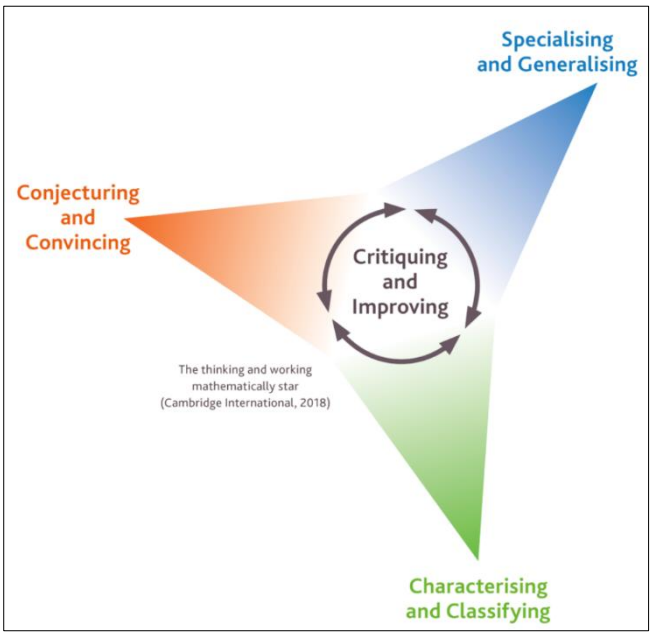
Day 2 AM : Unpacking Teaching and Working Mathematically (TWM)

математикалык ой жүгүртүү жана ишмердик

Recap

Overview of TWM

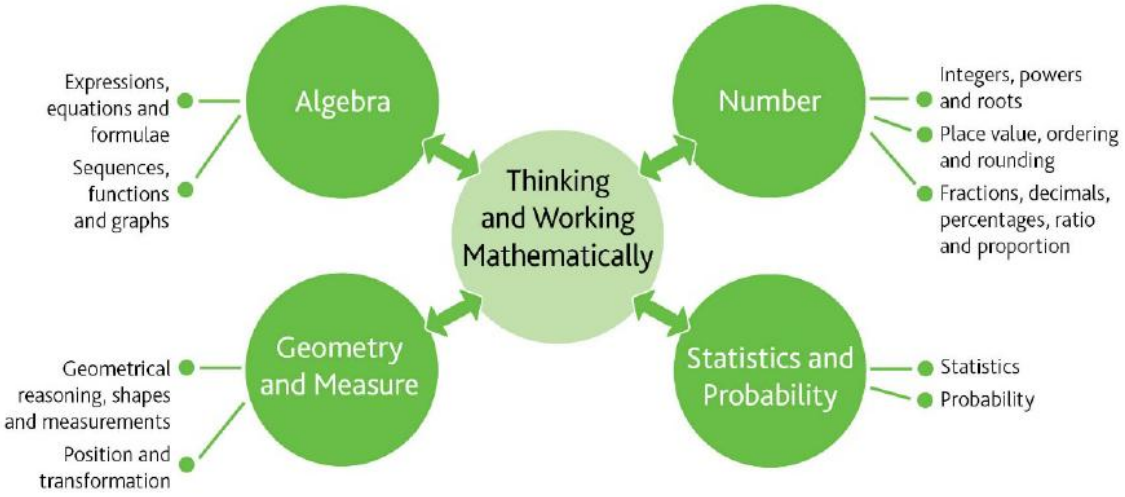
The TWM characteristics are a way of explaining the mathematical processes that mathematicians use when solving problems.



If students can use and apply these from Stage 1 onwards, then they will be well-equipped to reason mathematically rather than just rote learn facts and figures.

Ош

МОИ мүнөздөмөлөрү математиктер маселелерди чечүүдө колдонгон математикалык процесстерди түшүндүрүүнүн бир жолу. Эгерде окуучулар аларды 1-этаптан баштап колдонуп, колдоно алышса, анда алар фактыларды жана цифраларды жаттап албастан, математикалык ой жүгүртүүгө жакшы жабдылган болушат.



You can use the examples shown in G5 and G7 Teacher Guide to show and explain some examples for each TW before taking examples from the Student Book

Сиз G5 жана G7 Мугалимдер үчүн колдонмодо көрсөтүлгөн мисалдарды Студенттик китептен мисалдарды алуудан мурун ар бир TW үчүн айрым мисалдарды көрсөтүү жана түшүндүрүү үчүн колдоно аласыз.

Refer to G5 TG or G7 TG

Explain each of the TWM definition and the key skills involved in the TWM first

G5 TG же G7 TG караңыз

TWM аныктамасынын ар бирин жана алгач TWMге катышкан негизги көндүмдөрдү түшүндүрүңүз

TW.1 and TW.2 : Specialising and Generalising

(Жалпылоо жана адистештирүү)

TWM characteristic	Definition	Key skills
Specialising	Choosing an example and checking to see if it satisfies or does not satisfy specific mathematical criteria	• Choosing specific examples to try • Checking their own examples against criteria • Illustrate specific examples using diagrams or pictures
Generalising	Recognising an underlying pattern by identifying many examples that satisfy the same mathematical criteria	• Analysing similarities and differences to find patterns and rules • Giving examples that meet or do not meet the criteria • Noticing properties or structures

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Students will demonstrate specialising with explanations that involve choosing an example and checking if it meets the criteria.

Refer to G5 TG Page vii

• "If I try a rectangle pen with the sides 5m and 6m the perimeter will be 22 m and the farmer will have fencing left over so I can try making it bigger."

• "If I try a rectangle pen of sides 5 m and 7 m then the perimeter is 24 m and the farmer will not have fencing left over.

G5 TG Example

A farmer has 24 metres of fence to make a pen for his chickens and he wants to give them the most amount of space. What might this chicken pen look like ?

G5 TG Мисал

• "A rectangle pen of sides 5 m and 7 m has a perimeter of 24 m and will give an area of 35 m². A square pen of sides 6 m will also have a perimeter of 24 m but will give a bigger area of 36 m²."

Here students have used their own specific examples chosen to test against the criteria of a perimeter that is 24 m to give the biggest area.

Specialising is often a good start to think about solving a mathematical question - It means considering a simpler or familiar example.
The act of specialising is not to get to an answer as such, but rather to pay attention to what you are doing in order to recognise any relationships that might appear.

Адистештирүү көбүнчө математикалык суроону чечүү жөнүндө ойлонуунун жакшы башталышы болуп саналат - Бул жөнөкөй же тааныш мисалды карап чыгууну билдирет.

Адистештирүүнүн актысы - бул жооп алуу эмес, тескерисинче, пайда болгон мамилелерди тааныу үчүн эмне кылып жатканыңызга көңүл буруу.

At lower level grades, we can use another example

Teacher may tweak the question given in the TG
A farmer has 28 metres of fence to make a pen for his chickens and he wants to give them the most amount of space. What might this chicken pen look like ?

Try : 14 = 6 + 8 . The area = 48
14 = 7 + 7. The area = 49

Students will demonstrate generalising when they make connections between examples that meet the criteria to form rules or patterns. For example:

• “I found that a rectangle of sides 5 m and 7 m and a square of sides 6 m will both give a perimeter of 24 m. But a square of sides 6 m will give a bigger area of 36 m².

So when I have the same perimeter a square gives a greater area.”

Here students have made a connection between their examples to form a generalisation from the pattern.

• «Мен тик бурчтуктун капталдары 5 м жана 7 м жана квадраты 6 м периметри экөө тең 24 м периметрди беререн таптым. Ал эми капталдары 6 м болгон квадрат 36 м² чоңураак аянтты берет.

Ошентип, мен бирдей периметрге ээ болгондо, квадрат чоңураак аянтты берет.

Бул жерде окуучулар үлгү боюнча жалпылоону түзүү үчүн өз мисалдарынын ортосунда байланыш түзүшкөн.

At higher grade level, we can use algebra to generalise

Жогорку класстын деңгээлинде жалпылоо үчүн алгебраны колдоно алабыз

$A = x(12 - x)$

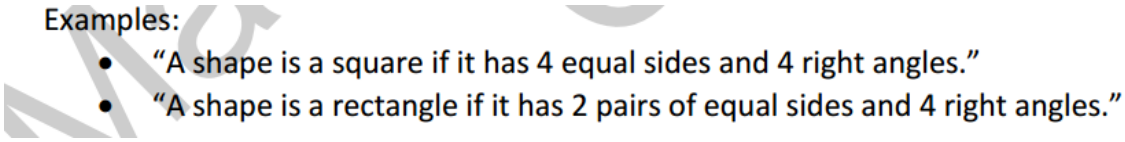
$= -x^2 + 12x = -(x^2 - 12x)$

$= -[(x - 6)^2 - 36]$

$= 36 - (x - 6)^2$

You may also go through G7 TG Example

Сиз G7 TG мисалы аркылуу да өтсөңүз болот


Examples:

- “A shape is a square if it has 4 equal sides and 4 right angles.”
- “A shape is a rectangle if it has 2 pairs of equal sides and 4 right angles.”

Мисал

- Форманын 4 бирдей капталы жана 4 тик бурчтары болсо квадрат болуп саналат
- Фигура тик бурчтук болуп саналат, эгерде анын 2 жуп бирдей капталдары жана 4 тик бурчтары бар

Students practise specialising when they choose a special case that satisfies a mathematical idea.

Студенттер математикалык ойду канааттандырган өзгөчө ишти тандаганда адистешет.

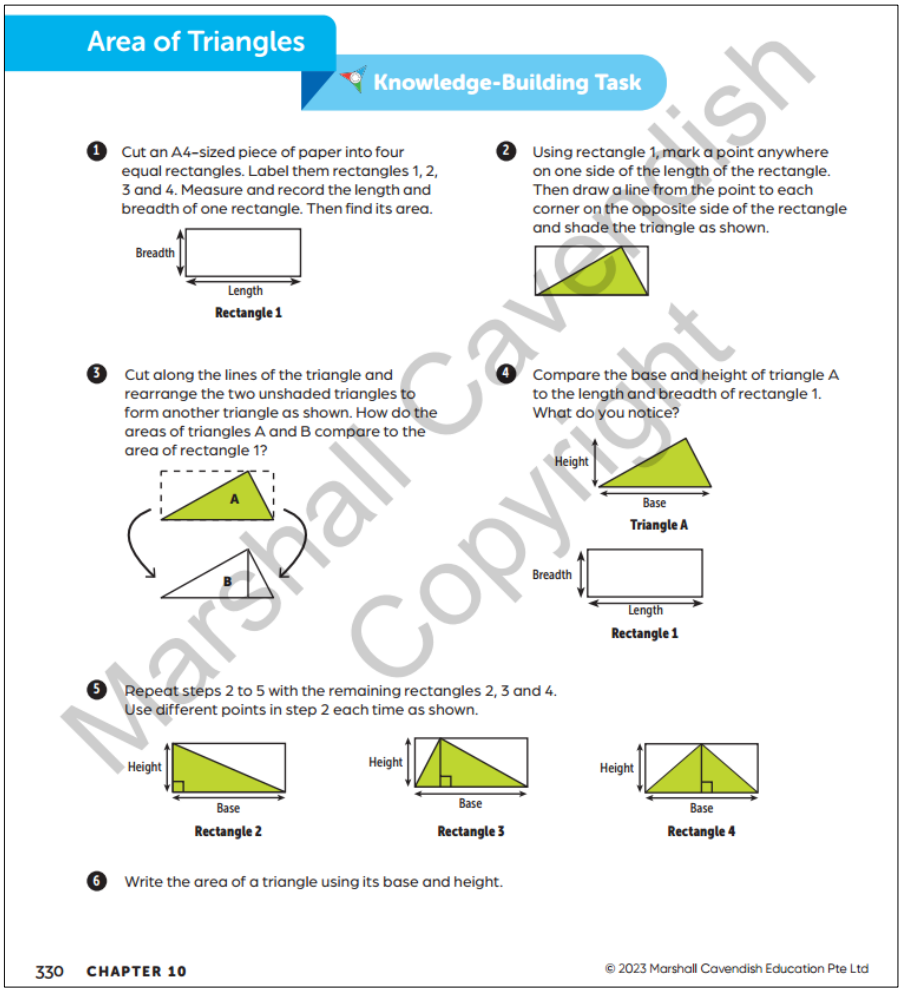
Students practise generalising when they recognise the underlying pattern by identifying **several examples** that satisfy the same mathematical criteria.

Студенттер бир эле математикалык критерийлерге жооп берген бир нече мисалдарды аныктоо аркылуу негизги үлгүнү тааныганда жалпылоону практикалайт.

G7 Student Book Chapter 10.2 Page 330
Hands-on (distribute a rectangular sheet of paper to each participant)

G7 Студенттик китеби 10.2-бөлүм 330-бет

Колдонмо (ар бир катышуучуга тик бурчтуу кагаз таратыңыз)



Area of Triangles

Knowledge-Building Task

1. Cut an A4-sized piece of paper into four equal rectangles. Label them rectangles 1, 2, 3 and 4. Measure and record the length and breadth of one rectangle. Then find its area.

Breadth
Length
Rectangle 1

2. Using rectangle 1, mark a point anywhere on one side of the length of the rectangle. Then draw a line from the point to each corner on the opposite side of the rectangle and shade the triangle as shown.

3. Cut along the lines of the triangle and rearrange the two unshaded triangles to form another triangle as shown. How do the areas of triangles A and B compare to the area of rectangle 1?

A
B

4. Compare the base and height of triangle A to the length and breadth of rectangle 1. What do you notice?

Height
Base
Triangle A

Breadth
Length
Rectangle 1

5. Repeat steps 2 to 5 with the remaining rectangles 2, 3 and 4. Use different points in step 2 each time as shown.

Height
Base
Rectangle 2

Height
Base
Rectangle 3

Height
Base
Rectangle 4

6. Write the area of a triangle using its base and height.

330 CHAPTER 10

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Teacher explains why this activity generalising that the area of a triangle is

Мугалим эмне үчүн бул иш үч бурчтуктун аянты экенин жалпылап түшүндүрөт

==========

TW3 and TW4 : Conjecturing and Convincing

(Болжолдоо жана ынандыруу)

TWM characteristic	Definition	Key skills
Conjecturing	Forming mathematical questions or ideas	• Suggest and discuss conjectures about mathematical concepts • Sharing and taking turns to take account of alternative views or conjectures • Forming statements and questions
Convincing	Presenting evidence to justify or challenge a mathematical idea or solution	• Presenting evidence to explain and convince • Presenting mathematical ideas and solutions along with evidence. • Persuading others using specific evidence • Visualising and drawing diagrams or pictures to convince

Use G5 TG Example
What happens when you add two odd numbers together?

G5 TG мисалын

Students will **demonstrate conjecturing** when they **form their own mathematical question or idea.**

Студенттер өздөрүнүн математикалык суроосун же идеясын түзүшкөндө болжолдоолорду көрсөтүшөт.

For example:

• “I think when you add two odd numbers together, is it always an even number?”

• “I noticed that when I add 5 and 9 it makes 14 which is an even number so I think when I add two odd numbers it will be an even number.

Мисалы:

• "Менимче, эки так санды кошкондо, ал ар дайым жуп сан болобу?"

• «Мен 5 менен 9ду кошкондо 14 жуп экенин байкадым, андыктан эки так санды кошкондо ал жуп сан болот деп ойлойм.

Students will demonstrate convincing when they can suggest or give evidence to justify or challenge a mathematical idea.

For example:

• “I know that all odd numbers are in arrays of pairs but have one left over. So when two odd numbers are put together the one left over makes another pair. That means that two odd numbers will always make numbers that can be in arrays of pairs.”

Can use manipulatives to convince students.

Мисалы:

• "Мен бардык так сандар жуптардын массивдеринде турганын билем, бирок бирөөсү калды. Ошентип, эки так санды бириктиргенде, калганы башка жупту түзөт. Бул эки так сан ар дайым жуп массивдеринде боло турган сандарды түзөт дегенди билдирет."

Окуучуларды ынандыруу үчүн манипуляцияларды колдоно алат.

For higher grade students (Жогорку класстын окуучулары үчүн)

Any odd numbers $N = 2k + 1$ where k is an integer

Two odd numbers $N_1 = 2k_1 + 1$ and $N_2 = 2k_2 + 1$

$N_1 + N_2 = (2k_1 + 1) + (2k_2 + 1)$

$= 2k_1 + 2k_2 + 2$

$= 2(k_1 + k_2 + 1)$ is a multiple of 2

You may select some TWM from the textbook and let your participants try

Сиз окуу китебинен TWM тандап, катышуучуларга аракет кыла аласыз

Group Work and Sharing : G5 Student Book Page 104

Топтук иш жана бөлүшүү : G5 Студенттик китеби 104-бет



Explain that this TWM is conjecturing as she expects to get about equal number of times of head and tail

Explain also that when the number of tosses increases, the number of heads and tails tend to be getting equal – this is Law of Large Number in Probability (for teachers' information)

Бул TWM болжолдуу экенин түшүндүрүңүз, анткени ал баш менен куйруктун бирдей санын күтөт

Ошондой эле, ыргытуулардын саны көбөйгөндө, баштар менен куйруктардын саны бирдей болуп калаарын түшүндүрүңүз – бул ыктымалдуулуктун чоң саны мыйзамы (мугалимдердин маалыматы үчүн)

You can direct your participants to G5 TG Page 105

Сиз катышуучуларыңызды G5 TG 105 бетине багыттасаңыз болот

Lesson development: Anchor Task **C**-P-A **(15 min)**	**Thinking Cap:** • The objective is to have students use their prior knowledge to explore new ideas and possible solutions through critical and creative thinking. • Make use of a coin to flip a few times as an example, or if possible, a computer programme to model flipping a coin 200 times. Students are not expected to solve the problem at this stage. • Repeat the experiment five times and record the results on a board. • Have students form a **conjecture (TWM.03)** by asking: - Caz uses a computer programme to model flipping a coin 200 times. What results can she expect? *(Expected answers: She can expect to get heads and tails about the same number of times. The likelihood of landing on heads and tails is equal, so one can expect to get heads and tails about the same number of times. Accept answers that say about 100 times for heads and about 100 times for tails. Reject answers that say exactly 100 times (See Misconception 1)* • Revisit the problem at the end of the section to get students to apply their newly learned knowledge to solve it.

Group Work G5 SB Page 107(Топтук иш G5 SB 107-бет)

3 Jean uses a digital dice. There is an equal chance that the dice will show either 1, 2, 3, 4, 5 or 6.

Jean rolled the dice 600 times. She recorded the results in a table.

Number	1	2	3	4	5	6
Frequency	99	101	103	97	98	102

Why are the frequencies of the numbers so close to each other?

Students explain that as the probability of each number appearing is $\frac{1}{6}$ (it means out of 6 times, each number will appear once theoretically). So in 600 times, we can conjecture that each number will show 100 times – this conjecture is supported by the theoretical probability of each outcome

Окуучулар ар бир сандын пайда болуу ыктымалдыгы катары түшүндүрүшөт

(6 жолудан, ар бир сан теориялык жактан бир жолу чыгат дегенди билдирет). Ошентип, 600 жолу, биз ар бир сан 100 жолу көрсөтөт деп божомолдосок болот - бул божомол ар бир жыйынтыктын теориялык ыктымалдыгы менен тастыкталат

For info only: The law of large numbers in probability states that as the number of trials of a random experiment increases, the average of the results will get closer to the expected value. Essentially, with sufficiently large number of repetitions of the same experiment, the observed number of outcomes converge towards the theoretical expected number of outcomes.

Ыктымалдуулуктагы чоң сандардын мыйзамы кокустук эксперименттин сыноолорунун саны көбөйгөн сайын натыйжалардын орточо көрсөткүчү күтүлгөн мааниге жакындай турганын айтат. Негизинен, бир эле эксперименттин жетишерлик көп кайталанышы

менен, байкалган натыйжалардын саны теориялык күтүлгөн натыйжалардын санына жакындайт.

You may want to skip this **(Сиз муну өткөрүп жиберсеңиз болот)**

“Knowledge at the mathematical horizon" a concept developed by Deborah Loewenberg Ball and colleagues at University of Michigan USA, refers to a teacher's awareness of how mathematical topics connect and build upon each other across the broader curriculum. It's a type of mathematical knowledge that goes beyond the specific content being taught in a particular lesson and encompasses an understanding of the bigger picture of mathematics.

“Математикалык горизонтто билим “ концепциясы Дебора Ловенберг Болл жана АКШнын Мичиган университетиндеги кесиптештери тарабынан иштелип чыккан, мугалимдин математикалык темалар кеңири окуу планы боюнча бири-бири менен кантип байланышып, бири-бирине негиздерин түшүнүүсүн билдирет. Бул белгилүү бир сабактын мазмунун жана сүрөтүн түшүнүү менен чектелбеген математикалык билимдин бир түрү. математикадан.

You do your own translation if you need (Керек болсо өзүңүздүн котормоңузду жасайсыз)

- **Beyond the Classroom:**

Horizon knowledge isn't just about knowing the material for the current lesson. It's about understanding how that material relates to what students will learn in the future and how it connects to what they've already learned.

- **Big Picture Understanding:**

It involves seeing the "forest" of mathematics, not just the "trees" of individual topics. For example, a teacher with strong horizon knowledge would understand how the concept of fractions connects to algebra, or how geometric shapes relate to measurement.

- **Impact on Teaching:**

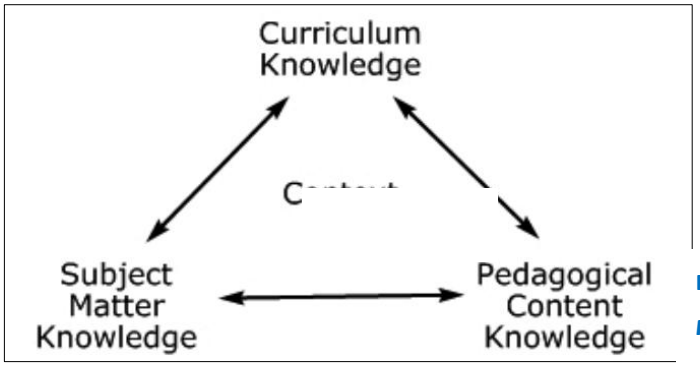
Teachers with strong horizon knowledge can make more informed decisions about lesson planning, explanations, and addressing student misconceptions. They can anticipate where students might struggle and provide a more coherent and connected learning experience.

Can go through this to emphasise the good teaching is the result of having sound curriculum knowledge, pedagogical knowledge and subject matter knowledge because they are all inter-related

Окутуунун жакшы экендигин баса белгилөө үчүн ушундан өтсө болот, бул так программалык билимдин, педагогикалык билимдин жана предметтик билимдин натыйжасы, анткени алардын баары бири-бири менен байланышкан.

окуу программасы

боюнча билим



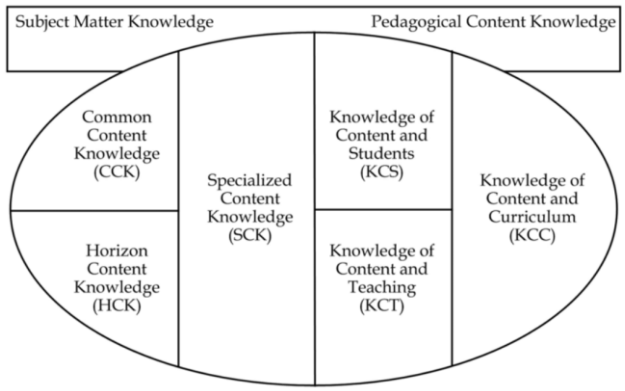
педагогиканын мазмунун билүү

предметтик билим

Skip this

Practice-based Framework of Mathematical Knowledge for Teaching (MKT)

Окутуу үчүн математикалык билимдердин практикалык негиздери (MKT)



Domains of Mathematical Knowledge for Teaching (MKT) by Ball et al. (2008)

TWM 5 and 6 : Characterising and Classifying

(Мүнөздөө жана классификациялоо)

Likewise explain the definition and the associated skills that giving rise to TWM

Ошо сыяктуу эле, TWMди пайда кылган аныктаманы жана ага байланыштуу көндүмдөрдү түшүндүрүңүз

TWM characteristic	Definition	Key skills
Characterising	Identifying and describing the mathematical properties of an object	• Comparing objects by their similarities and differences • Defining objects using their characteristics • Identifying properties or characteristics • Analysing and discussing mathematical characteristics
Classifying	Organising objects into groups according to their mathematical properties	• Placing objects, shapes or numbers into groups or classifications • Organising objects, shapes or numbers by their properties

Use the example in G7 TG
Is a rhombus sometimes, always or never a square?

ТГдагы мисалды

Students will **demonstrate characterising** when they **identify and describe** the **mathematical properties** of shapes, objects or numbers.

Студенттер фигуралардын, нерселердин же сандардын математикалык касиеттерин аныктап, сүрөттөп жатканда мүнөздөмөлөрдү көрсөтө алышат.

For example:

• “A rhombus has 4 straight sides that are the same length and opposite angles are the same.
A square has 4 straight sides that are the same length and opposite angles that are the same.”

• “But a square always has 4 right angles and a rhombus does not have to have 4 right angles.”

• “I noticed that a rhombus might sometimes be a square if the opposite angles are also right angles.”

G5 TG Example
How might you classify both rhombuses and squares in the same group?

Students will demonstrate **classifying** when they **organise** objects, shapes or numbers **according to their mathematical properties**.

Студенттер предметтерди, фигураларды же сандарды математикалык касиеттерине жараша иретке келтиргенде классификацияны көрсөтүшөт.

For example:

• “Rhombuses are quadrilateral shapes because they have 4 straight sides and are closed shapes. Squares are also quadrilateral shapes because they also have 4 straight sides and they are equal.

A square is a special rhombus

Мисалы:

• «Ромбулар төрт бурчтуу фигуралар, анткени алардын 4 түз тарабы бар жана жабык фигуралар.Квадраттар да төрт бурчтуу фигуралар, анткени алардын да 4 түз тарабы бар жана алар бирдей.

Чарчы - бул өзгөчө ромб

Example

Sort these shapes by characteristics they have in common – square, kite, pentagon.

A square is a 2D shape with four equal straight sides. It has four angles that are all right angles.

A kite is a 2D shape with four straight sides. It has two pairs of equal-length sides that are adjacent to each other. The diagonals cross at right angles.

I **classify** kites and squares into one group – quadrilaterals – because they have four sides and four angles.

TW7 and TW8 : Critiquing and Improving (Сындоо жана жакшыртуу)

TWM characteristic	Definition	Key skills
Critiquing	Comparing and evaluating mathematical ideas, representations or solutions to identify advantages and disadvantages	• Comparing solutions • Evaluating mathematical ideas, representations or solutions • Identifying and reasoning through advantages and disadvantages
Improving	Refining mathematical ideas or representations to develop a more effective approach or solution	• Refining mathematical solutions, ideas or representations • Creating a more effective approach or solution • Correcting errors or misconceptions and explaining why or how

G7 TG Example (G7 TG Мисал)

Example:

- Jim says, "The surface area of a cuboid of dimensions 4 cm by 2 cm by 1 cm is 8 cm^2."
- I disagree with Jim. I can draw a net of this cuboid. From the net, I see that the surface area of the cuboid is the sum of the areas of its 6 faces, which is $4 \times 2 + 2 \times 1 + 1 \times 4 + 4 \times 2 + 2 \times 1 + 1 \times 4 = 8 + 2 + 4 + 8 + 2 + 4 = 28$ cm^2.

Invite student to comment on what Jim says.

Students practise critiquing when they compare and evaluate ideas, solutions or representations by identifying advantages and disadvantages.

Окуучуну Джимдин айткандарына комментарий берүүгө чакыр.

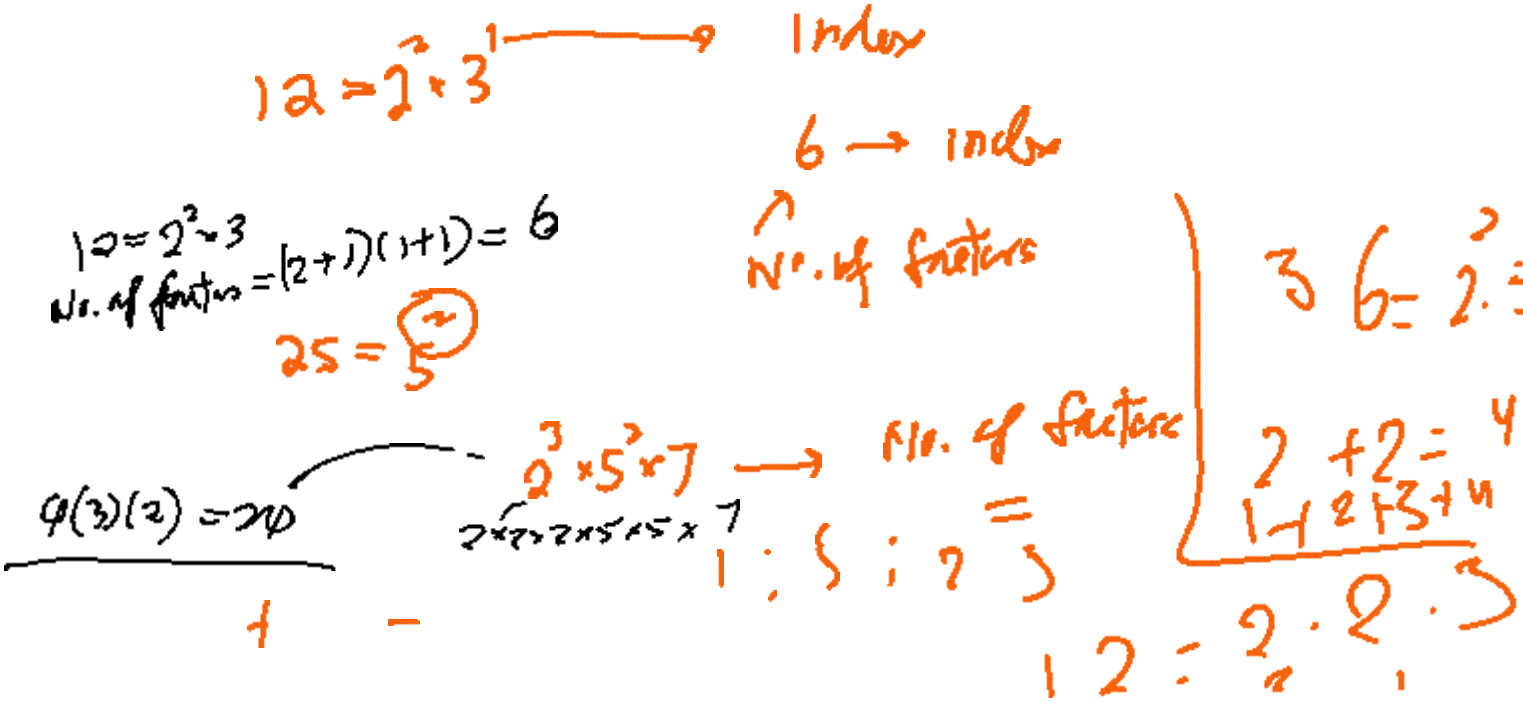
Студенттер артыкчылыктарды жана кемчиликтерди аныктоо аркылуу идеяларды, чечимдерди же өкүлчүлүктөрдү салыштырып, баалаганда сынга машыгышат.

Example:

- "Opposite faces of a cuboid have the same area. There are 3 sets of opposite faces in a cuboid. Therefore, we can work out the surface area of the cuboid of dimensions 4 cm by 2 cm by 1 cm this way: $2 \times (4 \times 2 + 2 \times 1 + 1 \times 4) = 2 \times (8 + 2 + 4) = 2 \times 14 = 28$ cm^2."

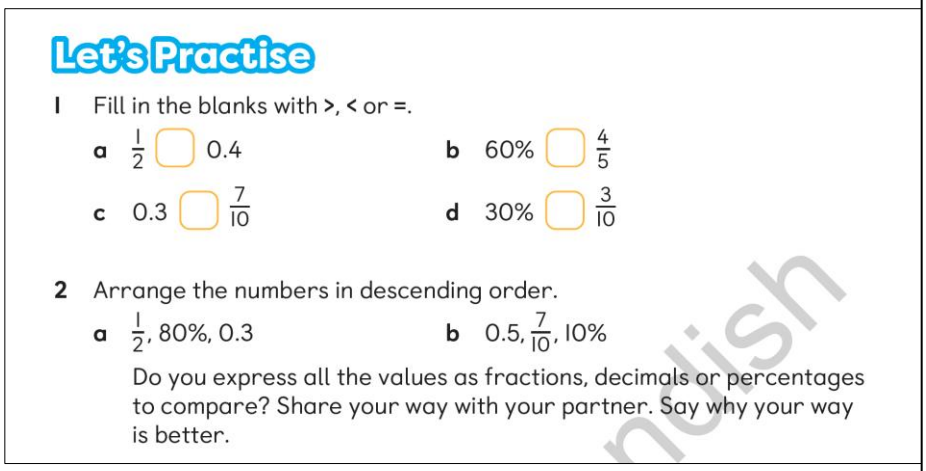
Students practise improving when they suggest a refinement to a mathematical approach, idea, solution or even a diagram

Студенттер математикалык ыкманы, идеяны, чечимди, жада калса диаграмманы тактоону сунушташканда, жакшыртышат.



Group work : Look at G5 Chapter 12 Section F Page 166

Топтук иш: G5 12-бөлүм F бөлүмүн караңыз 166-бет



Let's Practise

1 Fill in the blanks with >, < or =.

a $\frac{1}{2}$ ☐ 0.4 b 60% ☐ $\frac{4}{5}$

c 0.3 ☐ $\frac{7}{10}$ d 30% ☐ $\frac{3}{10}$

2 Arrange the numbers in descending order.

a $\frac{1}{2}$, 80%, 0.3 b 0.5, $\frac{7}{10}$, 10%

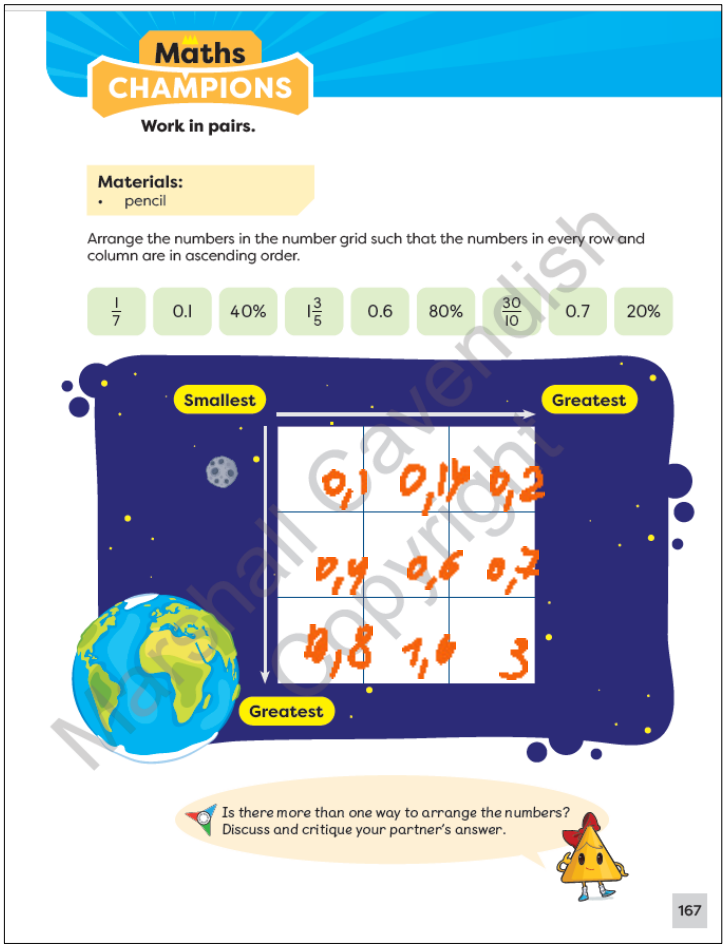
Do you express all the values as fractions, decimals or percentages to compare? Share your way with your partner. Say why your way is better.

Instruct students to comment on the method

There are TWM opportunities though there is no indication – our views can be different from the writer's views or interpretations

TWM мүмкүнчүлүктөрү бар, бирок эч кандай көрсөткүч жок - биздин көз караштарыбыз жазуучунун көз карашынан же чечмелөөсүнөн айырмаланышы мүмкүн

Group work G5 SB Page 167



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Discuss if there is any TWM students can tap on to solve the problem.

Critique: using decimals or fractions ?

using fractions – need to create common denominator – here we use decimals

$\frac{1}{7} = 0.142$, 0.1 , 0.4 , $1\frac{3}{5} = 1.6$, 0.6 , 0.8, 3, 0.7 , 0.2

Arranging the numbers in increasing order:

0.1, 0.142, 0.2, 0.4, 0.6, 0.7, 0.8, 1.6, 3

Smallest : 0.1 and Largest : 3

Сын: ондуктарды же бөлчөктөрдү колдонуу?

Сын : бөлчөктөрдү колдонуу - жалпы бөлүүчү түзүү керек

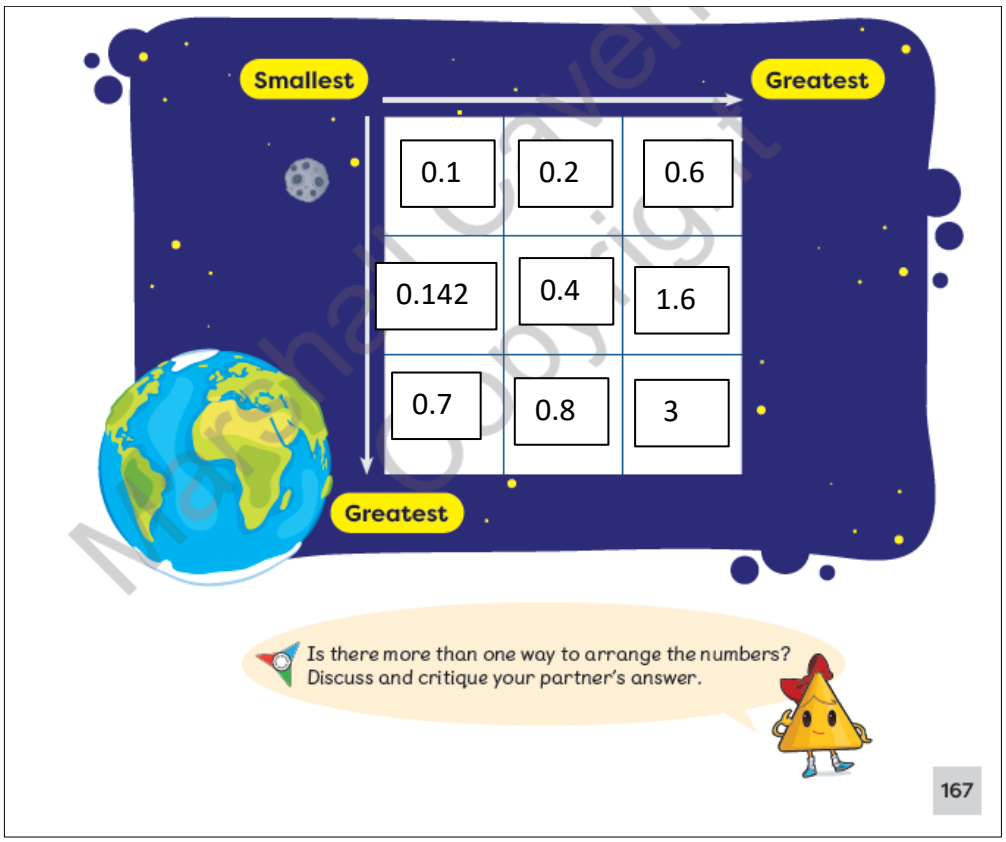
, 0,1 , 0,4 , , 0,6 , , 3, 0,7 , 0,2

Сандарды көбөйтүү иретинде жайгаштыруу:

0,1, 0,142, 0,2, 0,4, 0,6, 0,7, 0,8, 1,6, 3

Эң кичинеси: 0,1 жана эң чоңу: 3

TWM: Critiquing and Improving



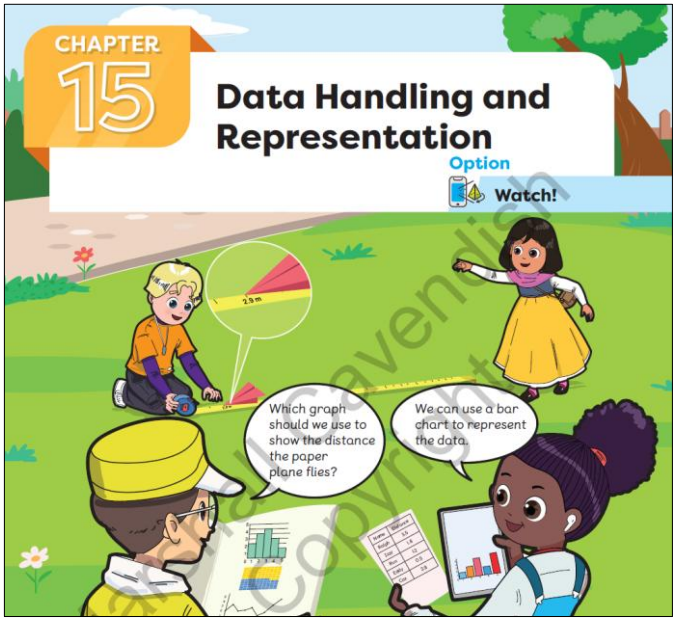
Ask if there is Alternative answer ?

Эгерде альтернативалуу жооп барбы?

0.1	0.142	0.6
0.2	0.4	0.8
0.7	1.6	3

G5 Chapter 15 – Data Handling Page 200

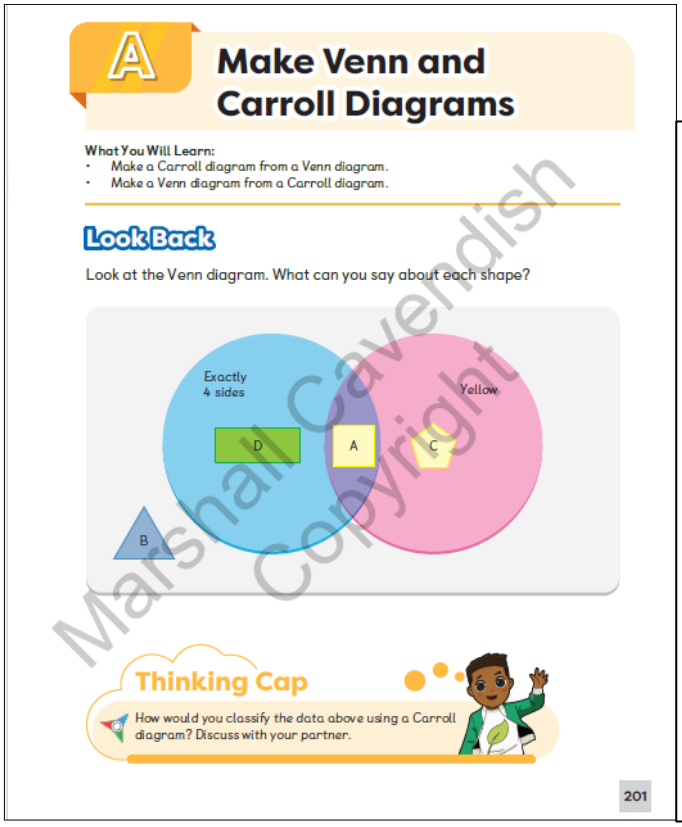
G5 15-бөлүм – Маалыматтарды иштетүү бет 200



The student Izzy commented that a bar chart can be used to represent the data. Teachers can ask a student if he/she is convinced - highlight that students practice "**convincing**" if a student is able to provide reasons to justify his/her answer.

Студент Иззи штрих диаграмма маалыматтарды көрсөтүү үчүн колдонулушу мүмкүн деп комментарий берди. Мугалимдер студенттен анын ишенгендигин сурай алат - эгерде студент өзүнүн жообун негиздөө үчүн жүйө келтире алса, студенттер "ынандыруу" көнүгүүлөрүн баса белгилегиле.

Another opportunity Page 201



A Make Venn and Carroll Diagrams

What You Will Learn:
- Make a Carroll diagram from a Venn diagram.
- Make a Venn diagram from a Carroll diagram.

Look Back

Look at the Venn diagram. What can you say about each shape?

Thinking Cap

How would you classify the data above using a Carroll diagram? Discuss with your partner.

201

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Conversion from Venn diagram to a Caroll diagram

Invite a student to draw the Caroll diagram

Students practising “classifying”

Венн диаграммасынан Кэролл диаграммасына которуу

Окуучуну Кэролл диаграммасын тартууга чакыр

Студенттер "классификациялоо"

Lesson Development: Anchor Task **C**-P-A **(10 min)**	**Thinking Cap** • The objective is to have students use their prior knowledge to explore new ideas and possible solutions through critical and creative thinking. • Prepare cut-outs of the shapes, the Venn diagram and an empty Carroll table. • Students are not expected to solve the problem at this stage. • Have students practise **classifying (TWM.06)** the shapes using a Carroll diagram by asking: - What columns and rows can be in the Carroll diagram? *(Suggested answer: The columns can be “With four sides” and “Without four sides” and the rows can be “Yellow” and “Not yellow”.)*

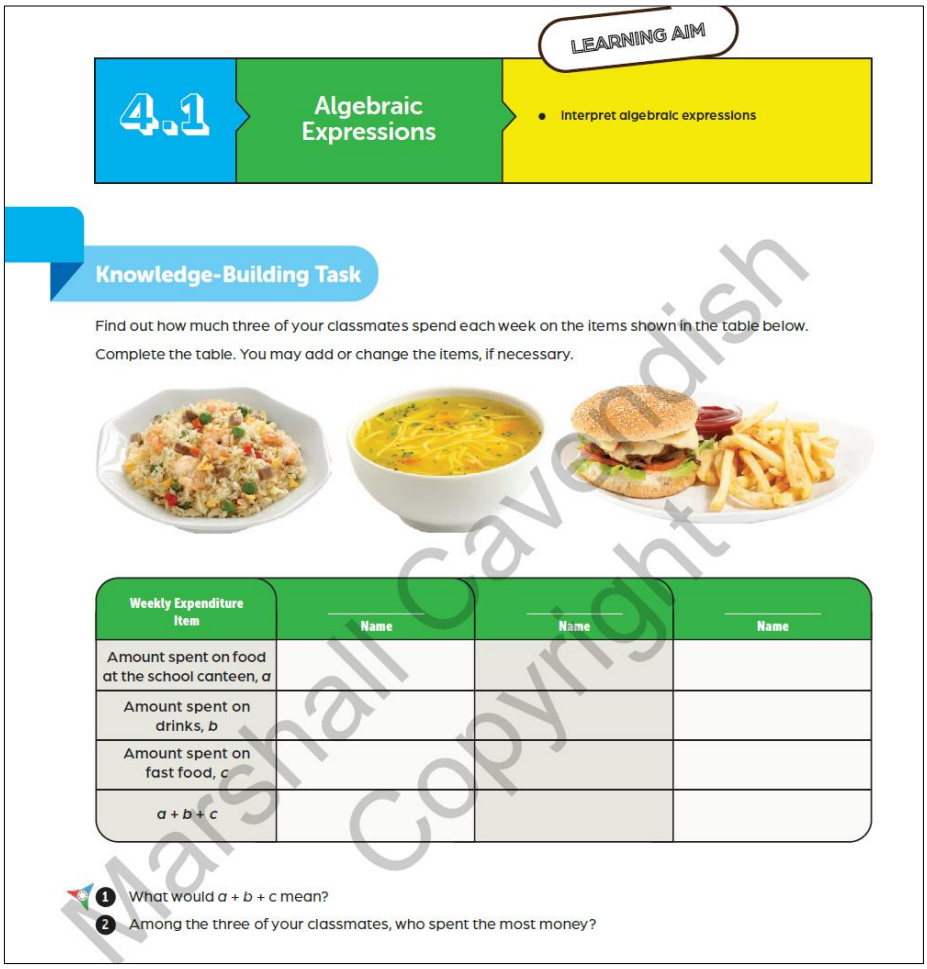
	With four sides	*Without four sides*
Yellow	*Shape A (square)*	*Shape C (pentagon)*
Not yellow	*Shape D (rectangle)*	*Shape B (triangle)*

Ask students to come up to the board to move the shapes into the correct sections of the Carroll diagram. This provides them a concrete experience to base their learning on.

You may want to ask the following questions for challenge/extension:
- What information can you get from both Venn and Carroll diagrams? *(Expected answer: Both of these are used to sort data based on what is the same and what is different.)*

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G7 SB Page 107 (G7 SB 107-бет)



LEARNING AIM

4.1 Algebraic Expressions

- Interpret algebraic expressions

Knowledge-Building Task

Find out how much three of your classmates spend each week on the items shown in the table below.
Complete the table. You may add or change the items, if necessary.

Weekly Expenditure Item	Name	Name	Name
Amount spent on food at the school canteen, a			
Amount spent on drinks, b			
Amount spent on fast food, c			
$a + b + c$			

1. What would $a + b + c$ mean?
2. Among the three of your classmates, who spent the most money?

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Discuss and share

Make students realise that a, b and c are variables in Algebra and they represent **generalised numbers**

Students practise characterising the variables a, b and c when they identify what a, b and c represents. They classify a + b + c as the total cost

Талкуу жана бөлүшүү

Окуучуларга алгебрада a, b жана c өзгөрмөлөр экенин жана алар жалпыланган сандарды билдирерин түшүнсүн

Студенттер a, b жана c өзгөрмөлөрү эмнени билдирерин аныктоодо a, b жана c өзгөрмөлөрүн мүнөздөөгө машыгышат. Алар a + b + c жалпы чыгым катары классификацияланат

G7 SB Page 108 **(G7 SB 108-бет)**

In the table shown on the previous page, the letters *a*, *b* and *c* are used to represent the amount of money spent on different items.

This use of letters to represent objects and numbers belongs to a branch of mathematics called **algebra**.

In arithmetic, we use numbers; in algebra, we use letters to represent numbers which may vary.

Note! Algebra was invented by Mohammad bin Musa Al-Khawarizmi around 830 AD. Use the Internet to search for the origins of the first algebra book in Arabic.

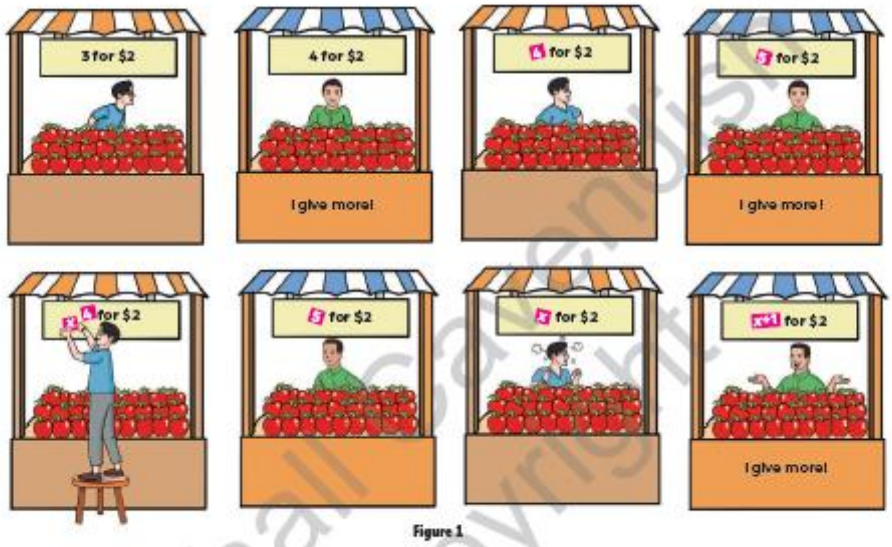


Figure 1

In algebra, we use letters to denote unknown numbers or variables. The letter can represent any number like 5, 3.5, $1\frac{1}{2}$ and 103.4.

In Figure 1, x is used to denote an unknown number of apples. However, we may use any letter to represent the unknown number of apples.

An **algebraic expression** consists of variables and numbers connected by some operations.

Note! Do not use the same letter for different unknowns!

In Figure 1, how does $x + 1$ (read as 'x plus 1') compare to x?

Ask participants to discuss and share: What can a teacher ask the students ?

Students practise generalising if they can explain that x + 1 is 1 more than x where x is a variable (unknown number)

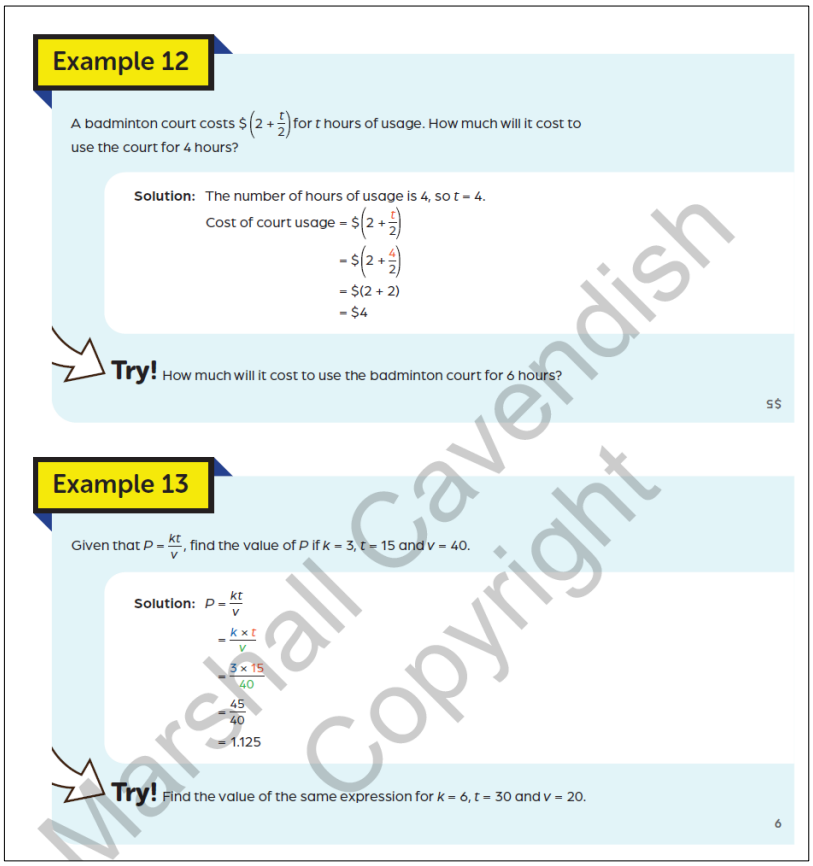
Катышуучуларды талкуулоону жана бөлүшүүнү сураныңыз: Мугалим окуучулардан эмне сурашы мүмкүн?

Студенттер жалпылоону практикалайт, эгерде алар x + 1 x өзгөрмөсүнө караганда 1ге көп экенин түшүндүрө алышса, анда x өзгөрмө (белгисиз сан)

Invite students to explain the difference between specialising and generalising

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G7 SB Page 119



Example 12

A badminton court costs $\$\left(2+\frac{t}{2}\right)$ for t hours of usage. How much will it cost to use the court for 4 hours?

Solution: The number of hours of usage is 4, so $t = 4$.

Cost of court usage $= \$\left(2+\frac{t}{2}\right)$

$= \$\left(2+\frac{4}{2}\right)$

$= \$(2 + 2)$

$= \$4$

Try! How much will it cost to use the badminton court for 6 hours?

$6

Example 13

Given that $P = \frac{kt}{v}$, find the value of P if $k = 3$, $t = 15$ and $v = 40$.

Solution: $P = \frac{kt}{v}$

$= \frac{k \times t}{v}$

$= \frac{3 \times 15}{40}$

$= \frac{45}{40}$

$= 1.125$

Try! Find the value of the same expression for $k = 6$, $t = 30$ and $v = 20$.

6

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Discuss

During lesson, apart from going through and explain the steps, what else can we ask students?

Талкуу

Сабак учурунда кадамдарды басып өтүп, түшүндүрүүдөн тышкары, студенттерден дагы эмне сурасак болот?

Eg:

(a) What does t represent in the algebraic expression $2 + \frac{t}{2}$?

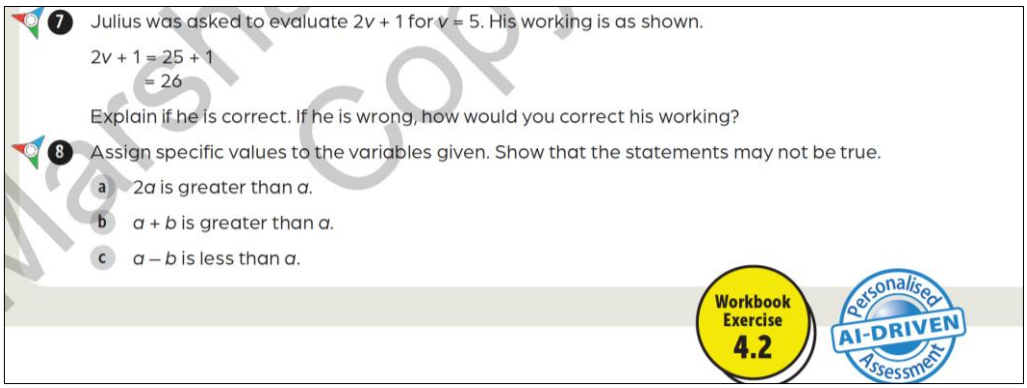
Can t be a negative value ? Why ? [No, t represent time]

(b) What can we say about $p = \frac{kt}{v}$? What TWM is this ? [Generalising]

What is the difference between $p = \frac{kt}{v}$ and $2 + \frac{t}{2}$?

[It is a general equation relating the variables p, l, t and v]

G7 SB Chapter 4 Page 120 (G7 SB 4-бөлүм 120-бет)



7 Julius was asked to evaluate $2v + 1$ for $v = 5$. His working is as shown.

$2v + 1 = 25 + 1$
$= 26$

Explain if he is correct. If he is wrong, how would you correct his working?

8 Assign specific values to the variables given. Show that the statements may not be true.

a $2a$ is greater than a.

b $a + b$ is greater than a.

c $a - b$ is less than a.

Workbook Exercise 4.2

Personalised AI-DRIVEN Assessment

Discuss Q7 and Q8

(a) What TWM students are practising ?

(b) Any common mistakes or misconceptions students may make ?

(c) Can we make the statements true ?

Q7 жана Q8 талкуулагыла

(а) TWM студенттери кандай машыгууда?

(б) Студенттер кетириши мүмкүн болгон ар кандай жалпы каталар же туура эмес түшүнүктөр?

(в) Биз айтылгандарды чын кыла алабызбы?

Look at TG

Estimated Time	Resources Required	Instructional Strategies
	• Student's Book, Practice 4B, p. 120 • Workbook Exercise 5.2 • Personalised Digital Assessment* 4.2 • Workbook Activity 4D • Workbook Activity 4E	***Additional Practice*** • If time allows, have students work on the questions in Practice 4B. If not, these questions can be assigned as homework together with the exercise in the Workbook. • In Question 7, students practise **critiquing (TWM.07)** and **improving (TWM.08)** when they can identify the mistake in the working and provide the correct solution. • In Question 8, students practise **specialising (TWM.01)** when they can use examples to show that the statements may not be true. • Allow students some time to work on Activity 4E in the workbook. Students practise **generalising (TWM.02)** when they can recognise the patterns. • For students who require more practice to master the concept(s) or more challenge, assign them the personalised digital assessment*. **For Support** • Note that in algebra, xy mean $x \times y$ but in arithmetic, xy mean $10 \times x + y$. For example, 23 is $10 \times 2 + 3$. Thus in substitution, there is a need to include multiplication symbol. The order of operation in arithmetic should be followed. **For Challenge** • Challenge students to substitute values to evaluate more complicated expressions. (a) $\frac{1}{xy+2}$ (b) $xy - \frac{x}{y}$ (c) $\frac{x}{y}(y + xy)$

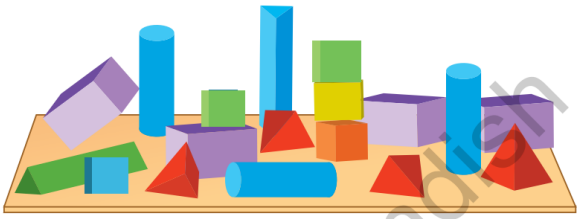
During lesson : Invite students to share and explain their answers.

Сабак учурунда : Студенттерди жооптору менен бөлүшүүгө жана түшүндүрүүгө чакырыңыз.

Group Work G5 SB Page 90 (Топтук иш G5 SB 90-бет)

Let's Practise

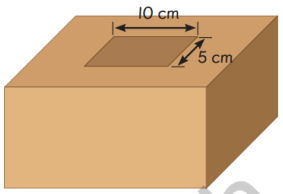
1 Anna has some playing blocks in different shapes. Classify and count the number of shapes.

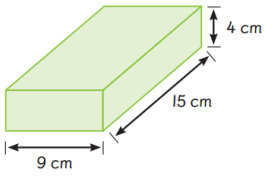


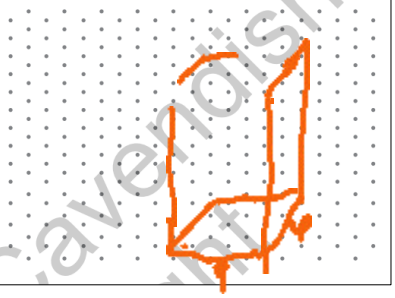
3D shape	Number	Describe the 3D shape
Cube		
Cuboid		
Pyramid		
Prism		
Cylinder		

3 A box with a hole measuring 10 cm by 5 cm is used for a game in which different-shaped solids must be oriented to fit into the hole.

Sketch an orientation of the cuboid that will fit into the hole. Explain why it will fit.



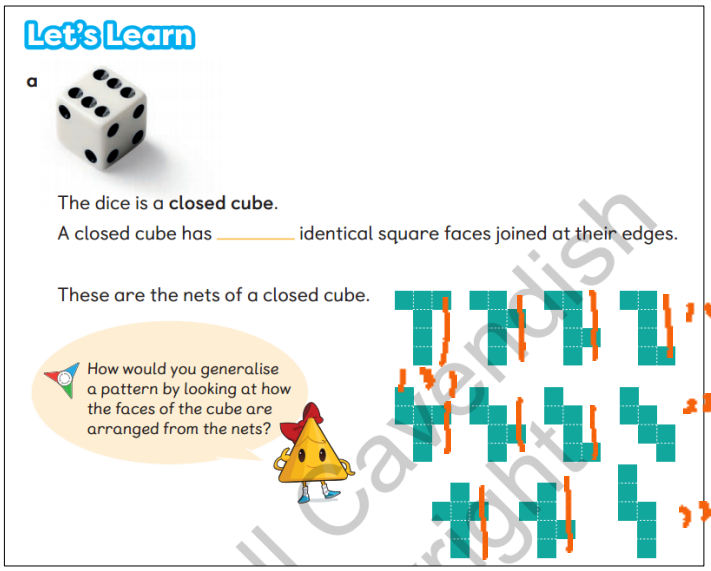




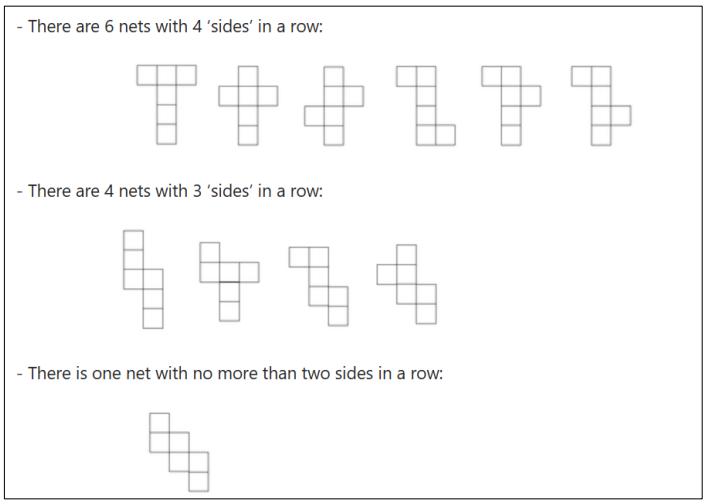
Lesson Development: Independent Practice (15 min)	**Let's Practise** • Allow students to try the questions independently. Assess students as they work and give assistance if help is required. • Go through the questions and encourage students to explain their answers. Have students check if their answers are reasonable. Select students who have different answers and have the rest of the class discuss if it can be an alternative answer. - (1) This question requires students to identify 3D shapes. Have students recall the different 3D shapes and look out for the different orientations they can be in. Then, let students practise **classifying (TWM.06)** by sorting the blocks in the diagram and describe the shapes. - (2) This question requires students to sketch 3D shapes. Have students practise **specialising (TWM.01)** by checking that the length of the cubical box is twice as long as the other box in their sketches. - (3) This question requires students to sketch 3D shapes. Have students practise **convincing (TWM.04)** by explaining to their partners why their orientation can fit into the hole. Get them to identify which face of the solid can fit into the hole of the box by comparing the dimensions of the faces. - (4) This question requires students to sketch 3D shapes. Remind students to join the adjacent dots when sketching the solids. • Make a note of the gaps in students' understanding. Revisit the sections they need more help with.

Marshall Cavendish

Group Work G5 Page 92 (10 -15 mins) Топтук иш G5 92-бет (10 -15 мүн.)



Can you classify the nets? Торлорду классификациялай аласызбы?



Answers : 1-4-1 (6 of them)
2-3-1 (3 of them)
2-2-2 (1 of them)
3-3 (1 of them)

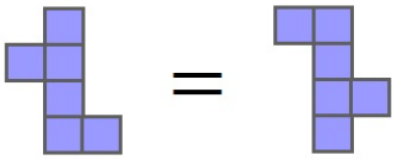
Жооптор: 1-4-1 (алардын ичинен 6)

2-3-1 (анын ичинен 3)

2-2-2 (анын ичинен 1)

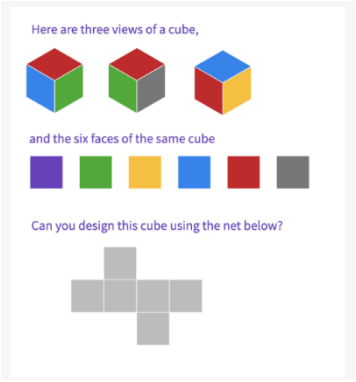
3-3 (анын ичинен 1)

Ask students to comment why (Студенттерден эмне үчүн комментарий берүүсүн сураныңыз)



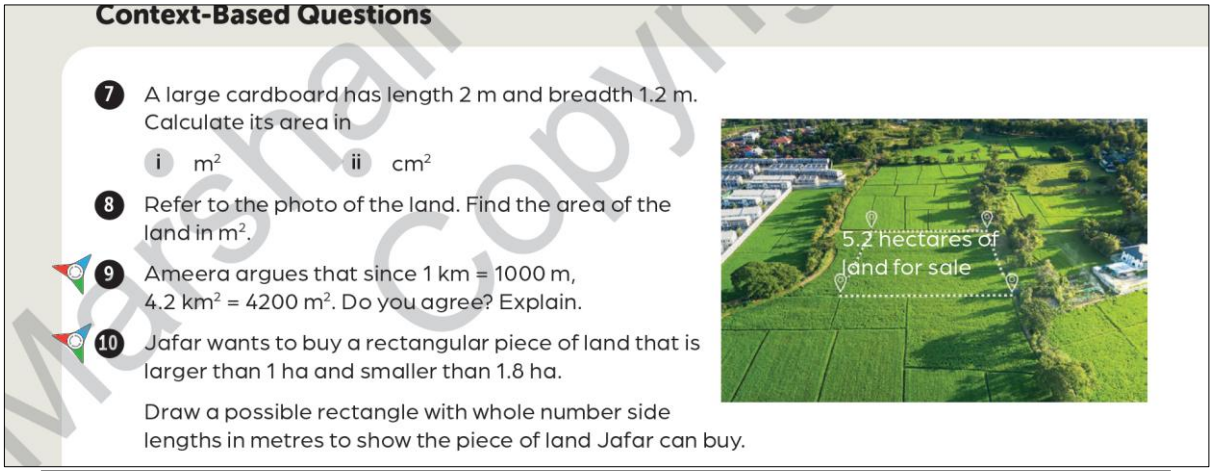
Same, 180° rotation **Ошол эле, 180о айлануу**

Optional question (Кошумча суроо)



To maximize the volume you can enclose with a given amount of material (represented by surface area), the sphere is the best shape to use.

G7 SB Page 329 Q9 and Q10 G7 SB Page 329 Q9 жана Q10

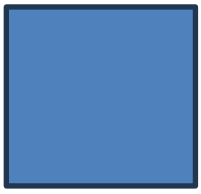


Q9

1 km = 1000 m so 1 km^2 = 1000^2 m^2

4.2 km^2 = 4.2 1000000 = 4.2 10^6 = 4200000 m^2

Invite the class to explain why Ameera is wrong.



1 km = 1000 m

TWM improving (it can mean getting the right answer)

Q9

1 км = 1000 м, ошондуктан 1 км2 = 10002 м2

4,2 км2 = 4,2 ⍰ 1000000 = 4,2 ⍰ 106 = 4200000 м2

Классты Амера эмне үчүн туура эмес экенин түшүндүрүүгө чакыр.

Q10

Recall that 1 ha (1 hectare) = 10 000 m^2

5.2 ha = 52 000 m^2



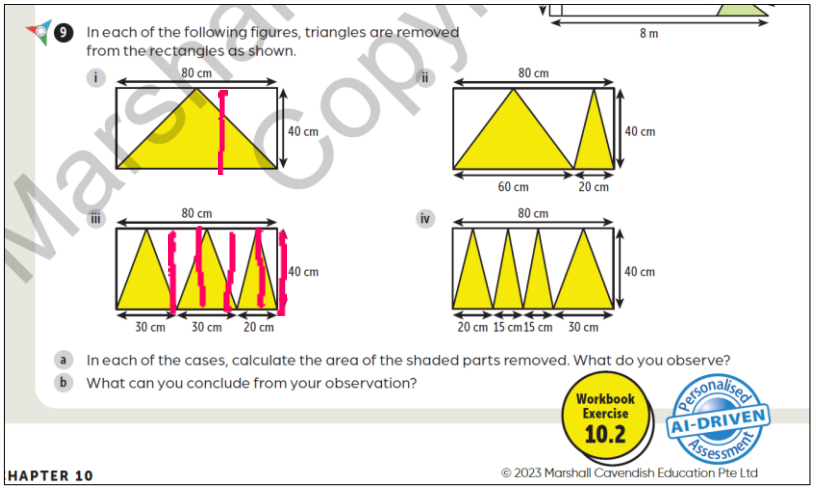
Invite different students to share possible answers with dimensions

Eg Take 1.5 ha = 15 000 m^2 (students must label the length and width with integer values)

10 min	• Student's Book, p. 328	**Example 2** • Pose the problem to students. Use Think-Pair-Share strategy to have students work through the problem. Invite volunteers to share and explain their solution with the class. • Allow students some time to work on the **Try!** question on their own. Have students discuss with their partners, then invite volunteers to share their answers with the class. **Common Misconception** • Students might assume that since 1 m = 100 cm, then 1 m^2 = 100 cm^2. Also, since 1 km = 1000 m, then 1 km^2 = 1000 m^2. Reiterate to students the differences between m and m^2, cm and cm^2, km and km^2 and have them work out the conversion.
	• Student's Book, Practice 10A, p. 329 • Workbook Exercise 10.1 • Personalised Digital Assessment* 10.1	***Additional Practice*** • If time allows, have students work on the questions in Practice 10A. If not, these questions can be assigned as homework together with the exercise in the Workbook. • In Question 9, students practise **critiquing (TWM.07)** and **improving (TWM.08)** when they can identify the mistake in the statement and explain why it is incorrect and how to arrive at the correct answer. • In Question 10, students practice **specialising (TWM.01)** when they can draw a rectangle that is within the boundaries of the area given. • For students who require more practice to master the concept(s) or more challenge, assign them the personalised digital assessment*.

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Question 9(a) Specialising

Question 9(b): Demonstrates specialising (using a few examples) to make a conjecture about a generalisation

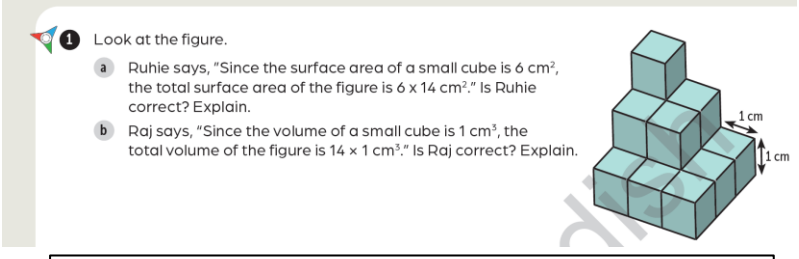
To generalise: In a rectangle, if n triangles are removed as shown, the remaining area is half of the area of the rectangle

Сурoо 9(б): Жалпылоо жөнүндө божомол жасоо үчүн адистештирүүнү (бир нече мисалдарды колдонуу менен) көрсөтөт

Жалпылоо үчүн: тик бурчтукта, эгер көрсөтүлгөндөй n үч бурчтук алынып салынса, калган аймак тик бурчтуктун аянтынын жарымына барабар.

	• Student's Book, Practice 10B, pp. 334-336 • Workbook Exercise 10.2 • Personalised Digital Assessment* 10.2 • Workbook Activity 10A	***Additional Practice*** • If time allows, have students work on the questions in Practice 10B. If not, these questions can be assigned as homework together with the exercise in the Workbook. • In Question 5, students practise **specialising (TWM.01)** when they can apply the formula of the area of triangle and draw two different triangles of the same area. • In Question 9(a), students practise **specialising (TWM.01)** and **characterising (TWM.05)** when they can calculate the area of the parts removed and observe that the areas removed from each figure is the same. • In Question 9(b), students practise **generalising (TWM.02)** and **conjecturing (TWM.03)** when they can conclude and explain why the areas removed from each figure is the same. • For students who require more practice to master the concept(s) or more challenge, assign them the personalised digital assessment*.

SB Exercise 10F Q1b, Q4 Page 354 - 355



(b)The total volume of the solid is made up of 14 unit cubes so the volume is indeed
14 cm^3

Total number of cubes:
1 + 4 + 9 = 14
(a) Students should critique that **there are overlapping and hidden surfaces** so the total surface area is less than 6 x 14 cm^2

Кубдордун жалпы саны:

1 + 4 + 9 = 14

(а) Студенттер кабатталган жана

4 A 4 cm by 4 cm by 4 cm cube is as shown. All the sides of the cube are painted as shown.



a What is the total surface area painted?

b When the cube is dismantled, how many 1-cm cubes are not painted on any sides?

Workbook Exercise 10.6

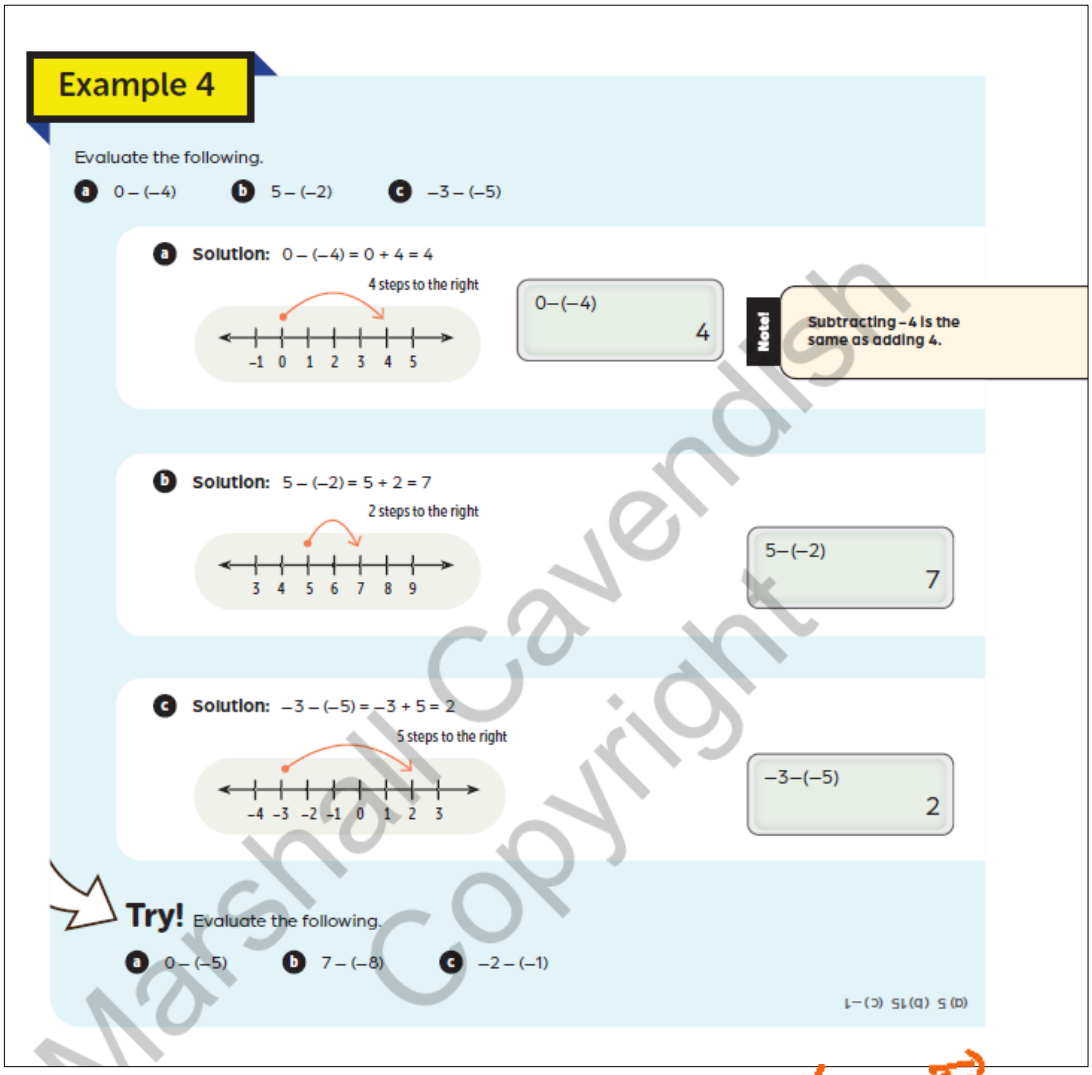
Personalised AI-DRIVEN Assessment

(b)The interior 2 cm by 2 cm cube is not painted.

There are $2^3 = 8$ 1-cm cubes not painted on any sides

Use manipulatives to make conjecture

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Example 4

Evaluate the following.

(a) $0-(-4)$ (b) $5-(-2)$ (c) $-3-(-5)$

(a) Solution: $0-(-4)=0+4=4$

$0-(-4)$ = 4

Note! Subtracting −4 is the same as adding 4.

(b) Solution: $5-(-2)=5+2=7$

$5-(-2)$ = 7

(c) Solution: $-3-(-5)=-3+5=2$

$-3-(-5)$ = 2

Try! Evaluate the following.

(a) $0-(-5)$ (b) $7-(-8)$ (c) $-2-(-1)$

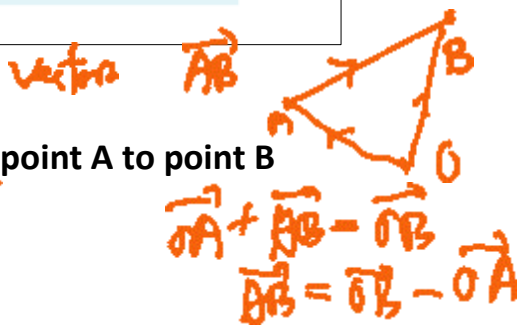
1−(c) 15(q) 5(p)

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We may use the directed number idea

In vectors $\overrightarrow{AB}$ **is the directed line segment from point A to point B**

and $\overrightarrow{AB}=\overrightarrow{OB}-\overrightarrow{OA}$

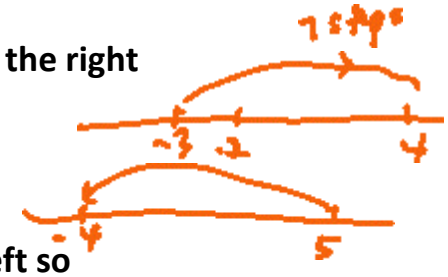


So using the same idea on a number line

Eg 1: 4 – (-3) is the directed distance from -3 to 4

On the number line we see that it is 7 steps towards the right

4 – (-3) = 7



Eg 2: -4 – 5 is the directed distance from 5 to -4

On the number line we see that it is 9 units to the left so

-4 – 5 = -9

Биз багытталган сан идеясын колдоно алабыз

Векторлордо А чекитинен В чекитине багытталган сызык сегмент жана

Ошентип, бир эле ойду сан сызыгында колдонуу

Мисалы, 1: 4 – (-3) -3төн 4кө чейинки багытталган аралык

Сан сызыгында анын оңго карай 7 кадам экенин көрөбүз

4 – (-3) = 7

Мисалы, 2: -4 – 5 - 5тен -4кө чейинки багытталган аралык

Сан сызыгында анын сол жакта 9 бирдик экенин көрөбүз

-4 – 5 = -9

Conclusion and summary

1. **Students need to be reminded if they are using TWM.**
2. **Teachers need to identify and highlight the relevant TWM deliberately**

Корутунду жана корутунду

1. Студенттер TWMди колдонуп жатышканын эскертип туруу керек.

2. Мугалимдер атайылап тиешелүү TWMди аныктап, бөлүп көрсөтүшү керек