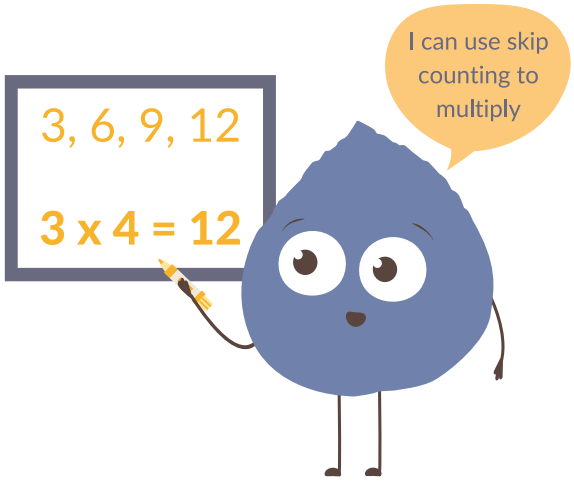
Mashup Math. (n.d.). Free Math Puzzles. Mashup Math. https://www.mashupmath.com/freemathpuzzles

Montero, M. (n.d.). Decimal Place Value Resources & Teaching Ideas. Teaching with a Mountain View. https://teachingwithamountainview.com/decimal-place-value-resources-teaching/

APPLY

4 - 6

To use (mathematical knowledge).



Applying requires that students use a fact, procedure, rule or strategy to answer a math question. When ***applying*** knowledge and understanding, it often helps students to recall previous experiences in which a method, strategy or procedure was useful. For example, a student who has learned how to skip count, may ***apply*** that strategy to solve a multiplication problem.

The table below shows where apply is included as student action within Alberta's 4-6 Math curriculum.

Grade Level	Learning Outcomes	Skills & Procedures
Grade 4	Students **apply** place value to decimal numbers. Students **apply** equivalence to the interpretation of fractions. Students represent and **apply** equality in multiple ways.	Recall and **apply** multiplication number facts, with factors to 12, and related division number facts. **Apply** preservation of equality to determine the unknown value in an equation, limited to equations with one operation. **Apply** addition and subtraction strategies to the calculation of duration.
Grade 5		**Apply** inverse operations to solve an equation, limited to equations with one or two operations.
Grade 6	Students **apply** standard algorithms to multiplication and division of decimal and natural numbers. Students **apply** equivalence to the interpretation of ratios and rates.	

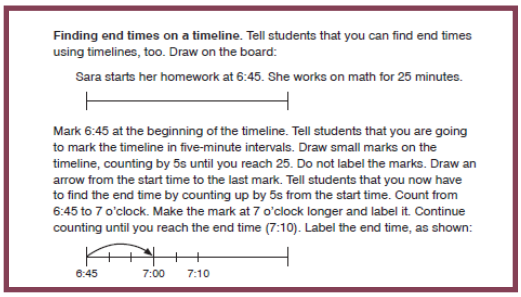
To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

Illustrative Examples

Skills and Procedures (4T1): ***Apply*** addition and subtraction strategies to the calculation of duration.

From JumpMath (ME4-26 Time Intervals).

Students are led through a series of lessons to develop the skill of **applying** a strategy using duration to calculate end time. In this example, the teacher shows skip counting on a timeline with 5 minute intervals.



Finding end times on a timeline. Tell students that you can find end times using timelines, too. Draw on the board:

Sara starts her homework at 6:45. She works on math for 25 minutes.

Mark 6:45 at the beginning of the timeline. Tell students that you are going to mark the timeline in five-minute intervals. Draw small marks on the timeline, counting by 5s until you reach 25. Do not label the marks. Draw an arrow from the start time to the last mark. Tell students that you now have to find the end time by counting up by 5s from the start time. Count from 6:45 to 7 o'clock. Make the mark at 7 o'clock longer and label it. Continue counting until you reach the end time (7:10). Label the end time, as shown:

6:45 7:00 7:10

This is an example of one of the extensions:

In a triathlon, competitors run, bike, and swim in a race. Here are the times for the top three competitors in hours, minutes, and seconds.

Competitor	Swim	Bike	Run
A	00:39:37	01:12:17	57:57
B	00:45:15	01:01:08	42:53
C	00:28:19	01:15:12	49:38

a) Who won the triathalon?

b) By how much did the winner beat the other two competitors?

Skills and Procedures (5A1.3): ***Apply*** inverse operations to solve an equation, limited to equations with one or two operations.

1. Play Secret Number.

   This is a game for two players using a simple calculator which allows students to **apply** inverse operations to solve a simple algebra equation.

   Here's an example:

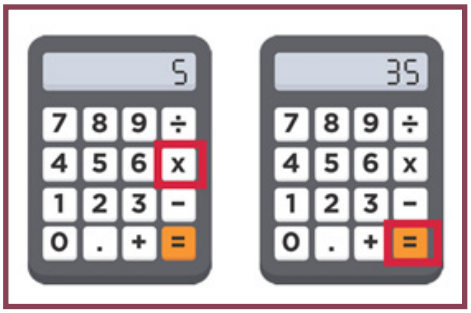
   Simran puts in a secret number without showing Boris and asks him, "What do you want to multiply it by?"

   Boris replies, "Multiply by 5."

   Simran puts in X 5, and hands the calculator to Boris.

   When Boris presses the = button, the calculator shows 35.

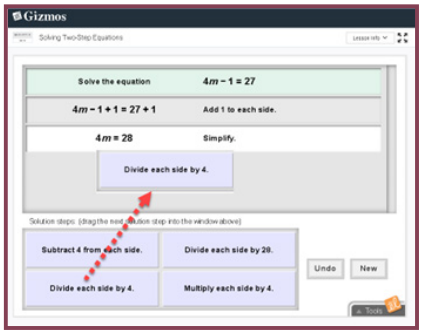
   Boris now has to figure out Simran's secret number.



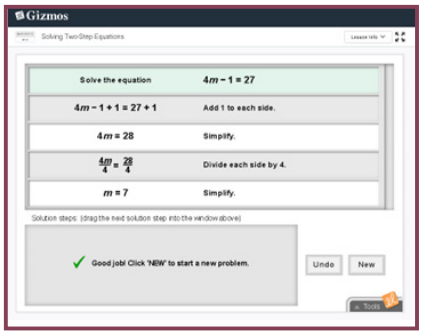
To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

Illustrative Examples

2. Students access Gizmos Solving Two-Step Equations through NewLearnAlberta. In this lesson, students are given an equation and are guided through a series of steps. For each step they need to **apply** their understanding as they select an operation to find the value that makes the equation true.



Example of Step 2.
(the student drags their choice to the upper box)



Example of Solution

Additional Resources

Jump Math - Slides for Elapsed Time
Elapsed Time online activity
Practice Clocks for adding time
Explanation of 'How to use inverse operations'
Gizmos PDF: Solving Two-Step Equations
Secret Number Game
Decimal Place Value Resources & Teaching Ideas. Teaching with a Mountain View.

References

Explore Learning LLC. (2022). *Solving Two-Step Equations.* Gizmos Interactive.
https://curriculum.learnalberta.ca/resources/permalink/3rMXmI8nEU6JqQ9RENhpPAr%20Resources/JUMP%20Math%204/JM4%20U13%20Measurement-Time.pdf

JUMP Math. (2021). *Unit 13: Measurement: Time Teacher Resource.* (pp 119-121). new LearnAlberta.
https://curriculum.learnalberta.ca/cdn/resources/jumpmath/Math%20Teacher%20Resources/JUMP%20Math%204/JM4%20U13%20Measurement-Time.pdf

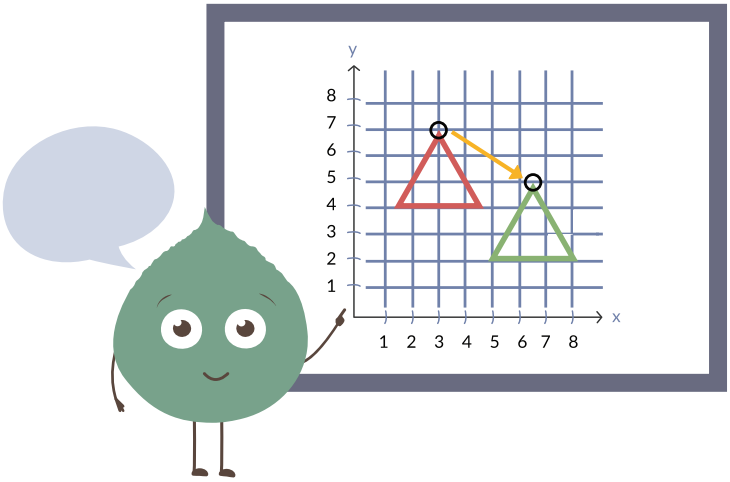
Montero, M. (n.d.). *Decimal Place Value Resources & Teaching Ideas.* Teaching with a Mountain View.
https://teachingwithamountainview.com/decimal-place-value-resources-teaching/

NRICH Maths. (n.d.). *Secret Number*. NRich Maths. Cambridge University, UK
https://nrich.maths.org/content/id/5651/Secret%20Number%20printable%20sheet.pdf

DESCRIBE

4 - 6

To communicate (orally or in writing) qualities, attributes, details and/or features of something.



Describing indicates that students are engaged in a process. They determine relevant details, facts, attributes, ideas, etc. and then share the information in a way that is understandable to the 'audience' (e.g. a classmate.) Depending on the context or complexity of what is being described, students may need to order this information or put it in sequence.

The table below shows where **describe** is included as student action within Alberta's 4-6 Math curriculum.

Grade Level	Learning Outcomes	Skills & Procedures
Grade 4		**Describe** a number as prime or composite. **Describe** triangles according to side length. **Describe** an angle as acute, right, obtuse, or straight. **Describe** the initial term and the constant change in an arithmetic sequence. **Describe** the initial term and the constant change in a geometric sequence. **Describe** the effect of scale on representation.

DESCRIBE

4 - 6

To communicate (orally or in writing) qualities, attributes, details and/or features of something.

Grade Level	Learning Outcomes	Skills & Procedures
Grade 5		**Describe** the order of rotation symmetry of a 2-D shape. **Describe** the location of a point on a coordinate grid using coordinates. **Describe** the location of a point on a coordinate grid in relation to the location of another point using positional language. **Describe** the location of the vertices of a polygon on a coordinate grid using coordinates. **Describe** the rectangle with the least perimeter for a given area. **Describe** the graph of an arithmetic sequence as a straight line. **Describe** a rule, limited to one operation, that expresses correspondence between positions and terms of an arithmetic sequence.
Grade 6		**Describe** the divisibility of numbers represented in various forms. **Describe** an equal-sharing situation using a fraction. **Describe** the symmetry between two shapes as reflection symmetry or rotation symmetry. Visualize and **describe** a combination of two transformations that relate symmetrical shapes. **Describe** the symmetry modelled in a tessellation. **Describe** symmetrical shapes as congruent. **Describe** the location of a point in the Cartesian plane using coordinates. **Describe** the location of the vertices of a polygon in the Cartesian plane using coordinates. **Describe** the horizontal and vertical components of a given translation. **Describe** the line of reflection of a given reflection. **Describe** the angle and direction of a given rotation. **Describe** the rule that determines the values of the dependent variable from values of the independent variable. **Describe** the likelihood of an outcome in an experiment using relative frequency.

To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

Illustrative Examples

Skills and Procedures (6G1.1) ***Describe*** the symmetry modelled in a tessellation.

Skills and Procedures (6G1.1) Visualize and ***describe*** a combination of two transformations that relate to symmetrical shapes.

Skills and Procedures (6G1.1) ***Describe*** the symmetry between two shapes as reflection symmetry or rotation symmetry.

1. Have students **describe** various types of symmetry while exploring pictures, books and sites, especially featuring Canadian Indigenous artwork such as painted drums, jewelry, beadwork, clothing, paintings, etc. A few sites are included in the resources section below with an *.
   (Note: Please vet all online sources before providing the link to students.)
   The description should express more than just the type of symmetry found, but *how* they know. For example, include details about the art that demonstrate the symmetry: colours, tessellation arrangements, points of congruency, etc.

Figure 1. Butterflies #2, Nigel Fox

Figure 2. Bears, Nigel Fox

The artwork above was created by Nigel Fox, an indigenous artist originally from the Ojibway Nation in Ontario who now lives in British Columbia. Many of his pieces feature a northwest coastal indigenous influence, as shown here in two pieces demonstrating a tessellation style. The artist's description of each of his pieces is inspirational.

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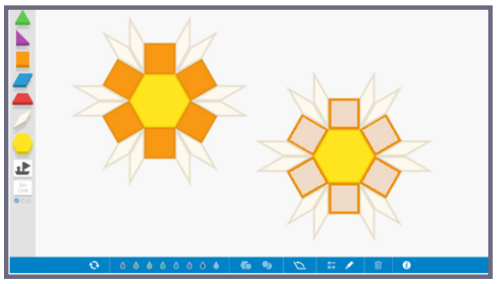
Illustrative Examples

2. Students create a symmetry quilt to illustrate different kinds of symmetry. There are sites noted below in the resources section for students to make a virtual quilt panel, which may be turned into a class quilt in which each student also **describes** in detail their own symmetrical design. For more detailed information about the process, view the Quilting Bee resource found on LearnAlberta. There are many opportunities for student exploration related to symmetry within, but like with any resource, not everything is applicable to the specifics of the grade 6 Alberta curriculum. Here is an example of trying out some e-designs using The Math Learning Centre's interactive Patterns app, as shown in the lessons from Two-Legged, Four-Legged, Winged, Finned: Patterns from Indigenous Art.



Additional Resources

*Coastal Indigenous Art -Symmetry lessons and links
*Frieze designs in Indigenous Art
*The Flower Beadwork People
*Modern Indigenous Fashion Arts
Symmetry Artist -Math is Fun
GIZMOS -Quilting Bee Symmetry
Math Learning Centre Patterns App
Explaining Tessellations with Symmetry

References

Fox. N.(2011) *Butterflies #2* (Acrylic on Paper). Nigel Fox Artworks
www.nigelfoxartworks.com/151-2/?artid=20030

Fox. N.(n.d.) *Bears* (Ink Print on Paper), Nigel Fox Artworks
http://www.nigelfoxartworks.com/purchase/?artid=40001

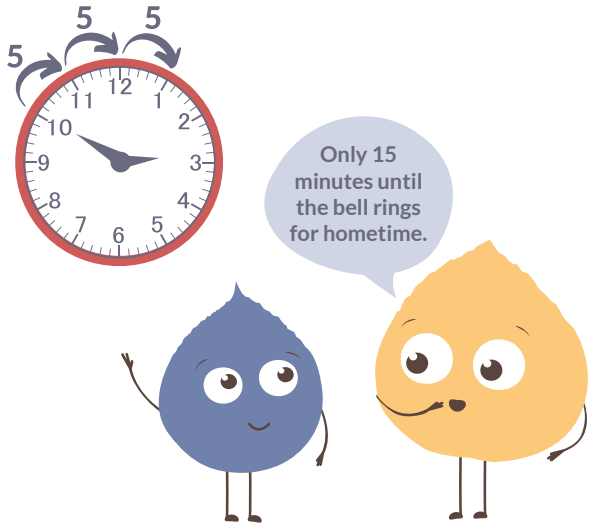
Gizmos. (2019). *Teacher Guide: Quilting Bee*.
https://el-gizmos.s3.amazonaws.com/materials/QuiltingBeeTG.pdf

Hunter, C. (2020, May 1). *Two-Legged, Four-Legged, Winged, Finned: Patterns from Indigenous Art*.
https://chrishunter.ca/2020/05/21/two-legged-four-legged-winged-finned-patterns-from-indigenous-

DETERMINE

4 - 6

To find an answer using a reasonable strategy, procedure, and/or calculation.



Determining requires that students apply knowledge and reasoning skills to select an appropriate strategy, procedure, and/or calculation to find a solution or answer.

The table below shows where **determine** is included as student action within Alberta's 4-6 Math curriculum.

Grade Level	Learning Outcomes	Skills & Procedures
Grade 4	Students **determine** and express angles using standard units.	**Determine** the value of each digit in a number, including tenths and hundredths. **Determine** the factors of a number within 100. **Determine** the first five multiples of a given number within 100. **Determine** fractions equivalent to a given fraction. Apply preservation of equality to **determine** the unknown value in an equation, limited to equations with one operation. **Determine** the area of a rectangle using multiplication. **Determine** duration in minutes using a clock.

DETERMINE

4 - 6

To find an answer using a reasonable strategy, procedure, and/or calculation.

Grade Level	Learning Outcomes	Skills & Procedures
Grade 5	Students **determine** divisibility of natural numbers.	**Determine** a decimal number between any two other decimal numbers. **Determine** factors of natural numbers using divisibility tests. **Determine** the missing term in an arithmetic sequence that corresponds to a given position. **Determine** frequency for each category of a set of data by counting individual data points.
Grade 6		**Determine** common factors for two natural numbers, using prime factorization. **Determine** divisibility of a natural number from its prime factorization. **Determine** the factor that relates one denominator to another. **Determine** whether two ratios are equivalent. **Determine** an equivalent ratio using a proportion. **Determine** a percent of a number, limited to percentages within 100%. **Determine** different strategies for solving equations. **Determine** the area of a parallelogram using multiplication. **Determine** the base or height of a parallelogram using division. **Determine** the area of a triangle, including various triangles with the same base and height. **Determine** the area of composite shapes using the areas of triangles and parallelograms. **Determine** the volume of a right rectangular prism using multiplication. **Describe** the rule that determines the values of the dependent variable from values of the independent variable. **Determine** a value of the dependent variable of a function given the corresponding value of the independent variable. **Determine** relative frequency for categories of a sample of data.

To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

Illustrative Examples

Learning Outcome 5N3: Students ***determine*** divisibility of natural numbers.

Skills and Procedures (5N3) ***Determine*** factors of natural numbers using divisibility tests.

Students should be familiar with divisibility tests before doing the following activity.

Divisibility Rules/Tests - are a set of general rules that are often used to **determine** whether or not a number is absolutely divisible by another number.

Procedure:

- Challenge the class to a teacher-versus-students contest to see who can **determine** whether a particular number is divisible by a designated factor (1 to 10).
- Name a factor.
- Have a student secretly write a number (two to six digits) on a display board.
- Designate two students to use calculators to **determine** the correct response. (Yes, it is divisible, or no, it is not divisible.)
- Reveal the number and begin the contest.
- Whoever replies correctly first, wins.
- Keep score if you wish (teacher versus students).

Skills and Procedures (6N3.1) ***Determine*** common factors for two natural numbers, using prime factorization.

Have students use prime factorization and prime factors to **determine** all the common factors of 40 and 70.

1. Ask students to help you list the prime numbers between 1 and 10 on the board. If necessary, remind them that 1 is neither prime nor composite because it has only one factor. Then write the number 40 . Is it prime or composite? Call on volunteers to **determine** if the number is a composite or prime.

   Carter: It's composite because it's even.

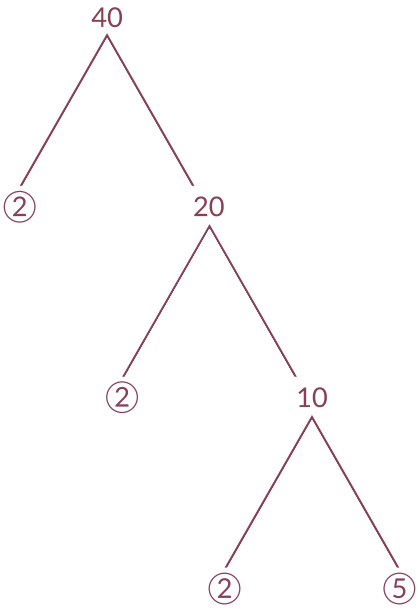
   Teacher: Are all even numbers composite?

   Yaritza: No, because 2 is an even number, and it's prime, remember? I think 40 is a composite number because it has more factors than just 1 and itself, like 4 and 10.

To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

Illustrative Examples

2. Review the fact that a composite number can be written as the product of prime numbers. This is called prime factorization. One way to make the prime factorization of a number is to make a factor tree. Work with the class to make a factor tree for 40. Start with a pair of branches that uses 2 as one of the factors. Ask students to record the tree in their journals and use the prime factorization of 40 to **determine** what are all the factor pairs. After they've had a minute or two to work, list the pairs.



40 = 2 x 2 x 2 x 5

(2) x (2 x 2 x 5) ⟶ 40 = 2 x 20

(2 x 2) x (2 x 5) ⟶ 40 = 4 x 10

(2 x 2 x 2) x (5) ⟶ 40 = 8 x 5

There is also 40 = 1 x 40

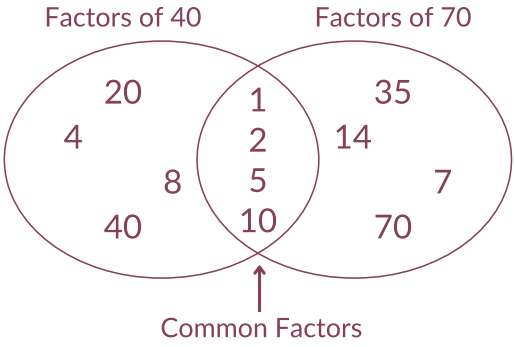
3. Write the number 70, and ask students whether they think 70 and 40 have any common factors. After they've had a minute to discuss their conjectures, have them make a factor tree for 70 in their journals and use it **determine** all the factor pairs. Record the results on the board. Then ask students to create a Venn diagram in their journals to show the common factors of 40 and 70.

(2) x (5 x 7) ⟶ 70 = 2 x 35

(2 x 5) x (7) ⟶ 70 = 10 x 7

(2) x 5 x (7) ⟶ 70 = 14 x 5

There is also 70 = 1 x 70



To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

4. Now tell students you have a number riddle for them to solve. Write the first clue on the board.

   Clue 1: I am a common factor of 28 and 40.

   Give students a few minutes to create a factor tree and **determine** the factor pairs for 28 (1 x 28, 2 x 14, and 4 x 7) and 40 (1 x 40, 2 x 20, 4 x 10, and 5 x 8) in their journals. Work with students to **determine** the common factors (1, 2, and 4).

5. Write the next two clues on the board and have students use them to **determine** the mystery number, which is (4).

   Clue 2: I am an even number

   Clue 3: I am not a prime.

6. In pairs have students work on the following riddles:
   - Make a factor tree and list the factor pairs for each number.
   - Find the factors shared by each number (their common factors)
   - Use the other clues to **determine** the answer to the riddle.
   - Show your work.

Riddle One: Answer is 9.

I am a common factor of 27 and 45.

I am an odd number.

When you multiply me by 3, you get a number greater than 10.

What number am I?

Riddle Two: Answer is 6.

I am a common factor of 36 and 48.

I am also a factor of 30

I am an even number.

I am divisible by 3.

What number am I?

To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

Additional Resources

Maths Pad Divisibility Rules Interactive

MathsPad Multiples and Factors Interactive

References

Manitoba Education. (2016). Grade 7 Mathematics Support Document for Teachers. *Numbers*, 12. https://www.edu.gov.mb.ca/k12/cur/math/support_gr7/full_doc.pdf

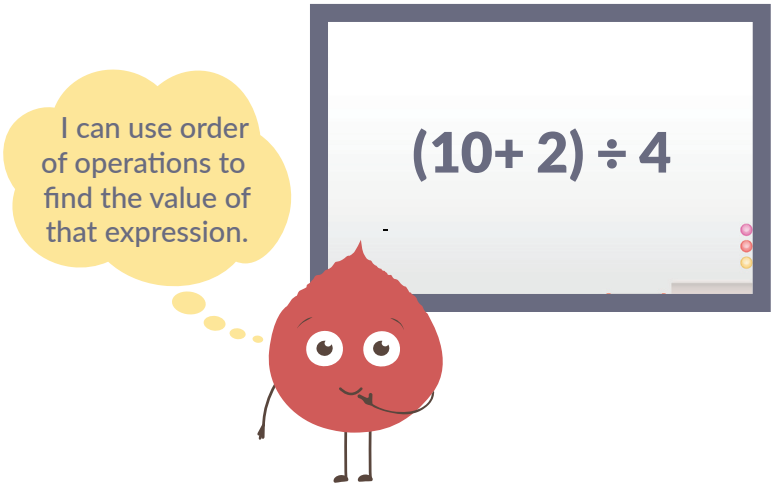
The Math Learning Center. (2013). Grade 5 Supplement: Set A2 Number & Operations: Primes, Composites and Common Factors. 7 - 9. https://www.mathlearningcenter.org/curriculum/free/lessons-activities-grade-5

Splash Learn. (n.d.). *Rules of Divisibility 1 to 13: Definition, Examples, Chart, Fact*. SplashLearn. https://www.splashlearn.com/math-vocabulary/divisibility-rules

EVALUATE

4 - 6

To determine the value of. (Note: definition is specific to mathematics)



In Mathematics, ***evaluating*** requires students to "find the value of" or "calculate the value of". A value refers to the worth or numerical representation of an object, quantity, or expression. For example, to evaluate an algebraic expression means to find the value of the expression when the variable is replaced by a given number.

The table below shows where **evaluate** is included as student action within Alberta's 4-6 Math curriculum.

Grade Level	Learning Outcomes	Skills & Procedures
Grade 4	Students **evaluate** the use of scale in graphical representations of data.	**Evaluate** expressions according to the order of operations.
Grade 5		**Evaluate** numerical expressions involving addition or subtraction in parentheses according to the order of operations. **Evaluate** an algebraic expression by substituting a given number for the variable.
Grade 6		**Evaluate** numerical expressions involving operations in parentheses and powers according to the order of operations.

To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

Illustrative Examples

Skills and Procedures (5A1.1) ***Evaluate*** numerical expressions involving addition or subtraction in parentheses according to the order of operations.

1. Have students watch a video on order of operations. For example, Math Antics - Order of Operations or Khan Academy's "Intro to Order of Operations".
2. Tell students that they are going to be using parentheses in the expressions they **evaluate**. Parentheses are a grouping symbol, indicated by:

   parentheses ( )

   Tell students that the rule changes when an expression has parentheses, which is to **evaluate** operations in parentheses before other operations.
3. Provide students with an example, such as:

   Ashmer and Ana were asked to **evaluate** the following numerical expressions.

   4 x (2 + 5) - 9
4. Their solutions are as shown below:

   Ashmer:

   4 x (2 + 5) - 9
   4 x 7 - 9
   28 - 9
   19

   Ana:

   4 x (2 + 5) - 9
   8 + 5 - 9
   13 - 9
   4
5. There can only be one correct answer. Who do you think did it right? Is it Ashmer or Ana? Have students discuss and share answers.
6. Let's find out how Asmer did it right!

   Ashmer:

   4 x (2 + 5) - 9
   4 x 7 - 9
   28 - 9
   19

   → Work on the calculations inside the parentheses.

   → Follow the rule working from LEFT to RIGHT
   Multiply or Divide (whichever comes first)
   Add or Subtract (whichever comes first)
7. Provide more numerical expressions for students to **evaluate** using parentheses.

To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

Additional Resources

LearnAlberta. Exploring Order of Operations Interactive.

SplashLearn.

References

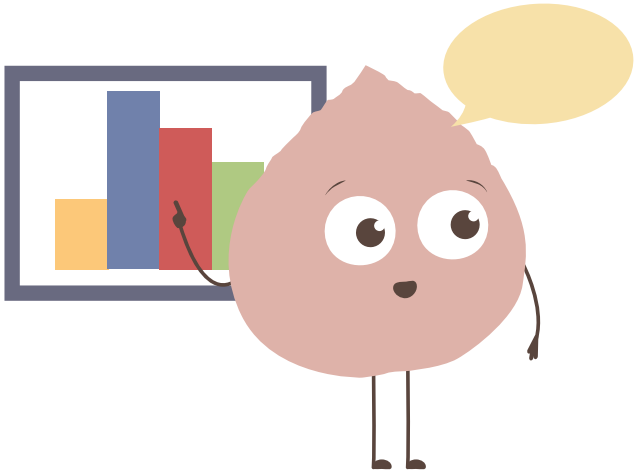
Khan Academy. (2010, May 27). *Introduction to order of operations | Arithmetic properties | Pre-Algebra | Khan Academy*. YouTube. https://youtu.be/ClYdw4d4OmA

Math Antics. (2012, April 16). *Math Antics - Order Of Operations*. YouTube. https://youtu.be/dAgfnK528RA

EXPLAIN

4 - 6

To describe the how or why of something; give the cause or reason for.



Explaining requires students to use facts and/or details, to clearly communicate more in-depth information about an idea, process, concept, relationship, etc. It is helpful for students to use visuals or manipulatives to demonstrate their understanding. When students **explain** it gives others an insight into their thinking and learning.

The table below shows where explain is included as student action within Alberta's 4-6 Math curriculum.

Grade Level	Learning Outcomes	Skills & Procedures
Grade 4	Students **explain** properties of prime and composite numbers using multiplication and division. Students analyze and **explain** geometric properties. Students interpret and **explain** arithmetic and geometric sequences.	Create and **explain** increasing or decreasing sequences, including numerical sequences.
Grade 5		**Explain** the standard algorithms for multiplication and division of natural numbers.
Grade 6	Students **explain** location and movement in relation to position in the Cartesian plane.	**Explain** the standard algorithms for multiplication and division of decimal numbers.

To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

Illustrative Examples

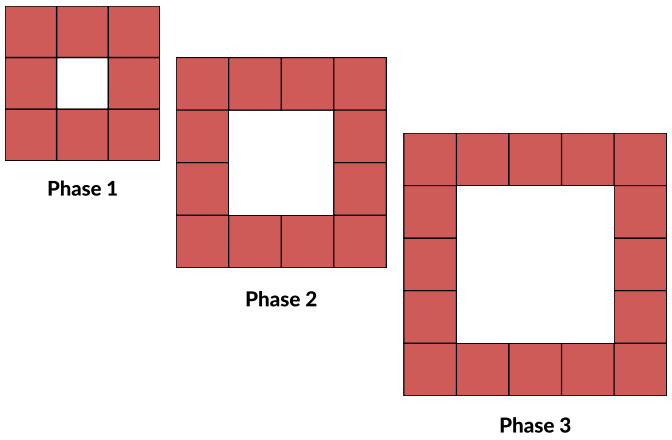
Skills and Procedures (4P1.1) Create and ***explain*** increasing or decreasing sequences, including numerical sequences.

Space Station Challenge Task (Lesson taken from "Guides to Effective Instruction in Mathematics. Patterning and Algebra - 4-6" pages 57 and 58)

1. Before having students do the *Space Station Challenge*, teachers are encouraged to do the *Picnic Partners* (pg. 47 to 56) learning activity prior to the challenge. This learning activity will introduce students to the exploration of increasing numeric sequences. The context is the seating around a picnic table. Students will use concrete manipulatives to create, T-charts to record, and graphs to model the pattern rule. Students will be **explaining** their thinking as they progress through the challenge with a partner.

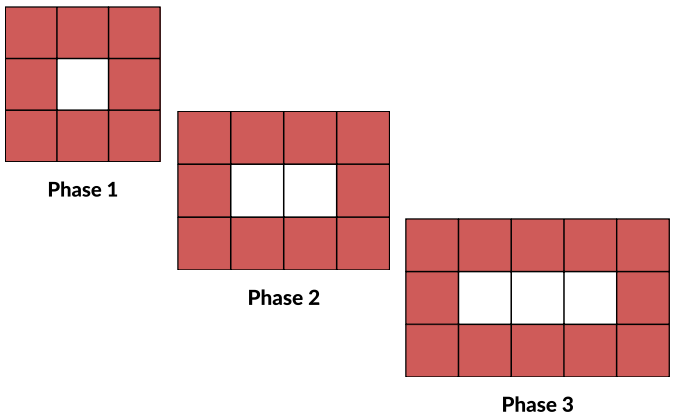
2. **Space Station Challenge Task** (pg. 57)
   Part 1: Design A

   The Canadian government wants to build an expandable space station that could provide classrooms for students who are studying outer space. Here is the design proposed by one company. The company provided a model made of cubes to show how the station might grow. The diagram shows the first three phases of the project. If the space station were to grow 2 more times, what would it look like? Create it.



   Part 2: Design B
   (Do not begin until Part 1 of the Project Status form is signed.)

   Another company has submitted a different proposal for the space station. The first phase is also made up of 8 cubes. The model and its growth in the first three phases are represented at right. Compare Design B with Design A. At Phase 8, which design will involve more cubes? **Explain** how you know?



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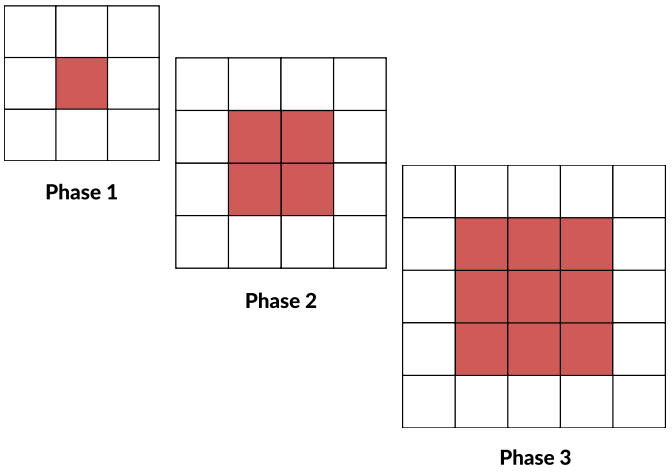
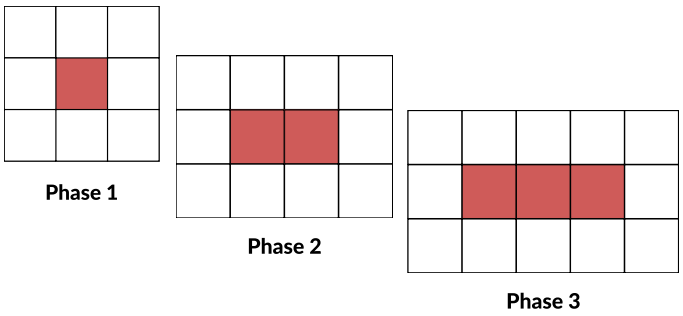
Illustrative Examples

Part 3: Designs C and D

Each of the two companies also submitted a second design that is a variation on their first design. Notice that in Designs C and D the space station is constructed in the central space of Design A or Design B. Look at the central space created by Design A. Phase 1 is the size of 1 cube, Phase 2 is the size of 4 cubes, and Phase 3 is the size of 9 cubes. How large would the central space be for Phase 5. Model the problem, record your results on a T-chart, and **explain** the pattern rule.



Design D uses the central space of Design B. Phase 1 is the size of 1 cube, Phase 2 is the size of 2 cubes, and Phase 3 is the size of 3 cubes. How large would the central space be for Phase 5? Have students use concrete manipulatives to create, use a T-chart to record, and explain the pattern rule. Have students **explain** their thinking as they progress through this activity.



Additional Resources

Guides to Effective Instruction in Mathematics. Patterning and Algebra - 4-6.

Maths Pad: Arithmetic Sequences - Increasing or Decreasing

References

Ontario Educators. (n.d.). *Guides to effective instruction in mathematics*. Patterning and Algebra- 4-6. pages 57 and 58.
https://drive.google.com/file/d/1slnZgHjfmtX_rOz5iNFgjDVnMQ40ay4I/view

EXPRESS

To convey knowledge and understanding.

4 - 6

Expressing indicates that students convey their ideas or response in any way that is appropriate to the context. This can include words, symbols, actions, objects, or images, etc. For example, students could express a relationship between meters and km as a ratio of 100 : 1 or 100 meters = 1 km.

The table below shows where express is included as student action within Alberta's 4-6 Math curriculum.

Grade Level	Learning Outcomes	Skills & Procedures
Grade 4	Students interpret and **express** area. Students determine and **express** angles using standard units.	**Express** numbers, including decimal numbers, using words and numerals. **Express** various compositions of a number, including decimal numbers, using place value. **Express** the relationship between two numbers, including decimal numbers, using <, >, or =. **Express** a monetary value in cents as a monetary value in dollars using decimal notation. Divide and **express** a quotient with or without a remainder. **Express** a fraction in simplest form. **Express** fractions as decimal numbers and vice versa, limited to tenths and hundredths. **Express** the fraction, decimal, and percentage representations of the same part-whole relationship. **Express** a numerical sequence to represent a concrete or pictorial sequence. **Express** the first five terms of an arithmetic sequence related to a given initial term and constant change. **Express** the first five terms of a geometric sequence related to a given initial term and constant change. **Express** time of day using fractions.

EXPRESS

4 - 6

To convey knowledge and understanding.

Grade Level	Learning Outcomes	Skills & Procedures
Grade 5		**Express** numbers within 10 000 000, including decimal numbers to thousandths, using words and numerals. **Express** the relationship between two numbers, including decimal numbers, using <, >, or =. **Express** a quotient with or without a remainder according to context. **Express** improper fractions and mixed numbers symbolically. **Express** an improper fraction as a mixed number and vice versa. **Express** the composition or decomposition of fractions with common denominators as a sum or difference. **Express** part-part ratios and part-whole ratios of the same whole to describe various situations. **Express** the product of a number and a variable using a coefficient. **Express** the quotient of a variable and a number as a fraction. **Express** the relationship between square centimetres, square metres, and square kilometres. **Express** the area of a rectangle using standard units given the lengths of its sides.
Grade 6	Students interpret and **express** volume.	**Express** positive and negative numbers symbolically, in context. **Express** the relationship between two numbers, including positive and negative numbers, using <, >, or =. **Express** zero as the sum of integers in multiple ways. **Express** a difference as a sum. **Express** the prime factorization of a composite number. **Express** the product of identical factors as a power, including within a prime factorization. **Express** a fraction as a division statement and vice versa. **Express** two fractions with common denominators. **Express** a unit rate to represent a given rate, including unit price and speed. **Express** the terms of an algebraic expression in a different order in accordance with algebraic properties. **Express** volume in non-standard units or cubic centimetres. **Express** relative frequencies as decimals, fractions, or percentages.

To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

Illustrative Examples

Skills and Procedures (4N5.2): ***Express*** fractions as decimal numbers and vice versa, limited to tenths and hundredths.

Skills and Procedures (4N5.2): ***Express*** the fraction, decimal and percentage representations of the same part-whole relationship.

Students log into the Fraction, Decimal and Percent App from Gizmos with LearnAlberta. Through this app they can **express** the same amount in various representations, including a number line when the number line and comparison boxes are checked. The student can take a screenshot of their work, built right into the app.

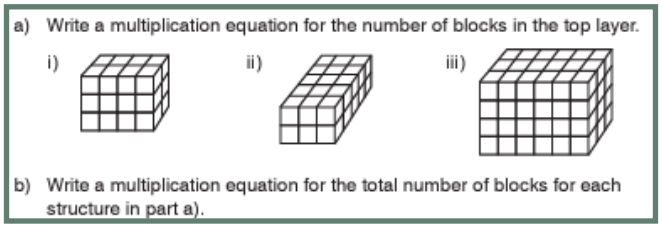
There are also student activities which they can access through the Lesson info drop down.

Learning Outcome 6M2: Students interpret and **express** volume.

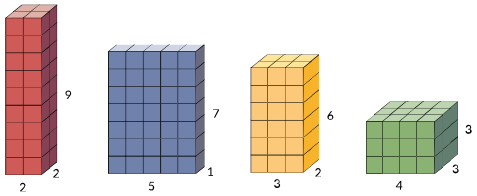
Skills and Procedures (6M2): ***Express*** volume in non-standard units or cubic centimeters.

Example 1: The Jump Math Resource: Measurement: 3-D Shapes, Volume, and Surface Area includes lessons to engage students in learning about and **expressing** volume.

- The teacher models how to find and **express** volume using connecting cubes: using one layer of blocks to determine area and then multiplying that amount by the number of layers. Discuss how the dimensions in the volume formula (L x W x H) are related to the layers in a stack. Some practice Questions could follow.

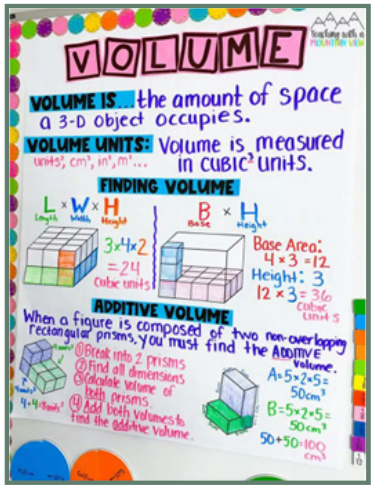


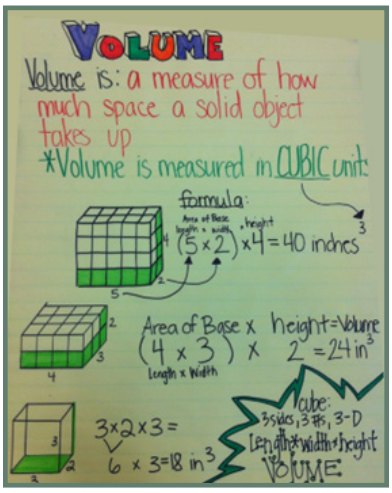
- Students work in pairs with connecting cubes. Each student creates several rectangular stacks of cubes and exchanges stacks with their partner. The partner finds the number of cubes (i.e the volume) for each stack made by their partner by multiplying length, width and height. Partners check each other's work to verify if they have correctly **expressed** the volume. A variation for this task is where one partner provides a number, such as 24, and the other partner has to show 2 ways of creating that volume. (e.g. 4 x 2 x 3 and 6 x 2 x 2)



To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

Example 2: Students, with a partner, create an anchor chart similar to the one shown here from the blog, *Teaching with a Mountain View*. In this task, students are **expressing** what they know about volume.





Additional Resources

Gizmos : Modeling Decimals-Teacher Guide
Student Exploration: Fraction, Decimal, Percent
LearnAlberta Resource
Math with Mr. J- Finding Volume with Unit Cubes video

References

Explore Learning LLC. (2022). *Fraction, Decimal, Percent (Area and Grid Models)*. Gizmos Interactive. https://curriculum.learnalberta.ca/resources/permalink/LbhOTLD1T0O_qhDlWeL0QA

Explore Learning LLC. (2022). *Percents, Fractions, Decimals*. Gizmos Interactive. https://curriculum.learnalberta.ca/resources/permalink/0Y7AQtrCaUy_mOKEHdxMqA

JUMP Math (English). (2021). *JUMP Math 6: Unit 16.* Unit 16: Measurement: 3-D Shapes, Volume, and Surface Area (Teacher Resource). https://curriculum.learnalberta.ca/resources/permalink/XHXFtMMmyEyQE657JX3ROQ

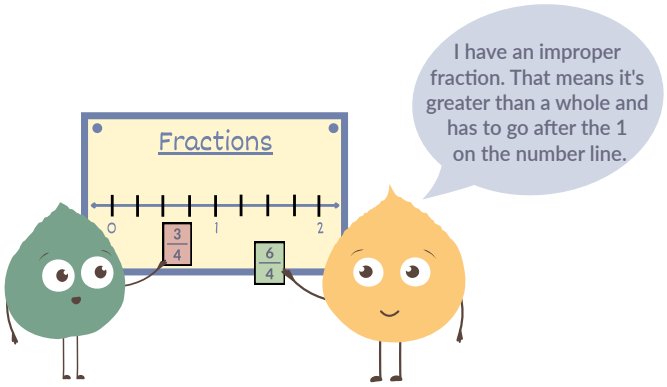
Montero, M. (n.d.). *Decimal Place Value Resources & Teaching Ideas.* Teaching with a Mountain View. https://teachingwithamountainview.com/decimal-place-value-resources-teaching/

McHugh. (2013, April 3). An Exploration of Volume. Ms. McHugh's Corner. http://msmchughscorner.blogspot.com/2013/04/an-exploration-of-volume.html

INTERPRET

4 - 6

To use reasoning and knowledge to make sense of, and draw meaning from, a text, set of data, visual, graph, etc.



Interpreting requires students to draw conclusions from, and/or explain the meaning of, given information. It involves identifying the key features of the information, recognizing connections, patterns, similarities and/or differences and then expressing understanding in their own words. ***Interpreting*** is a comprehensive process in which students have multiple opportunities over time to work within the specific grade level context of the verb in the curriculum.

The table below shows where **interpret** is included as student action within Alberta's 4-6 Math curriculum.

Grade Level	Learning Outcomes	Skills & Procedures
Grade 4	Students **interpret** percentages. Students **interpret** and express area. Students **interpret** and explain arithmetic and geometric sequences.	**Interpret** data represented in various graphs.
Grade 5	Students **interpret** improper fractions. Students **interpret** numerical and algebraic expressions.	
Grade 6	Students **interpret** the multiplication of natural numbers by fractions. Students **interpret** and express volume.	**Interpret** frequency of categorized data as relative frequency.

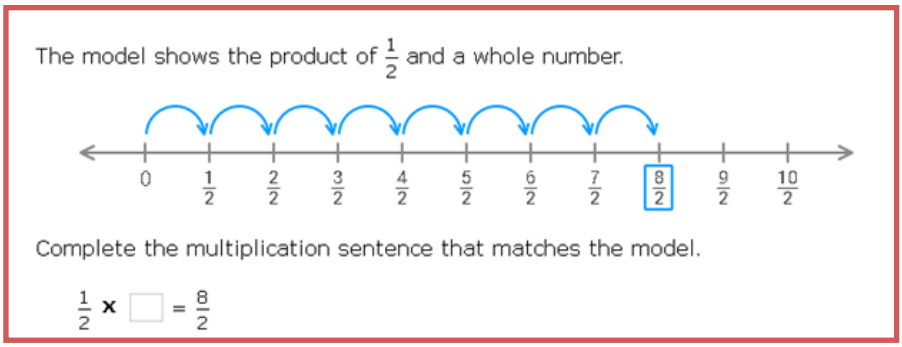
To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

Illustrative Examples

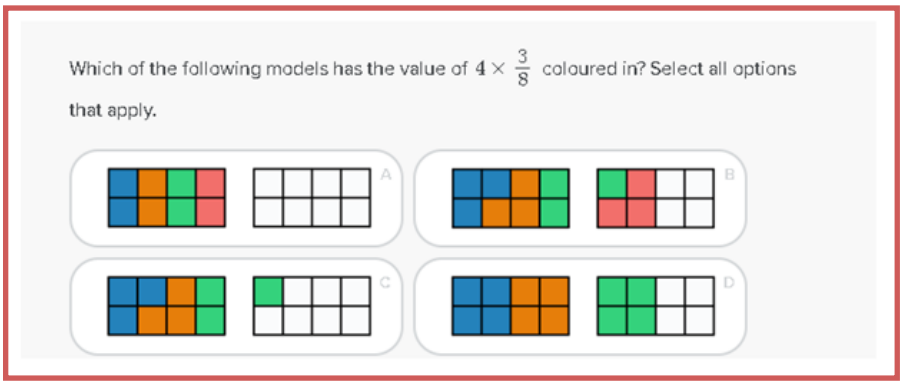
Learning Outcome 6N7: Students ***interpret*** the multiplication of natural numbers by fractions.

There are many sites noted in the resources and references section below such as with video explanations, review lessons and practice for students to **interpret**.

Example 1: This example, from IXL, involves students **interpreting** the visual of a number line showing repeated addition to solve the multiplication equation.



Example 2: Provide students with multiple visual choices to answer a question. This requires students to **interpret** each option to determine the correct one. They should represent and/or explain how they determined their choice was correct. This example comes from MathSpace:



To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

Additional Resources

SplashLearn - Fractions

Khan Academy - Fractions

Generation Genius - Multiplying Fractions by Whole Numbers

Math Antics - Multiplying Fractions

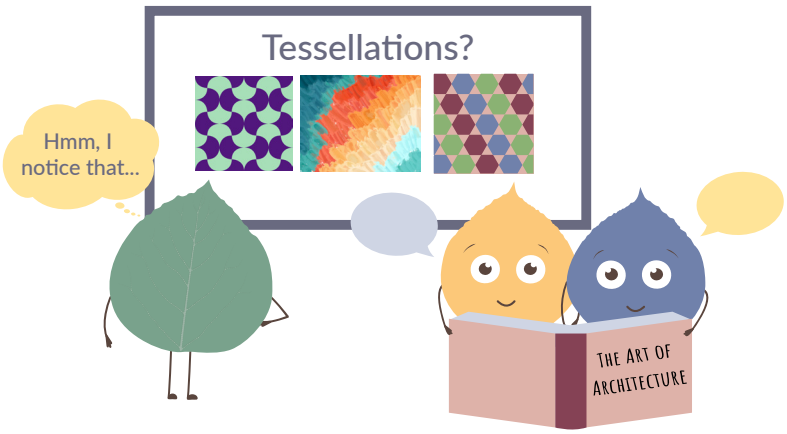
References

Ontario Educators. (n.d.). *Guides to effective instruction in mathematics*. Patterning and Algebra- 4-6. pages 57 and 58. https://drive.google.com/file/d/1slnZgHjfmtX_rOz5iNFgjDVnMQ40ay4I/view

INVESTIGATE

4 - 6

To use a process of inquiry or exploration to gain deeper understanding.



Investigating requires students to use mathematical knowledge and reasoning to complete a series of tasks connected to the content. ***Investigating*** is a process in which students have multiple opportunities over time to explore different approaches or strategies. Through ***investigation***, students will be able to draw new conclusions and gain a more thorough understanding of a math concept or idea.

The table below shows where **investigate** is included as student action within Alberta's 4-6 Math curriculum.

Grade Level	Learning Outcomes	Skills & Procedures
Grade 4		**Investigate** patterns in multiplication and division of natural numbers by 10, 100, and 1000. **Investigate** strategies for estimation of products and quotients. **Investigate** percentage in familiar situations. **Investigate** preservation of equality using a balance model. **Investigate** preservation of equality using an equation without an unknown value. **Investigate** increasing sequences, including the Fibonacci sequence, in multiple representations.
Grade 5	Students **investigate** symmetry as a geometric property.	**Investigate** divisibility by natural numbers to 10, including 0. **Investigate** the composition and decomposition of a quantity within 1 using unit fractions. **Investigate** order of operations when performing inverse operations on both sides of an equation. **Investigate** symmetry in familiar 2-D and 3-D shapes using hands-on materials or digital applications.

INVESTIGATE

4 - 6

To use a process of inquiry or exploration to gain deeper understanding.

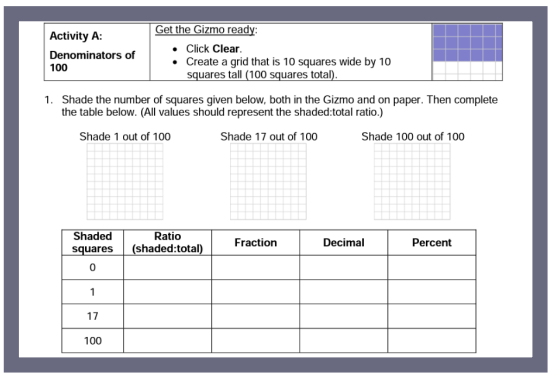
Grade Level	Learning Outcomes	Skills & Procedures
Grade 6	Students **investigate** magnitude with positive and negative numbers. Students **investigate** functions to enhance understanding of change. Students **investigate** relative frequency using experimental data.	**Investigate** addition of an integer and its additive inverse. **Investigate** like terms by modelling an algebraic expression. **Investigate** tessellations found in objects, art, or architecture. **Investigate** strategies for determining a value of the independent variable of a function given the corresponding value of the dependent variable. **Investigate** strategies for determining a value of the independent variable of a function given the corresponding value of the dependent variable.

To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

Illustrative Examples

Skills and Procedures (4N6): ***Investigate*** percentage in familiar situations.

Students can **investigate** percentages through Gizmos (Part-to-Part and Part-to-Whole Ratios). Through a series of interactive simulations, students will develop an understanding of percent, fractions and decimals in relation to a number line and express them as equivalents. This learning experience includes student access to the simulation, a teacher guide, a student exploration page with an answer key and a vocabulary page.



Learning Outcome 6N1.1: Students ***investigate*** magnitude with positive and negative numbers.

MATH TALK (A learning experience where students focus on vocabulary, make connections and use reasoning to justify a response.)

Images on the following page show real-life examples using positive and negative integers. (The lesson idea was adapted from a grade 6 Math UP action task.) Have students **investigate** and discuss one image one at a time. Ask students open-ended questions, such as:

- What do you notice?
- What do you wonder?
- What questions could you ask about the information that you see?

To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

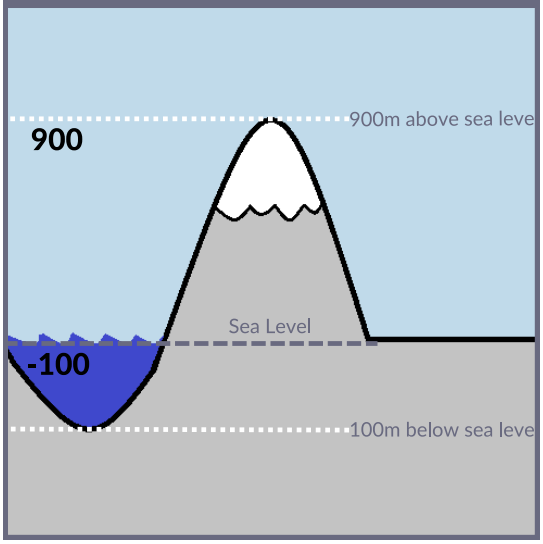
Bank Statement

Date	Description	Money Out	Money In	Balance
March 17	ATM (withdrawal)	$20.00		$40.00
March 25	eDeposit (cheque #0001)		$50.00	$90.00
April 5	Skip the Dishes (withdrawal)	$40.00		$50.00
April 10	Shoe Purchase (withdrawal)	$100.00		-$50.00
April 10	Hoodie Purchase (withdrawal)	$60.00		-$110.00

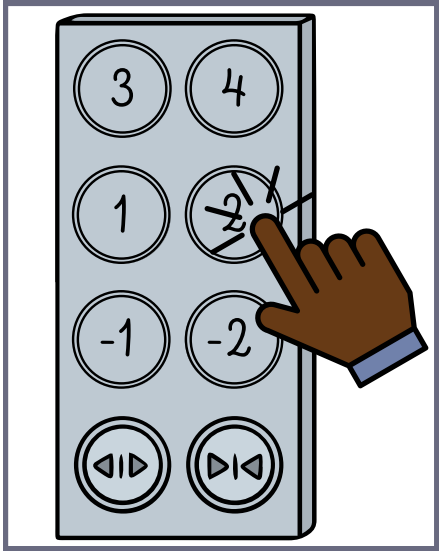
Golf Tournament

Player	Total	Strokes
Tiger	-2	70
Dustin	-2	70
Rory	+3	75
Scottie	Even	72

Water Level



Elevator Buttons



Additional Resources

LearnAlberta. Planning Guide: Grade 6 Ratio and Percents.

References

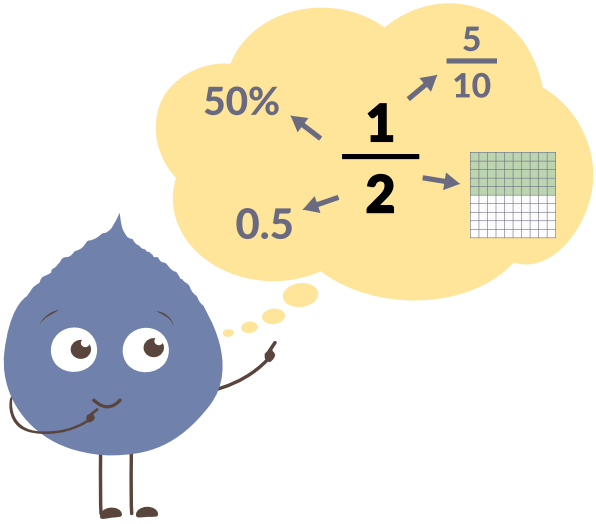
Explore Learning LLC. (2022). *Part-to-part and Part-to-whole Ratios*. Gizmos Interactive. https://curriculum.learnalberta.ca/resources/permalink/UTJOHZN72kmY-szXX4vINw

Rubicon Publishing. (n.d.). *Math UP Classroom - Grade 6 Representing Integers*. Math. www.mathup.ca/

RELATE

4 - 6

To show a connection or relationship between two or more things.



Relating requires that students understand the connection within or between one or more math concepts or ideas. For example, students identify information that supports an idea, and then make a connection to a similar idea in a different context, situation, problem, etc. *Relating* is a process that often involves more than one step.

The table below shows where relate is included as student action within Alberta's 4-6 Math curriculum.

Grade Level	Learning Outcomes	Skills & Procedures
Grade 4		**Relate** the values of adjacent places, including tenths and hundredths. **Relate** the position of equivalent fractions on the number line. **Relate** fractions and equivalent decimal numbers to their positions on the number line. **Relate** angles of 90°, 180°, 270°, and 360° to fractions of a circle. **Relate** durations of 15 minutes, 20 minutes, 30 minutes, 40 minutes, and 45 minutes to fractions of a circle.

RELATE

4 - 6

To show a connection or relationship between two or more things.

Grade Level	Learning Outcomes	Skills & Procedures
Grade 5	Students **relate** location to position on a grid. Students **relate** terms to position within an arithmetic sequence.	**Relate** the names of place values that are the same number of places to the left and right of the ones place. **Relate** a decimal number to its position on the number line. **Relate** fractions, improper fractions, and mixed numbers to their positions on the number line. **Relate** repeated addition of a variable to the product of a number and a variable. **Relate** a centimetre to a square centimetre. **Relate** a metre to a square metre. **Relate** a square centimetre to a square metre.
Grade 6	Students **relate** fractions to quotients.	**Relate** magnitude to the distance from zero on the number line. **Relate** positive and negative numbers, including additive inverses, to their positions on horizontal and vertical models of the number line. **Relate** multiplication of a natural number by a fraction to repeated addition of the fraction. **Relate** multiplication by a unit fraction to division. **Relate** percentage of a number to a proportion. **Relate** the axes of the Cartesian plane to intersecting horizontal and vertical representations of the number line. **Relate** the coordinates of a polygon and its image after translation, reflection, or rotation in the Cartesian plane.

To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

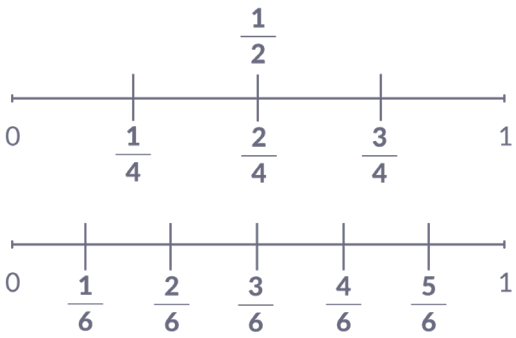
Illustrative Examples

Skills and Procedures (4N5.1) ***Relate*** the position of equivalent fractions on the number line.

Students will use number lines to show how two fractions can be equivalent. Students need to know that two fractions are equivalent if they represent the same amount or mark the same position on the number line.

1. Teacher draws on the board a number line from 0 to 1 divided into four equal parts. ASK: How many parts is the distance from 0 to 1 divided into? (4) Have a volunteer label the fractions. (1/4, 2/4, 3/4).

2. Teacher then draws another number line from 0 to 1, directly below the first one, but without markings. Have a volunteer label the halfway mark.
   ASK: What fraction on the first number line is in the same position as the fraction 1/2 on the second number line? (2/4) Show students how these fractions **relate** to each other and are equivalent. Teacher points out that if you have four steps to take, doing two of them will get you halfway. Now draw another number line underneath, this one divided into sixths. Have a volunteer circle the fraction that is equal to one half.
   Beside the number line, write: $\frac{1}{2} = \frac{2}{4} = \frac{3}{6}$



3. Tell students that these fractions **relate** to each other because they are all equal and they represent the same place on the number line. ASK: What do we call fractions that are equal? (equivalent) Write "equivalent" on the board and underline the first three letters. Point out that the word equivalent comes from the word equal, and write "equal" on the board as well.

4. Have students complete the activity shown on pg 39 from Jump Math, Unit 9: Number Sense: Fractions (Teacher Resource) where students use fraction strips of paper to **relate** equivalent fractions.

To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

Additional Resources

Equivalent Fractions on a Number Line

Math is Fun: Fractions on a Number Line

Math Learning Center Interactive Number Line

Maths Pad - Representing Equivalent Fractions

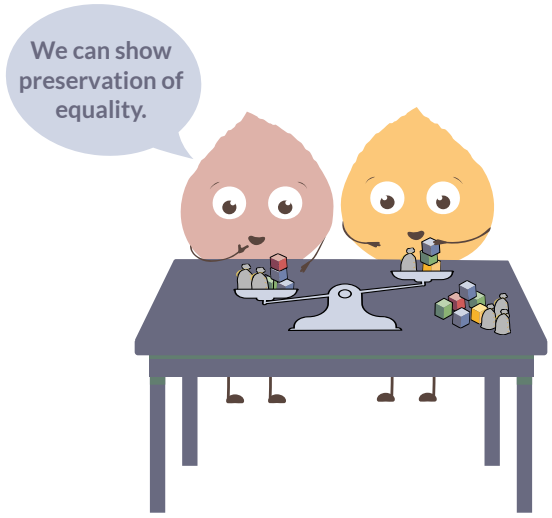
References

JUMP Math. (2019). *Grade 4 Unit 9: Number Sense Fractions*. Learn Alberta. https://curriculum.learnalberta.ca/resources/permalink/-MhOrN0D906_Hlk_al9gLA

REPRESENT

4 - 6

To convey mathematical ideas using manipulatives, diagrams, models, signs, symbols, etc.



Representing indicates that students are showing their knowledge and understanding. For example, ***representing*** a story problem using an equation and/or manipulatives, or choosing which coins might be used to purchase a chocolate bar. When students express the same concept in different forms it helps to clarify their understanding.

The table below shows where **represent** is included as student action within Alberta's 4-6 Math curriculum.

Grade Level	Learning Outcomes	Skills & Procedures
Grade 4	Students **represent** and apply equality in multiple ways.	**Represent** data in a graph using many-to-one correspondence.
Grade 5	Students employ ratios to **represent** relationships between quantities.	**Represent** one-to-one correspondence between positions and terms of an arithmetic sequence in a table of values and on a coordinate grid.
Grade 6		**Represent** corresponding values of the independent and dependent variables of a function in a table of values and as points in the Cartesian plane.

To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

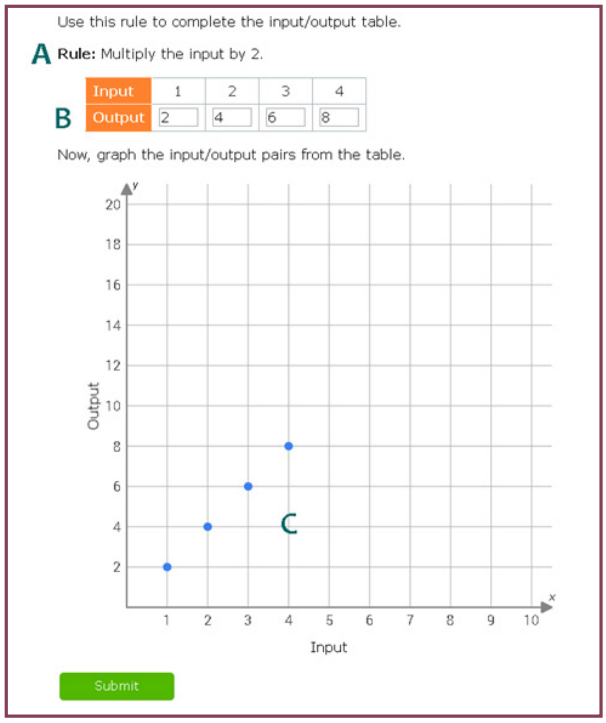
Illustrative Examples

Skills and Procedures (5P1) ***Represent*** one-to-one correspondence between positions and terms of an arithmetic sequence in a table of values and on a coordinate grid.

1. Students go to the IXL Input/Output Interactive task.

   An example is shown here:

   - Students apply the rule shown at the top of the page (see A)
   - Next, they calculate the output and place the answer in the table (see B)
   - Finally, students **represent** the input/ output pairs in the graph below and press Submit.



2. Students create a series of 3 task questions (similar in nature to the online ones in number 1 above) along with an answer key for each one. These will be traded with a partner who will **represent** their answers on the graph paper. Alternately, students could **represent** their rule on the graph and their partners would have to determine the rule and complete the input/output table.

Additional Resources

Maths Pad - Coordinate Grid interactive for 2 teams

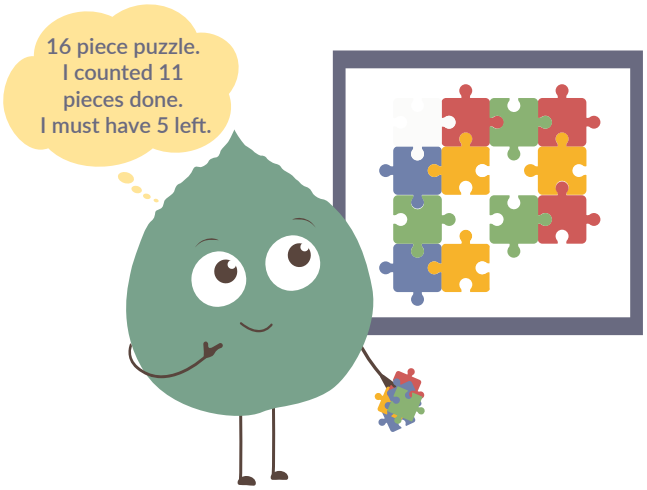
References

IXL Learning. (n.d.). *AA.5 Use a rule to complete a table and a graph*. IXL Learning. https://ca.ixl.com/math/grade-5/use-a-rule-to-complete-a-table-and-a-graph

SOLVE

To find a solution or an answer.

4 - 6



Solving requires students to determine a value (or values) that makes the equation or situation true. Often there is more than one way to determine how to **solve** a problem. Students may use different strategies or approaches to arrive at the correct response. ***Solving*** becomes a higher level process when students are asked to justify the solution or situation.

The table below shows where solve is included as student action within Alberta's 4-6 Math curriculum.

Grade Level	Learning Outcomes	Skills & Procedures
Grade 4		**Solve** problems using addition and subtraction, including problems involving money. **Solve** problems using multiplication and division. **Solve** problems using equations, limited to equations with one operation. **Solve** problems involving area of rectangles. **Solve** problems involving duration.
Grade 5		**Solve** problems using addition and subtraction, including problems involving money. **Solve** problems using multiplication and division of natural numbers. **Solve** problems requiring addition and subtraction of fractions with common denominators, including improper fractions and mixed numbers. Apply inverse operations to **solve** an equation, limited to equations with one or two operations. **Solve** problems using equations, limited to equations with one or two operations. **Solve** problems involving perimeter and area of rectangles. **Solve** problems involving an arithmetic sequence.

SOLVE

To find a solution or an answer.

4 - 6

Grade Level	Learning Outcomes	Skills & Procedures
Grade 6	Students **solve** problems using standard algorithms for addition and subtraction. Students analyze expressions and **solve** algebraic equations.	**Solve** problems in various contexts using standard algorithms for addition and subtraction. **Solve** problems using multiplication and division, including problems involving money. **Solve** problems involving addition and subtraction of fractions. **Solve** problems using multiplication of a fraction and a natural number. **Solve** problems involving ratios, rates, and proportions. **Solve** equations, limited to equations with one or two operations. **Solve** problems using equations, limited to equations with one or two operations. **Solve** problems involving the areas of parallelograms and triangles. **Solve** problems involving volume of right rectangular prisms. **Solve** problems involving a function.

To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

Illustrative Examples

Skills and Procedures (4N2): ***Solve*** problems using addition and subtraction including problems involving money.

Sample Problem Solving Question:

- Aspen Leaf Elementary had their annual Scholastic Book Fair. The Grade 4C class earned $45.00 in rewards. They want to buy a novel that costs $14.99, and 5 book marks that cost $3.50 each.
- Does the class have enough money to purchase the novel and book marks?
- If so, how much money do they have left? Solve.

Skills and Procedures (6N8): ***Solve*** equations, limited to equations with one or two operations.

Bowling Dilemma Task:
Prior to this learning activity students should have experience with using variables (symbols or letters), and they should understand the concept of balance in an equation.

Materials: chart grid paper (1 per group)

As a class **solve** the following:

1. You want to invite your friends to a bowling competition. You haven't yet decided how many games will be played in the competition, but you are confident that you will play at least 2 games and at most 5 games. There are two bowling sites quite near by, and you are trying to decide which site offers the better deal. At site 1 each person would pay a rate of $3.50 per game plus a one-time $3. 00 fee for shoe rental. At site 2 each person would pay a rate of $4.50 per game, but there is no shoe rental fee. Which site is the better value? Write an algebraic equation to **solve** for each.
2. In your group, create a table of value chart, using the provided chart grid paper.
3. Tell students that they will now be calculating the costs at each site for more than one game. Have students **solve** using the algebraic equations, and record in their table of values chart.
4. As students are working, walk around to the groups and discuss:
   - Is there just one solution?
   - Which site would you pick? Why?

Number of Games	Site 1 ($)	Site 2 ($)
1	3.50(1) + 3 = 6.50	4.50(1) = 4.50
2		
3		
4		
5		

To best support learners, student action verbs should be explicitly taught, modeled and practiced through multiple experiences. The illustrative examples can provide clarification about how student understanding might be developed. It is important to reference the curriculum to view the entire context of the Learning Outcome and related KUSPS.

Additional Resources

University of Waterloo. Problem of the Week.

Hands-On Problem Solving- A Minds On Approach. Jennifer E. Lawson. Portage and Main Press.

References

Ontario Educators. (2008). Patterning and Algebra, Grades 4 to 6.
Grade 6 Learning Activity Bowling Dilemma, 101 - 107.
https://drive.google.com/file/d/1slnZgHjfmtX_rOz5iNFgjDVnMQ40ay4I/view