8

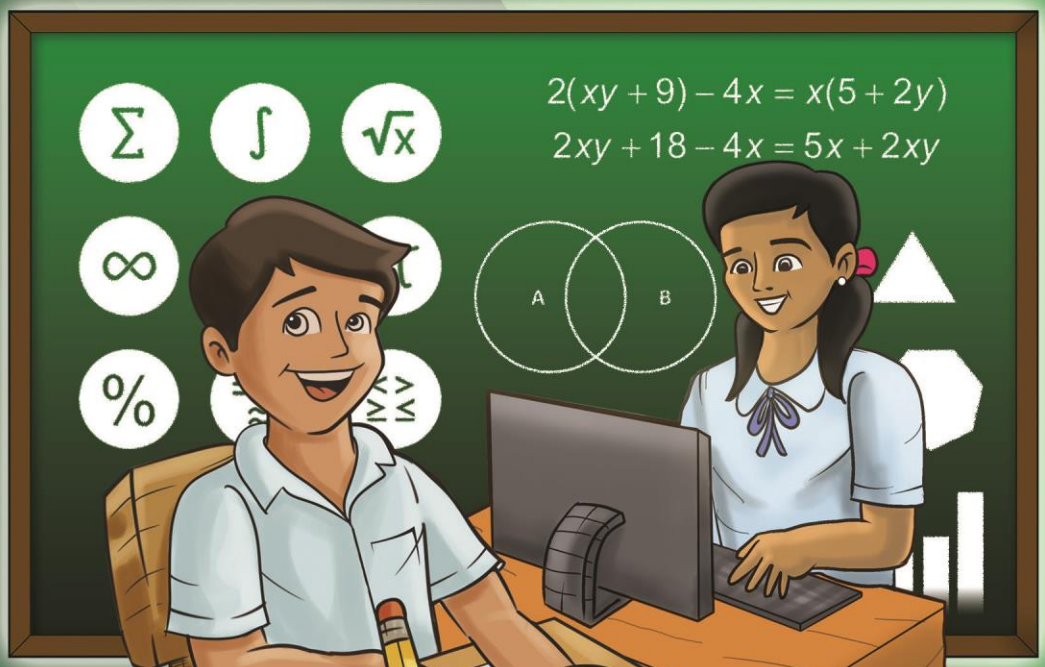
NATIONAL LEARNING CAMP

DepED DEPARTMENT OF EDUCATION

Mathematics

Consolidation Learning Camp

Lesson Plans



Consolidation Learning Camp
Lesson Plan Booklet

Mathematics Grade 8

Weeks 1 to 3

Contents

Dear Reader

Every care has been taken to ensure the accuracy of the information provided in this Booklet. Nevertheless, if you identify a mistake, error or issue, or wish to provide a comment we would appreciate you informing the **Office of the Director of the Bureau of Learning Delivery** via telephone numbers (02) 8637-4346 and 8637-4347 or by email at bld.od@deped.gov.ph

Thank you for your support

National Learning Camp Overview

Overview

The National Learning Camp (NLC) aims to enhance student and teacher learning through interactive lessons based on prior educational content. The program focuses on consolidating student knowledge, updating and expanding teacher expertise, and applying research-based strategies to improve learning teaching outcomes.

The NLC offers grade-level review lessons that are directed by the teacher and designed to be highly interactive among:

(i) students with their teacher; and
(ii) students with their peers.

The Camp lessons are grounded in the 'Science of Learning' framework, focusing on cognitive research and practical applications to enhance learning outcomes. Lessons are structured to reinforce foundational knowledge and skills, involve real-world problem-solving activities, and encourage higher-order thinking. The Camps also offer teachers opportunities for reflection and professional growth, encouraging the adoption of new teaching approaches and the extension of student learning through systematic review and application of knowledge.

Design Basis

A strength of the design is the focus on both student and teacher learning. The intentions and expectations of the NLC are for:

- students to consolidate and enhance their thinking in topics already covered;
- teachers to update, strengthen and expand their subject knowledge in ways that encourage students to be involved in learning activities at different levels including those considered as higher order; and
- teachers to enhance their pedagogical practices by focusing on selected skills, which include 21st century skills.

Under the framework of 'Science of Learning', research-evidence is used to ground teaching and learning decisions around cognition research and features of a learning brain such as working memory demands, cognitive load, valuing errors, and domain specific skills. This framework highlights a *learning-focused approach* where teachers go beyond what might be considered current practice in the Philippines and incorporate brain-based ideas and approaches, including 21st Century skills, to make teaching more effective in enhancing learning for all.

To further support this direction, teachers are provided with resources, time and the opportunity to further extend their skills, knowledge and understandings of teaching and how students learn. The review lessons are designed to apply subject content already encountered by students. Because of this, lessons do not contain repetitive, routine questions of a particular subject aspect.

Review lessons

The review lessons are based on content already encountered by students in their current grade. All lessons *involve an exploration of ideas, concepts and content*. The purpose of the review lessons is two-fold:

(i) to establish in students a stronger basis for future learning development (prior to enrolling in a new Grade after the summer break); and

(ii) to enable teachers to strengthen and enrich their teaching practice in a research-based, learning-focused professional program (prior to a new academic year).

The primary focus of the review lessons concerns revising, clarifying and then applying previously-taught subject content with real-world problem-solving and/or comprehension activities. Each lesson begins by a focused content review and clarification of material needed in the lesson to come. For students, this initial review enables them to practice retrieving and practicing important basics relevant to the lesson to come.

For Teachers this information is designed to help determine learners' subject background knowledge and skills relevant to the lesson as well as help teachers identify where to build on previous learning. This approach is different to 'teaching' students anew as if they have not been taught previously.

Lesson Overview

All lessons in each of the three subjects, English, Mathematics and Science, contain five components. These are 1. Short Review, 2. Purpose/Intention, 3 Language Practice, 4 Activity and 5 Conclusion.

Timing

Approximate component timings are indicated as advice to guide the teacher in pacing the lessons. Time management involves:

- moving through components at a pace that is appropriate for learners;
- ensuring that all components are completed in a timely, efficient and constructive manner.

Research on student-learning quality and 'time' are related through student 'time-on-task'. Time-on-task refers to when students are actively involved (engaged) in some aspects of the learning process. The suggested times for each component are intended to maximize the time available for student involvement. This will encourage the student and teacher to work efficiently, timewise, through the lesson without jeopardizing the importance of student activities such as to:

- answer routine and non-routine questions,
- respond to verbal questions and explanations,
- interpret and use appropriate terminology,
- discuss aspects with their peers,
- explain or justify his/her approaches and thinking,
- work productively on their own, and
- listen carefully to the teacher or peers.

Establishing what is on-task time is more problematic when the teacher talks and students passively listen, such as in didactic teaching. With such an approach it is difficult to determine whether students are listening or even paying attention. Often in lessons identifying time-on task can also be problematic in case of problem-solving or intense reading and comprehension. Here, student activity is often more subtle and cerebral as students need to think quietly by themselves.

Ultimately, however, the time allocated to components will be determined by learners' needs and strengths, but not completely. There needs to be practical limits on the duration of the components to prevent major disruption to lessons which can have a detrimental impact on student learning. Often, teacher should not expect too much learning to occur on an initial meeting of unfamiliar content. It is repeated exposure associated with elaboration, addressing errors, and deliberately practicing key aspects where most learning occurs.

When times are allocated appropriately, and students become familiar with the approach and teacher expectations, concept development and student skill levels are improved as well as student engagement.

Note: Care needs to be exercised in determining what engagement means. Engagement is clearer when **students are doing the learning** through answering questions, writing, discussing and reading.

Key Ideas and Questioning

Critical aspects of the NLC for the teacher include questions related to learning areas, based around a *key idea*. The questions are offered at different levels of difficulty involving lower- to higher-order thinking, starting with questions of modest complexity up to those that require more developed reasoning.

In the lessons, students are provided with opportunities to practise solving non-routine questions to help improve their conceptual understanding by applying known content to subject-related problems.

Teacher Reflection

Teacher reflection on the lessons offer important insights to stimulate teachers and their peers to enhance their own practice and the learning of their students. This includes:

- new teaching approaches encouraged by lesson components that can contribute in different ways to student learning and lesson success;
- the use of review lessons that help review learnt material and extend student abilities in problem solving by utilizing known information;
- a focus on student concept and skill acquisition, pedagogical approaches, student errors, time-on-task, deliberate practice and working memory demands.

Enhancement and Consolidation Camps

The Enhancement Camp and the Consolidation Camp offer students the chance to review their subject background knowledge by consolidating previously taught material. The intention is:

- for students to have opportunities to review past work and to practice applying this knowledge of concepts and ideas through grade-related sets of questions of developing difficulty; and
- for teachers to follow the given format of components with some flexibility to adjust parts of a lesson to meet the learning needs of students in their class, particularly, if students are having difficulties.

Camp Differences

In the case of lessons for students in either the Enhancement Camp or Consolidation Camp, the materials, including the lesson plans and the sets of questions, are, on the surface, the same. These questions range from those of modest difficulty to those which require more insight and more knowledge and understanding.

There are important reasons for both Camps sharing the same content. Exploring and answering these question sets has value to students from both Camps, albeit in different ways. It enables students to work through a range of ideas on their own before hearing from their peers and teacher concerning the same questions – a very rich learning environment. Also, similar questions mean that expectations for students in both Camps is not limited and students have the same potential for growth.

The difference between Camps concerns the teaching focus, which is related to the breadth and depth of conceptual knowledge of students. It is anticipated that based on student performance within a lesson, the teacher will decide whether the class needs more practice and discussion of straightforward questions or whether extension material is more appropriate for the class.

In particular, questions marked as **Optional** (typically high-order questions) are more likely to be addressed in the Enhancement Camp than the Consolidation Camp, but not exclusively. It is the teacher who decides whether to include 'optional' questions and this will depend on student-learning success and understanding at that time.

If Optional questions are not used, teachers would spend that time productively. This includes reinforcing the concepts by increasing the focus on student errors and/or increasing student-student, and student-class directed conversations.

Lower- and Higher-order Skill and Knowledge Development

In all learning, lower-order thinking is a pre-requisite for higher-order skills and knowledge development. Many students are disadvantaged in their attempts to move forward in their learning through a lack of practice and conceptual development of needed lower-order skills, knowledge and understandings. Hence, *all* students benefit from a stock-take on relevant lower-order skills from previously addressed content. This helps establish a basis upon which student learning should build.

In both the Enhancement and Consolidation Camps important lower-order content skills, knowledge and understandings are re-visited at the beginning of each lesson. This helps ensure that potential learning obstacles are made visible to the student and the teacher. It also means that some errors in understanding or misconceptions are identified. This information is important to teachers in helping all students move forward regardless of their achievement levels.

As many questions posed are about applying content already encountered to a new problem, students have the opportunity to use their current knowledge, skill and understanding in a practical way at their level, further developing their conceptualization and understanding of the subject matter.

Both Camps offer students the opportunity to improve their learning and conceptual development by a stepped approach that involves:

(i) reminding students of relevant lower-order skills through practice,
(ii) having students use and discuss their knowledge in sets of graded questions with an emphasis on straightforward questions,
(iii) expecting students to apply their knowledge leading to more breadth in learning,
(iv) beginning an initial focused practice on higher-order skill development.

The approach advocated to solve problems or comprehend passages extends student learning beyond simple repetitive exercises sets. For these students the teaching part of the lesson requires teachers reviewing closely student solution attempts through student explanation, discussion and questioning of fundamental aspects of topics that are typically found in the earlier questions. Teachers should be sensitive to students' self-perceptions here as they may meet the ideas, presented in the lessons, maybe after many failures with these concepts in the past.

Nevertheless, these students should become aware of the more difficult questions as teachers allow them to consider links or connections between concepts previously taught. There is great value in problem solving for students to have time to read the problem and then be able to indicate in their own words, what the problem is about.

Finally, it is important that teachers in the Enhancement and Consolidation Camps become aware of what their students know, where they are progressing and how to build on student skills and knowledge. Teachers need to be nurturing and supportive of this development and continually look for evidence of success and growth. Teachers also need to encourage students to persist, continue to practice individual aspects, and use any mistakes/errors they make as an opportunity to learn more. These are important features of a successful learning journey.

Lesson Components: Short Overview

Lesson Component 1 (Lesson Short Review)

Component 1 offers teachers the chance to:

- settle the class quickly;
- review previously encountered information;
- address previous content in the form of a few targeted questions that are *relevant to the current lesson;*
- note what students already know;
- elicit answers from the class to reinforce the important content needed for the lesson; and
- address briefly issues that may arise.

The questions set for the Short Review section of a lesson are designed to *remind* students of knowledge and skills developed when first studying the topic area, which are relevant to the lesson.

Lesson Component 2 (Lesson Purpose/Intention)

This component offers teachers a chance to acquaint students with the purpose/intention of the lesson. It is valuable if students see a link here with their prior knowledge or experience, especially if the teacher can connect it to the responses and levels of student understanding evident in Component 1.

In addition, this component is an appropriate time to address what students might expect/aim to achieve, i.e., their lesson goal(s). Teachers should clarify, in clear language, the learning intention for the students as well as what success will look like. (Note**:** The degree of success or partial success of student learning in the lesson should occur as part of Component 5.)

Lesson Component 3 (Lesson Language Practice)

Component 3 concerns language use – speaking, hearing, listening, and comprehending. The focus is on words or phrases that are to be used in the lesson.

The language practice suggested has been identified by considering the whole lesson and identifying those words/phrases that have the potential to cause difficulties for students through speech, or listening, or understanding. Typically, the language identified is restricted to less than 6 words/phrases so that there is enough time to use a variety of approaches of practice within the time available.

Lesson Component 4 (Lesson Activity)

Component 4 has three aspects, 4A, 4B, and 4C.

In the case of the Learning Camp activity, Component 4 addresses the key idea for the lesson. It is about students applying known content to solve real-world problems. This requires students to interpret/understand the correct meaning of the 'stem', a stimulus, (such as a passage/text or diagram or the first part of the problem or story) before answering questions of differing degrees of complexity related to the stem.

Students are first presented with the stem in 4A and are given the time/chance to interpret its meaning. Then in 4B and 4C, two separate sets of questions related to the same stem are asked.

4A Reading and Understanding the Stem

4A involves understanding the language of the stem. The purposes here are for the teacher:

- to model fluent reading of the stem (first)

- to identify any unfamiliar language for the student (possibly addressed in Component 3)
- to read the passage or describe the figure, etc.
- to hear and experience fluency in reading the stem.

4B Solving the First Set of Questions

4B involves a set of questions associated with the stem. Students will need to refer to the stem as they prepare to answer the set of questions. Students write down responses or attempts at each question. It is important that every student in the class is expected to have a response for each question. It is expected and acceptable that students would make errors, which provide teachers with important information concerning students' learning needs. A critical procedural action here for teachers is the importance of **all** students starting on the same set of questions, *at the same time*.

When the students are finished, or sufficient time has been allocated, the teacher marks the questions. This can be achieved by student answers or approaches to the questions and by explaining or justifying their reasons. Time should be allocated to student discussion, explanation, and reasoning about answers.

4C Solving the Second Set of Questions

4C offers a new start for students regardless of how they performed in Component 4B. The structure is very similar to Component 4B, i.e., undertaking a new set of questions related to the same stem. In addition, the lesson structure allows a refresh as 4C presents a new starting point for the student. This structure also allows all students in the class to start a new activity at the same time.

This approach serves two purposes for teachers. *First,* it enables teachers to bring all students back together to proceed as a group with issues able to be directed to and considered by every student at the same time. *Second,* it offers teachers a way to extend their students problem solving practice where *a different sets of questions* can be used with a single Stem. This is an efficient way to incorporate more problem-solving or comprehension practice on specific content into a lesson.

Lesson Component 5 Lesson Conclusion

Component 5 has a high metacognitive aspect for students – students thinking about their own thinking – which can be further enhanced by teacher modelling. Component 5 is designed to offer a student-focused overview to the main intentions of the lesson. In particular, the focus is about helping students reflect on their progress and achievement (or partial achievements) of the lesson intention as well as their understanding development during the lesson.

It builds on comments from Component 2 about teacher expectations. There is the chance here to confirm student progress during the lesson. A teacher may use a diagram, picture or some aspect of the lesson as a catalyst to stimulate student discussion and reflection.

NOTE: A fuller description of the Components and features of the lessons is provided in the **Learning Camp – Notes to Teachers Booklet.** It is recommended that these notes are read and discussed by teachers as they provide a further basis to understanding the structure of lessons and the pedagogy.

Mathematics Grade 8 Lesson Plan 1

Factors of Trinomials

Key Idea

Solving real life problems by factorizing trinomials.

Component 1: Short Review

Time: 10 minutes

- Ask students to answer the following questions on their worksheet.
  1. Factorize $2x + 4$
  2. Factorize $3x - 9$
  3. Factorize $12a^2 + 6$
  4. Factorize $x^2 + 3x^3$
  5. Factorize $x^2 + 5x + 6$

- Ask students to volunteer answers, giving positive feedback. Read out a sample answer for all students to listen to and write down. (This may come from one of the students or from the sample answers below).

Sample answers:

1. $2(x + 2)$
2. $3(x - 3)$
3. $6(2a^2 + 1$
4. $x^2(1 + 3x)$
5. $(x + 2)(x + 3)$

- If students get the earlier Short Review questions incorrect, then time should be devoted to looking at their knowledge of the skills of factorizing. Perhaps, give them more similar questions after some basic skills have been reviewed before moving on to the more difficult questions in Component 4.

Component 2: **Lesson Purpose/Intention**

Time: 3 minutes

This lesson is about factorizing, expanding and solving equations. This is an important process that helps us understand more about algebraic expressions which will eventually assist in solving equations. Factorizing enables us to rewrite polynomials in a simpler form.

Students will find this skill invaluable as they study the later topics in the review of the Mathematics in Year 8. As students become more confident in their algebraic skills, their ability to engage with more challenging algebraic expressions will become less daunting.

Component 3: Lesson Language Practice

Time: 5 minutes

- The following words would be those used most often in this section. It is necessary for students to really understand the meaning of all of these words as they are the directions teachers give to inform students of what is required of them to do.

Product – the result of two or more numbers when multiplied together.
Factor – numbers or terms that divide exactly into another number or expression.
Squares – a number that is multiplied by itself.
Expand – to expand brackets, or multiply out, involves multiplying every term inside the bracket by the

term on the outside and then collecting like terms with the aim of removing the set of brackets.
***Factorizing* –** find what can be multiplied to get a given expression.

- Read out difficult or unfamiliar words or phrases and ask the students to read them to themselves and then out loud as a class.
- Ask the students to practice saying the words in a sentence.

Component 4*:* Lesson Activity
Time: 25 minutes
Component 4A

- Refer students to the main lesson stimulus.
- Read out the written text.
- Ask the students if there are any words that they are not familiar with (or suggest and give descriptions of any words that may be problematic.

> If three times Alan's age 6 years ago is subtracted from twice his present age, the result would be equal to his present age. Find Alan's present age.

- Students should say out loud what the question requires them to do. They could also explain to each other how they will start the problem.

Component 4B
Write an equation to show the information in the problem.
Simplify the expression and solve the problem.

Sample answers:
Let x be Alans's present age.

Alan's age 6 years ago = x - 6.

Three times Alan's age 6 years ago is 3(x - 6).

Twice his present age = 2x.

If three times Alan's age 6 years ago is subtracted from twice his present age, the result would be equal to his present age.

$$2x - 3(x - 6) = x$$

$$2x - 3x + 18 = x$$

$$-x + 18 = x$$

$$18 = 2x$$

$$x = 9\text{A}$$

Alan's present age is 9 years.

Component 4C (Optional)

- Read out the following question and ask students to answer.

If 18 is taken away from 8 times a number, the result is 30. Find the number.

- Observe students' answers.
- Ask the students to volunteer their answers, giving positive feedback.
- Select a good sample answer for all students to write down. This may come from one of the students or from the following sample answer.

Sample answers:

Let x be the number.
If 18 is taken away from 8 times a number and the result is 30
Then, we have
$8x - 18 = 30$
Add 18 to both sides.
$8x = 48$
Divide both sides by 8.
$x = 6$
The number is 6.

Component 5: Lesson Conclusion

Time: 5 minutes

In this component, the teacher initiates and leads a student-focused wrap-up to the main objectives of the lesson. The focus is on the whole lesson experience, including how well what students feel that they take from the lesson relates to what their expectations were for the lesson, as outlined in Component 2 ('Purpose/focus' of the lesson).

The teacher should facilitate student reflection and discussion, that address such questions as:

- What do you think were the key mathematical concepts addressed in this lesson?
- Would you rate your level of understanding of the material covered in this lesson as high, moderate, or low?
- Has the lesson helped you to gain further insight into aspects of the material covered that represent strengths or represent weaknesses?
- What would you describe as the main barriers, if any, to your ongoing progress and achievement in relation to the topic area addressed in this lesson?
- What do you think would best assist your ongoing progress and achievement in relation to the topic area?

Mathematics Grade 8 Lesson Plan 2

Problems with Polynomials

Key Idea

Applying algebraic skills and understanding to solve a real-world problem.

Component 1: Short Review
Time: 5 minutes

- Ask students to answer the following questions.
  - Q1. Expand $3(5x - 12)$
  - Q2. Factorize $15a^2 + 30a$
  - Q3. Expand and collect like terms to simplify $5(3t - 4) + 6(4 - 5t)$
  - Q4. Factorize $x^2 + 9x + 20$
  - Q5. Expand $(x - 3)^2$
- Ask students to volunteer answers, giving positive feedback. Read out answers for all students to listen to and write down. (This may come from one of the students or from the answers below).

Sample answers:
Q1. $15x - 36$

Q2. $15a(a + 2)$

Q3. $-15t + 4$

Q4. $(x + 4)(x + 5)$

Q5. $x^2 - 6x + 9$

Component 2: **Lesson Purpose/Intention**
Time: 3 minutes

The lesson is about *the manipulations of polynomials to solve problems.* Polynomials are often called the "language" of mathematics and algebra. They are used in nearly every type of mathematics to show numbers and expressions as a result of different mathematical operations. The manipulation of polynomials allows us to simplify mathematical expressions to make them more useable to solve problems.

Component 3: Lesson Language Practice
Time: 5 minutes

- Read out difficult or unfamiliar words or phrases and ask the students to read them to themselves and then out loud as a class.

Expression *– Numbers, symbols and operators (such as and times) grouped together that show the value of something.*
Simplest form *– An expression is in simplest form when there are no more terms that can be combined.*
Represent *– to show or stand in place of.*
Perimeter *– the total length of a boundary or the distance around the outside of a shape.*
Area *– The space enclosed by the boundary of a plane figure.*

- Ask the students to practice saying the words in a sentence.

Component 4*:* Lesson Activity
Time: 25 minutes

Component 4A

- Refer students to the main lesson stimulus.
- Read out the written text.
- Ask the students if there are any words that they are not familiar with and give descriptions of any words that may be problematic.

> Annie is going to buy a television set. She is unsure as to what size she should buy. She uses a formula to determine the correct size to suit her wall. The length of the TV is $10x + 2$ units and a width of $6x + 5$ units.

Component 4B

- Read out the following questions and ask students to answer *Q1.*
  Q1. Write an expression for the area of the TV in simplest form.
  Q2. Write an expression to represent the perimeter of the TV in its simplest form.
  Q3. If $x = 10cm$, what is the area of the Tv in sq.cm?
  Q4. If $x = 10cm$, what is the perimeter of the Tv in cm?

- Observe students' answers. Ask the students to volunteer their answers, giving positive feedback.

Sample answers:
Q1. $60x^2 + 62x + 10$

Q2. $32x + 14$

Q3. 6630 sq.cm

Q4. 334 cm

Component 4C

- Read out the following question and ask students to answer.

  Annie decided the TV was too big for her wall. She determined to let $x = 5\text{cm}$.
  Q1. Calculate the area of the TV set when $x = 5\text{cm}$
  Q2. Calculate the perimeter of the TV set when $x = 5\text{cm}$
  Q3. **(Optional)** What do you notice about the area and perimeter of this TV as compared to the TV where $x = 10$

- Observe students' answers.
- Ask the students to volunteer their answers, giving positive feedback.

Sample answers:
Q1. $area$ *=1820 sq. cm*
Q2. $perimeter = 174\ cm$
Q3. The area is less than half the area of the first tv but the perimeter is half the perimeter of the first TV.

Component 5: Lesson Conclusion

Time: 5 minutes

- In this component, the teacher initiates and leads a student-focused wrap-up to the main objectives of the lesson. The focus is on the whole lesson experience, including how well what students feel that they take from the lesson relates to what their expectations were for the lesson, as outlined in Component 2 ('Purpose/focus' of the lesson).
- The teacher should facilitate student reflection and discussion, that addresses such questions as:
    - What do you think were the key mathematical concepts addressed in this lesson?
    - Would you rate your level of understanding of the material covered in this lesson as high, moderate, or low?
    - Has the lesson helped you to gain further insight into aspects of the material covered that represent strengths or represent weaknesses?
    - What would you describe as the main barriers, if any, to your ongoing progress and achievement in relation to the topic area addressed in this lesson?
    - What do you think would best assist your ongoing progress and achievement in relation to the topic area?

Mathematics Grade 8 Lesson Plan 3

Simplifies Rational Algebraic Expressions

Key Idea

Using knowledge of algebra and fractions to simplify rational algebraic expressions.

Component 1: Short Review
Time: 5 minutes

- Ask students to answer the following questions.

Simplify these expressions as far as possible.

Q1. $\frac{15}{20}$

Q2. $\frac{8x}{8}$

Q3. $\frac{10a}{12a}$

Q4. $\frac{16m^2}{24m^3}$

- Ask students to volunteer answers, giving positive feedback.

Sample answers:

Q1. $\frac{3}{4}$

Q2. x

Q3. $\frac{5}{6}$

Q4. $\frac{2}{3m}$

Component 2: **Lesson Purpose/Intention**
Time: 3 minutes

The lesson is about simplifying algebraic fractions. An algebraic fraction is a fraction where the numerator and/or the denominator are algebraic expressions. If a problem involves solving an expression that involves algebraic fractions, then it is necessary to have the skills to be able to manipulate and simplify these expressions.

Component 3: Lesson Language Practice
Time: 5 minutes

- Read out difficult or unfamiliar words or phrases and ask the students to read them to themselves and then out loud as a class.
- Ask the students to practice saying the words in a sentence.

***Simplify* –** reduce the expression into a simpler form.
***Expression* –** a set of terms combined using the four operations.
***Cancel* –** simplify a fraction by dividing both top and bottom by the same amount.
***Common factor* –** numbers or terms that divide exactly into another number or expression.

Component 4*:* Lesson Activity

Time: 25 minutes

Component 4A

- Refer students to the main lesson stimulus.
- Read out the written text.
- Ask the students if there are any words that they are not familiar with (and give descriptions of any words that may be problematic.

> Peter and John want to practice their algebraic fraction skills. Their teacher suggested that they write each other some questions to do so that they will have more questions to improve their skills. Peter writes 5 questions and John writes 5 questions. Both Peter and John answer their own questions. They swap questions and answer them. They then discuss their solutions to see if they got them correct.

Component 4B

- *Complete Peter and John's questions to help you practice your algebraic fraction skills.*

  Peter's Questions

  Simplify each algebraic fraction

  Q1. $\frac{11a}{22}$

  Q2. $\frac{15ab}{25a}$

  Q3. $\frac{9x^2}{18x}$

  Q4. $\frac{35a^2}{25a^2}$

  Q5. $\frac{16x^2y^2}{8xy}$

  John's Questions

  Simplify each algebraic fraction

  Q1. $\frac{21a}{15}$

  Q2. $\frac{25xy}{35y}$

  Q3. $\frac{18x^2y}{12x}$

  Q4. $\frac{28m^3}{2m^2}$

  Q5. $\frac{42ay^2}{8a^2y}$

- Observe students' answers. Ask the students to volunteer their answers, giving positive feedback.

Sample answers:

Peter's Answers

Q1. $\frac{a}{2}$

Q2. $\frac{3b}{5}$

Q3. $\frac{x}{2}$

Q4. $\frac{7}{5}$

Q5. 2xy

John's Answers

Q1. $\frac{7a}{5}$

Q2. $\frac{5x}{7}$

Q3. $\frac{3xy}{2}$

Q4. 14m

Q5. $\frac{21y}{4a}$

Component 4C (Optional)

- Read out the following questions and ask students to answer.

  After Peter and John completed their questions correctly, they decided to do some more difficult questions to make sure they really understood how to simplify algebraic fractions. They asked their friend, Ken, to write 3 more difficult questions for them both to complete.

  Q1. $\frac{24a^2b^3}{12a^2b^4}$
  Q2. $\frac{20x^4y^5}{25x^2y^3}$
  Q3. $\frac{15x^3y^3z^5}{40x^6y^4z^8}$

- Observe students' answers.
- Ask the students to volunteer their answers, giving positive feedback.

Sample answers:

Q1. $\frac{2}{b}$

Q2. $\frac{4x^2y^2}{5}$

Q3. $\frac{3}{8x^3yz^3}$

***Component 5*: Lesson Conclusion**

Time: 5 minutes

- In this component, the teacher initiates and leads a student-focused wrap-up to the main objectives of the lesson. The focus is on the whole lesson experience, including how well what students feel that they take from the lesson relates to what their expectations were for the lesson, as outlined in Component 2 ('Purpose/focus' of the lesson).
- The teacher should facilitate student reflection and discussion, that addresses such questions as:
  - What do you think were the key mathematical concepts addressed in this lesson?
  - Would you rate your level of understanding of the material covered in this lesson as high, moderate, or low?
  - Has the lesson helped you to gain further insight into aspects of the material covered that represent strengths or represent weaknesses?
  - What would you describe as the main barriers, if any, to your ongoing progress and achievement in relation to the topic area addressed in this lesson?
  - What do you think would best assist your ongoing progress and achievement in relation to the topic area?

Mathematics Grade 8 Lesson Plan 4

Solves Problems with Rational Expressions

Key Idea

Students use their algebraic skills to solve problems.

Component 1: Short Review

Time: 7 minutes

- Ask students to answer the following questions on their Worksheets.

Simplify these expressions as far as possible:

Q1. $\frac{6x}{12xy}$

Q2. $\frac{x}{3} + \frac{2x}{5}$

Q3. $\frac{3x-6}{5} - \frac{2x+1}{3}$

Q4. $\frac{3}{2x} - \frac{y+1}{3xy}$

- Ask students to volunteer answers, giving positive feedback.

Answers:

Q1. $\frac{1}{2y}$

Q2. $\frac{11x}{15}$

Q3. $\frac{-x-23}{15}$

Q4. $\frac{7y-2}{6xy}$

Component 2: **Lesson Purpose/Intention**

Time: 3 minutes

The lesson is about performing operations on algebraic fractions. If a problem involves solving an expression containing algebraic fractions, then the skills and techniques to simplify an expression are valuable.

Component 3: Lesson Language Practice

Time: 5 minutes

- Read out difficult or unfamiliar words or phrases and ask the students to read them to themselves and then out loud as a class.
- Ask the students to practice saying the words in a sentence.
- Ask students to volunteer their answers, giving positive feedback and discussing.

Simplify **–** reduce the expression into a simpler form.
Expression –- a set of terms combined using the four operations.
Cancel **–** simplify a fraction by dividing both top and bottom by the same amount.
Common factor **–** numbers or terms that divide exactly into another number or expression.

Component 4*:* Lesson Activity
Time: 25 minutes

Component 4A

- Refer students to the main lesson stimulus below.
- Read out the written text.
- Ask the students if there are any words that they are not familiar with (or suggest examples) and give descriptions of any words that may be problematic.

Joe is a cook in a restaurant. Joe uses algebraic expressions and formulae to determine how many boxes of vegetables he needs to buy to cook his meals each night. The number of boxes of vegetables determines how much soup he can cook.

On a particular night, Joe intends to make carrot soup. The number of boxes Joe will need is determined by the expression:

$$\frac{y+1}{2}+\frac{y-1}{3}$$

where y is the number of boxes of carrots.

Component 4B

- Students read the following questions and answer in the space on their worksheet.

  Q1. Simplify this expression.

  Q2. There are 51 people booked into the restaurant that night. If each person has carrot soup, how many boxes of carrots will Joe require?

  Q3. On a previous night, Joe purchased 19 boxes of carrots. How many people was he expecting at the restaurant?

- Observe students' answers. Ask for reasoning.
- Select an answer for all students to write down. This may come from one of the students or from the following sample answer.

Sample answers:

Q1. $\frac{5y+1}{6}$

Q2. $y = 61$

Q3. 16

Component 4C

- Students read out the following questions and answer them in the space on their worksheet.

Joe decided to cook potato soup to include in his menu at the restaurant. The number of potato soups that can be cooked was determined by the expression:

$$\frac{2x+1}{5}+\frac{x-1}{2}$$

where x is the number of boxes of potatoes required.

Q1. Simplify this expression.

Q2. There are 60 people booked into the restaurant that night. How many boxes of potatoes will Joe require if every person has potato soup?

Q3. **(Optional)** Joe buys 40 boxes of potatoes. How many people will be able to have potato soup?

- Observe students' answers.
- Ask the students to volunteer their answers, giving positive feedback.
- Select an answer for all students to write down. This may come from one of the students or from the following sample answers.

Sample answers:

Q1. $\frac{9x-3}{10}$

Q2. Joe will need 67 boxes.

Q3. The number of people using the formula is $35\frac{7}{10}$, therefore 35 people can have potato soup.

Component 5: Lesson Conclusion

Time: 5 minutes

- In this component, the teacher initiates and leads a student-focused wrap-up to the main objectives of the lesson. The focus is on the whole lesson experience, including how well what students feel about the lesson and to their expectations, as outlined in Component 2 'Purpose'.
- The teacher should facilitate student reflection and discussion, that addresses questions such as:
  - What were the key mathematical concepts addressed in this lesson?
  - Would you rate your level of understanding of the material covered in this lesson as high, moderate, or low?
  - Has the lesson helped you to gain further insight into aspects of the material covered?
  - Describe any issue to your progress and achievement in relation to the topic area?
  - What would best assist your progress and achievement in this topic area?

Mathematics Grade 8 Lesson Plan 5

Co-Ordinate Geometry

Key Idea

Understand the Number Plane and Co-Ordinate Geometry

Component 1: Short Review

Time: 7 minutes

- Ask students to answer the following questions.

Q1. For the two points (2,5) and (-1, 7) on a number plane, calculate:

a) The gradient of the interval which joins them
b) The distance between them
c) The midpoint of the interval which joins them

Q2. Complete the co-ordinates in the table for $y = 3x + 2$

x	-2	-1	0	1	2	3	4
y							

a) Where does the line cross the x-axis? (x-intercept) Name the co-ordinates of the point.
b) Where does the line cross the y-axis? (y-intercept) Name the co-ordinates of the point.
c) What is the gradient of the line?
d) What do you notice about the gradient of the line with reference to the equation of the line?

- Mark the questions. Ask students to volunteer answers, giving positive feedback.

Sample answers:

Q1. a) $\frac{2}{-3}$

b) $\sqrt{13}$

c) $(\frac{1}{2}, 6)$

Q2.

x	*-2*	*-1*	*0*	*1*	*2*	*3*	*4*
y	*-4*	*-1*	*2*	*5*	*8*	*11*	*14*

a) $(\frac{-2}{3}, 0)$
b) (0,2)
c) 3
d) Equation of the line is $y = 3x + 2$ *where 3 is the gradient*

Component 2: **Lesson Purpose/Intention**

Time: 3 minutes

The lesson is about using the number plane to determine the position or location of a point. Co-ordinate Geometry is a tool that is used in many disciplines that use some form of geometry. Confidence in using a Number Plane will assist in many other aspects of Mathematics.

Component 3: Lesson Language Practice

Time: 5 minutes

- Read out difficult or unfamiliar words or phrases and ask the students to read them to themselves and then out loud as a class.
- Ask the students to practice saying the words in a sentence.

Distance – is the shortest distance between two points is a straight line.
Gradient – is the steepness and direction of a line as read from left to right.
Co-ordinate – are two numbers which locate a specific point on a coordinate plane.
Variable – is a quantity that can be changed and is not fixed.
Dependent – dependent variable is one that depends on the value of another number.
Independent – A dependent variable in an equation that may have its value freely chosen without considering values of any other variable.

Component 4*:* Lesson Activity
Time: 25 minutes

Component 4A

- Refer students to the main lesson stimulus below.
- Read out the written text.
- Ask the students if there are any words that they are not familiar with or suggest examples and give descriptions of any words that may be problematic.

> Emma really likes to eat chocolate. A friend gave Emma a large block of chocolate to eat over the weekend. On Saturday morning, Emma ate 2 squares from the block of chocolate and decides to eat 3 more squares every hour over the weekend.
> Let C be the total number of chocolate squares Emma eats over the weekend and let h be the number of hours Emma spends eating chocolate.

Component 4B
Students read out the following questions and then answer the following:

Q1. What are the independent and dependent variables?

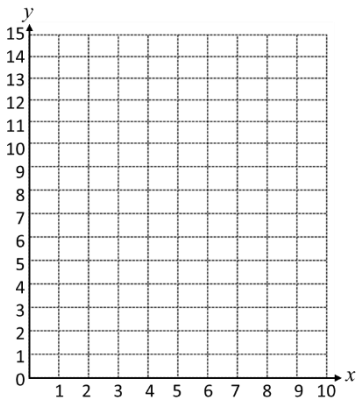
Q2. Complete the table.

Time (h) x-axis	0	1	2	3	4	5
Number of chocolate squares (C) y-axis						

Q3. How many squares of chocolate would Emma have eaten after 7 hours?

Q4. If the chocolate block contained 35 squares, how many hours would it have taken to eat the entire block of chocolate?

Q5 Plot the graph of the coordinate points from the table.



Q6. Is the relationship between the time and the squares of chocolate linear? Why?
Q7. Why is the graph only in the first quadrant?

- Observe students' answers. Ask the students to volunteer their answers and reasoning, giving positive feedback.
- Select an answer for all students to write down. This may come from one of the students or from the following sample answer.

Sample answers:

Q1. C is the dependent variable and h is the independent variable

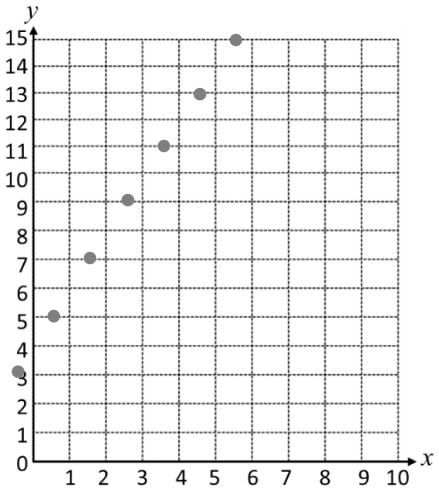
Q2.

x	0	1	2	3	4	5
y	3	5	7	9	11	13

Q3. 17

Q4. 16 hours

Q5.



Q6. Yes, as the graph is a straight line.

Q7. The graph is only in the first quadrant because you can't have negative time or negative number of pieces of chocolate.

Component 4C

- Read out the following questions and ask students to write down the answer.

Q1. Show that the point (1,3) lies on the line $y = 2x + 1$

Q2. What is the gradient of the line $y = 2x + 1$?

Q3. What is the *y*-intercept of the line $y = 2x + 1$?

Q4. Write the equation of a line that would be parallel to the line $y = 2x + 1$.

Q5. Write the equation of a line that would have the same *y*-intercept as the line $y = 2x + 1$.

Q6. Show that the point (1,3) lies on the line $y = -2x + 5$

Q7. **(Optional)** Explain graphically how (1,3) lies on both the line $y = 2x + 1$ and the line $y = -2x + 5$

- Observe students' answers.
- Ask the students to volunteer their answers and justify where appropriate, giving positive feedback.
- Select an answer for all students to write down. This may come from one of the students or from the

following sample answer.

Sample answers:

Q1. Substitute the values to show that the point lies on the line (i.e., both left-hand side and right-hand side of equation are equal after substitution)

Q2. $m = 2$

Q3. $y = 1$

Q4. There are many correct answers, but they must have $y = 2x$ *+ or – a number, e.g.,* $y = 2x + 5$ *is a possible answer.*

Q5. There are many answers, but the equation must be of the form $y = \mathrm{m}x + 1$*, e.g.,* $y = 3x + 1$ *is a possible answer.*

Q6. Substitute the values into the equation (i.e., both left-hand side and right-hand side of equation are equal after substitution).

Q7. It is the point of intersection.

Component 5: Lesson Conclusion

Time: 5 minutes

- In this component, the teacher initiates and leads a student-focused wrap-up to the main objectives of the lesson. The focus is on the whole lesson experience, including how well what students feel about the lesson and to their expectations, as outlined in Component 2 'Purpose'.
- The teacher should facilitate student reflection and discussion, that addresses questions such as:
    - What were the key mathematical concepts addressed in this lesson?
    - Your level of understanding of the material in this lesson is high, moderate, or low?
    - Has the lesson helped you to gain further insight into aspects of the material covered?
    - Describe any issue to your progress and achievement in relation to the topic area?
    - What would best assist your progress and achievement in this topic area?

Mathematics Grade 8 Lesson Plan 6

Consolidation 1 Patterns and Algebra

Key Idea

Review Patterns and Algebra

Component 1. Short Review

Time: 7 minutes

Factorize:

Q1. $10a + 5$
Q2. $x^2 + 7x + 10$
Q3. $6m^2 + 13m - 5$
Q4. $12m^2 - 16mn$
Q5. $y^2 - y - 20$

Sample Answers

Q1. $5(2a + 1)$
Q2. $(x + 5)(x + 2)$
Q3. $(3m - 1)(2m + 5)$
Q4. $4m(3m - 4n)$
Q5. $(y + 4)(y - 5)$

Component 2: **Lesson Purpose/Intention**

Time: 3 minutes

The lesson is about *ensuring the skills learnt during the week will be consolidated in this review lesson.*

Component 3: Language Practice

- Revise the language encountered during the week.

Expression, simplest form, represent, perimeter, area, cancel, simplify, common factor, product, squares, expand, factorize, distance, gradient, co-ordinate, variable, dependent, independent

Component 4*:* Lesson Activity

Time: 25 minutes

Component 4A

Factorize:

Q1.$7a + 21$
Q2. $x^2 - 7x + 10$
Q3. $4m^2 - 12m + 5$
Q4. $15m^2 - 20mn$
Q5. $y^2 - y - 20$

Sample Answers

Q1. $7(a + 3)$
Q2. $(x - 5)(x - 2)$
Q3. $(2m - 1)(2m - 5)$
Q4. $5m(3m - 4n)$
Q5. $(y + 4)(y - 5)$

Component 4B

Expand:

Q1. $4(3x + 5)$

Q2. $(2a + 5)^2$

Q3. $(3m - 5)(3m + 5)$

Simplify:

Q1. $\frac{3ab}{18a^2b^3}$

Q2. $\frac{25-x^2}{x+5}$

Q3. $\frac{25x^2 12y^3}{15x^3 16y}$

Sample answers:

Q1. $12x + 20$

Q2. $4a^2 + 20a + 25$

Q3. $9m^2$*-25*

Q1. $\frac{1}{6ab^2}$

Q2. $5 - x$

Q3. $\frac{5y^2}{4x}$

Component 4C

1. Read out the following questions and ask students to answer *Q1.*

Q1. When a number is added to the square of itself, the answer is 20. What could the number be?

Q2. Explain why there is more than one possible answer.

2. On a number plane, graph the line $y = 3x - 5$

Q1. What is the gradient of the line?

Q2. What is the y-intercept of the line?

Q3. On the same number plane, graph a line parallel to $y = 3x - 5$.

Sample answers:

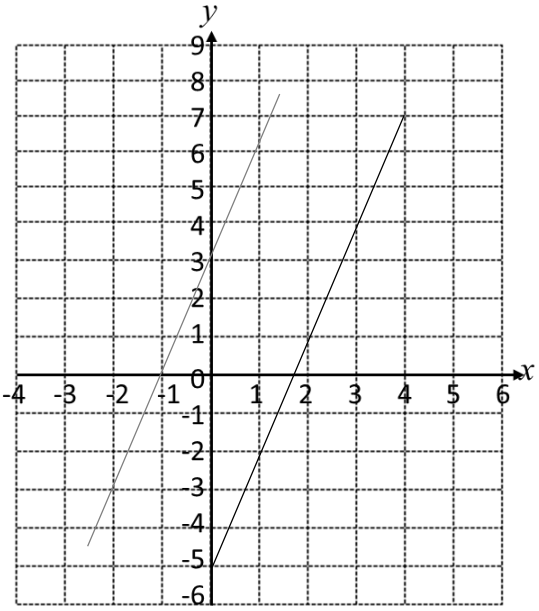
1. *Q1.* $x = 4$ *or* -5

Q2. The equation that was formed was a quadratic equation and therefore there is more than one answer.

2. *Q1.* $m = 3$

Q2. $y = -5$

Q3. Many answers such as:



Component 5: Lesson Conclusion

Time: 5 minutes

- In this component, the teacher initiates and leads a student-focused wrap-up to the main objectives of the lesson. The focus is on the whole lesson experience, including how well what students feel that they take from the lesson relates to what their expectations were for the lesson, as outlined in Component 2 ('Purpose/focus' of the lesson).
- The teacher should facilitate student reflection and discussion, that addresses such questions as:
    - What do you think were the key mathematical concepts addressed in this lesson?
    - Would you rate your level of understanding of the material covered in this lesson as high, moderate, or low?
    - Has the lesson helped you to gain further insight into aspects of the material covered that represent strengths or represent weaknesses?
    - What would you describe as the main barriers, if any, to your ongoing progress and achievement in relation to the topic area addressed in this lesson?
    - What do you think would best assist your ongoing progress and achievement in relation to the topic area?

Mathematics Grade 8 Lesson Plan 7

Applications of Co-Ordinate Geometry

Key Idea

Using Co-Ordinate Geometry to solve problems.

Component 1: Short Review
Time: 7 minutes

- Ask students to answer the following questions and write the answers on their Worksheet.
  Q1. What is the gradient of the line $y = 3x - 7$?
  Q2. What is the *y*-intercept of the line $y = 3x - 7$?
  Q3. Rewrite the equation of the line $y = 3x - 7$ in the form $ax + by + c = 0$
  Q4. Write an equation of a line parallel to of the line $y = 3x - 7$
  Q5. Graph the line $y = 3x - 7$ on a number plane and then graph your line from Q4.
  Q6. How do you know the lines are parallel?
- Ask students to write down the answers and then have volunteer answers, with feedback.

Sample answers:
Q1. $m = 3$
Q2. $y = -7$
Q3. $3x - y - 7 = 0$
Q4. There will be many answers, but a correct answer has to have a 3 in front of the x.
Q5. Graph of the line.
Q6. They have the same gradient.

Component 2: **Lesson Purpose/Intention**
Time: 3 minutes
The lesson is about graphing lines on a number plane and investigating the properties of the lines.

Component 3: Lesson Language Practice
Time: 5 minutes

- Read out difficult or unfamiliar words or phrases and ask the students to read them to themselves and then out loud as a class.
- Ask the students to practice saying the words in a sentence.
- Ask students to volunteer their answers, giving positive feedback and discussing.

Parallel Lines – are lines in a plane that are always the same distance apart, do not intersect.
Perpendicular Lines – are lines that intersect at a right (90 degrees) angle.
Intercept – is the point where the line crosses the x-axis, called the x-intercept, and the point where the line crosses the y-axis, called the y-intercept.

Component 4*:* Lesson Activity
Time: 25 minutes

Component 4A

- Refer students to the main lesson stimulus below.
- Read out the written text.
- Ask the students if there are any words that they are not familiar with (or suggest examples and give descriptions of any words that may be problematic.

Line A is parallel to the line with equation $2x - y = 7$ and passes through the point (2, 3).
Line B is perpendicular to the line with equation $4x - 3y + 3 = 0$ and also passes through the point (2, 3).
Line C intersects with line A where it cuts the y-axis and intersects with line B where it cuts the x-axis.

Component 4B

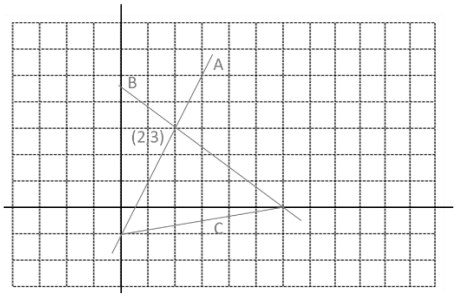
- Read out the following questions and ask students to answer.
  Q1. Determine the equations for all three lines. Give answers in the form $ax + by + c = 0$.
  Q2. Sketch all three lines on the same number plane.
  Q3. **(Optional)** Determine whether the triangle formed by the three lines is scalene, isosceles or equilateral**.**

- Observe students' answers. Ask the students to volunteer their answers, giving positive feedback.

Sample answers:

Q1. *A:* $2x - y + 1 = 0$
B: $3x + 4y - 18 = 0$
C: $x - 6y - 6 = 0$

Q2.



Q3. Scalene triangle as all three sides have different lengths

Component 4C

- Students read out the following questions and provide answers on their worksheet.
  Q1. A square has vertices at (0, 0) and (2, 0). Where are the other 2 vertices? (There is more than one possible answer.)
  Q2. An equilateral triangle has vertices at (0, 0) and (2, 0). Where is the other vertex? (There are 2 possible answers.)
  Q3. A parallelogram has vertices at (0, 0), (2, 0). and (1, 1). Where is the other vertex?
- Observe students' answers.
- Ask the students to volunteer their answers, explaining their approach, giving positive feedback. Are there alternative ways to do this?

Sample answers:

Q1. (0,2) and (2,2) or (0,-2) and (2,-2)

Q2. (1, $\sqrt{3}$) or (1,-$\sqrt{3}$)

Q3. (-1,-1)

Component 5: Lesson Conclusion

Time: 5 minutes

- In this component, the teacher initiates and leads a student-focused wrap-up to the main objectives of the lesson. The focus is on the whole lesson experience, including how well what students feel about the lesson and to their expectations, as outlined in Component 2 'Purpose'.
- The teacher should facilitate student reflection and discussion, that addresses questions such as:
    - What were the key mathematical concepts addressed in this lesson?
    - Your level of understanding of the material in this lesson is high, moderate, or low?
    - Has the lesson helped you to gain further insight into aspects of the material covered?
    - Describe any issue to your progress and achievement in relation to the topic area?
    - What would best assist your progress and achievement in this topic area?

Mathematics Grade 8 Lesson Plan 8

Solving Problems using Co-Ordinate Geometry

Key Idea

Applying co-ordinate geometry knowledge to problems

Component 1: Short Review

Time: 5 minutes

- Ask students to answer the following questions on their worksheet.

Q1. What is the gradient and *y*-intercept of $y = 7x - 5$?

Q2. What is the gradient of the line joining *(3,5)* and *(-1, 9)*?

Q3. Rewrite $2x + 3y - 6 = 0$ in the form $y = mx + b$

Q4. Draw a number plane and draw the equation of the line $y = 2x - 1$

- Ask students to volunteer answers, giving positive feedback. Read out a sample answer for all students to listen to and write down. (This may come from one of the students or from the sample answers below).

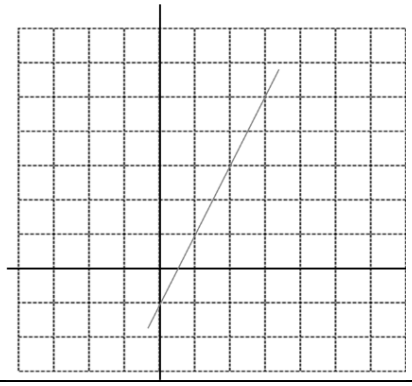
Sample answers:

Q1. m=7, y-intercept is -5

Q2. m=-1

Q3. $y = \frac{-2}{3}x + 2$

Q4.



Component 2: **Lesson Purpose/Intention**

Time: 5 minutes

The lesson is about: *Using your knowledge of Co-Ordinate Geometry to solve real life problems*

Component 3: Lesson Language Practice

Time: 5 minutes

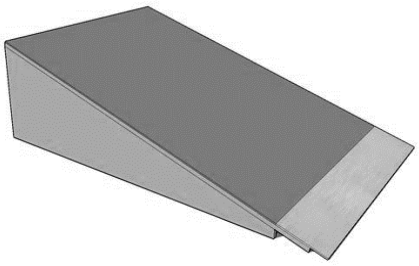
- Read out difficult or unfamiliar words or phrases and ask the students to read them to themselves and then out loud as a class.
- Ask the students to practice saying the words in a sentence.
- Ask students to volunteer their answers, giving positive feedback and discussing.

Gradient – is the slope or steepness of a line when viewing from left to right.
y-intercept – where a line cuts the y- axis, where x=0.
x-intercept – where a line cuts the x-axis, where y=0.

Component 4*:* Lesson Activity
Time: 25 minutes
Component 4A

- Refer students to the main lesson stimulus below,
- Read out the written text.
- Ask the students if there are any words that they are not familiar with and give descriptions of any words that may be problematic.

Joshua is a champion skateboard rider. He is designing a ramp for himself to skate down to complete a new trick.



He uses a number plane and a linear equation to design the ramp. The vertical height of the ramp is 8 meters and the horizontal length of the ramp is 20 meters.

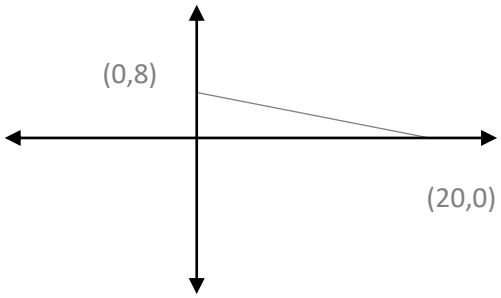
Component 4B

- Read out the following questions and ask students to answer in the space on their worksheet.
  Q1. Draw a diagram to show the side of the ramp on a number plane. Place the right angle of the ramp at the origin on the number plane.
  Q2. What is the y-intercept?
  Q3. What is the x-intercept?
  Q4. What is the gradient of the ramp?
  Q5. Write an equation for the ramp.

- Observe students' answers. Ask the students to volunteer their answers, giving positive feedback.
- Select a good sample answer for all students to write down. This may come from one of the students or from the following sample answer.

Sample answers:

Q1.



Q2. $y = 8$

Q3. $x = 20$

Q4. $\frac{-2}{5}$

Q5. $y = \frac{-2}{5}x + 8$ *or* $2x - 5y + 40 = 0$

Component 4C

- Read out the following questions and ask students to answer in the space on their worksheet.
- Observe students' answers. Ask the students to volunteer their answers, giving positive feedback.

Joshua decided that the ramp was not steep enough. He made the ramp 4 meters higher.

Q1. On the same diagram as above, draw a diagram to show the new side of the ramp on the number plane.

Q2. What is the gradient of the new ramp?

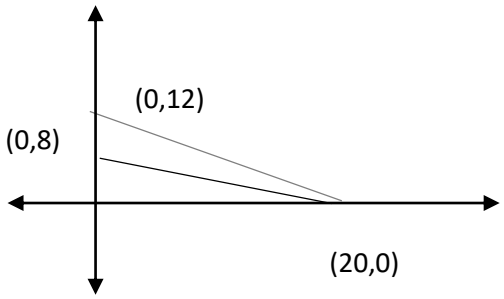
Q3. What is the new equation of the ramp?

Q4. **(Optional)** If Joshua wanted the new ramp to have the same gradient as the old ramp, what would the new horizontal length have to be?

- Select a good sample answer for all students to write down. This may come from one of the students or from the following sample answer.

Sample answers:

Q1.



Q2. $m = \frac{-3}{5}$

Q3. $y = \frac{-3}{5}x + 12$ or $5y - 3x + 60 = 0$

Q4. 30 meters

Component 5: Lesson Conclusion

Time: 5 minutes

- In this component, the teacher initiates and leads a student-focused wrap-up to the main objectives of the lesson. The focus is on the whole lesson experience, including how well what students feel about the lesson and to their expectations, as outlined in Component 2 'Purpose'.
- The teacher should facilitate student reflection and discussion, that addresses questions such as:
  - What were the key mathematical concepts addressed in this lesson?
  - Your level of understanding of the material in this lesson is high, moderate, or low?
  - Has the lesson helped you to gain further insight into aspects of the material covered?
  - Describe any issue to your progress and achievement in relation to the topic area?
  - What would best assist your progress and achievement in this topic area?

Mathematics Grade 8 Lesson Plan 9

Simultaneous Equations

Key Idea

To understand where and why mathematical inequalities are used.

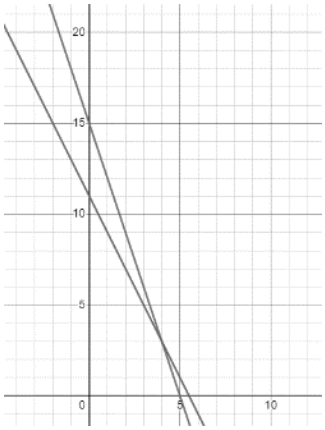
Component 1: Short Review

Time: 7 mins

1. Solve the pair of equations by elimination $2x + y = 11$ and $3x + y = 15$
2. Draw a sketch of $2x + y = 11$ on a number plane.
3. On the same number plane sketch $3x + y = 15$
4. What do you notice?
   - Teacher provides answers to questions and highlights particular concepts, as well as issues that may have arisen in student answers (issues not addressed to be noted at end of lesson).
   - Ask students to volunteer their answers, giving positive feedback. Read out a sample answer for all students to listen to and write down. This may come from one of the students or from the sample answers below.

Sample Answers

1. $2x + y = 11$….A
   $3x + y = 15$….B
   B-A
   $3x - 2x + y - y = 15 - 11$
   $x = 4$
   Substitute $x = 4$ into $2x + y = 11$
   $2 \times 4 + y = 11$
   $y = 3$
2. & 3.



4. From the graph, the lines intersect at the point determined by the algebra, (4,3)

Component 2: **Lesson Purpose/Intention**

Time: 3 mins

To solve a system of linear equations to solve real life problems

Component 3: Lesson Language Practice

Time: 5 mins

- Read out difficult or unfamiliar words or phrases and ask the students to read them to themselves and then out loud as a class.

Equation – a statement that the values of two mathematical expressions are equal.

Simultaneous – happens at the same time.

Solution – The answer to a problem.

- Ask students the difference between the words ‘***simultaneous’*** and ***‘equation’*.**

Component 4*:* Lesson Activity

Time: 25 mins

Component 4A

- Refer students to the main lesson stimulus below.
- Read out the written text.
- Ask the students if there are any words that they are not familiar with and give descriptions of any words that may be problematic.

A dressmaker sells her sewing at a street stall. She has a set price for each skirt and each dress that she sells at the stall. Last month, the dressmaker sold 6 skirts and 8 dresses and earned 6700 PHP in all. This month, she sold 12 skirts and 10 dresses and earned 9500 PHP in all.

Component 4B

- Read out the following questions and ask students to answer in the space on their worksheet.
- How much does the dressmaker charge for a skirt?
- How much does the dressmaker charge for a dress?
- Write a system of equations for the problem and use any algebraic methods to solve the problem.
- Observe students' answers. Ask the students to volunteer their answers, giving positive feedback. Select good sample answers for all students to write down. These may come from the students or from the following sample answers.

Sample answers:

Let s be the number of skirts and d be the number of dresses.
From the information
$6s + 8d = 6700$ and
$12s + 10d = 9500$

Solving simultaneously
$6s + 8d = 6700$….A
$12s + 10d = 9500$…B
$A \times 2$ is $12s + 16d = 13400$…C
$C - B$: $6d = 3900$
$d = 650$
Insert $d = 650$ into B
$12s = 3000$
$s = 250$

A dress cost 650PHP and a skirt costs 250PHP.

Component 4C

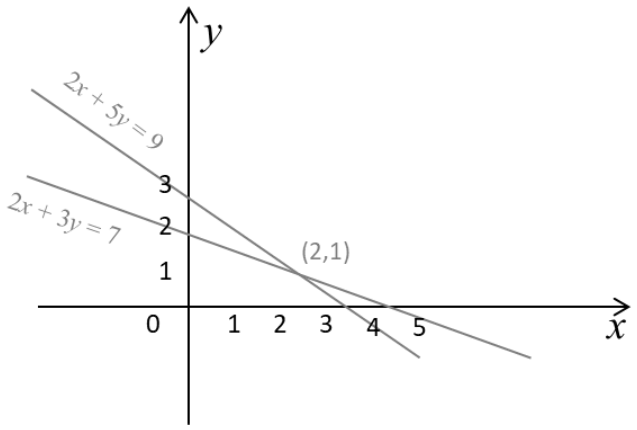
- Read out the following questions and ask students to answer in the space on their worksheet.

Solve $2x + 5y = 9$ ***and*** $2x + 3y = 7$ simultaneously:

- using algebraic methods
- using graphical methods
- Observe students' responses, giving encouragement. Ask the students to volunteer their answers, giving positive feedback. Select good sample answers for all students to write down. These may come from the students or from the following sample answer.

Sample Answers:

$2x + 5y = 9 \ldots A$
$2x + 3y = 7 \ldots B$
$A\text{-}B$
$2y = 2$
$y = 1$
Substitute y=1 into B
$2x + 3 = 7$
$2x = 4$
$x = 2$
Substitute into A
$4 + 5y = 9$
5y=5
Y=1
Solution is x=2, y=1



Lesson Component 5: Reflection

Time: 5 minutes

- In this component, the teacher initiates and leads a student-focused wrap-up to the main objectives of the lesson. The focus is on the whole lesson experience, including how well what students feel that they take from the lesson relates to what their expectations were for the lesson, as outlined in Component 2 ('Purpose/focus' of the lesson).
- The teacher should facilitate student reflection and discussion, that addresses such questions as:
    - What do you think were the key mathematical concepts addressed in this lesson?
    - Would you rate your level of understanding of the material covered in this lesson as high, moderate, or low?
    - Has the lesson helped you to gain further insight into aspects of the material covered that represent strengths or represent weaknesses?
    - What would you describe as the main barriers, if any, to your ongoing progress and achievement in relation to the topic area addressed in this lesson?
    - What do you think would best assist your ongoing progress and achievement in relation to the topic area?

NOTE: Remember to collect student's worksheets to review and analyze student's learning.

Mathematics Grade 8 Lesson Plan 10

Inequalities

Key Idea

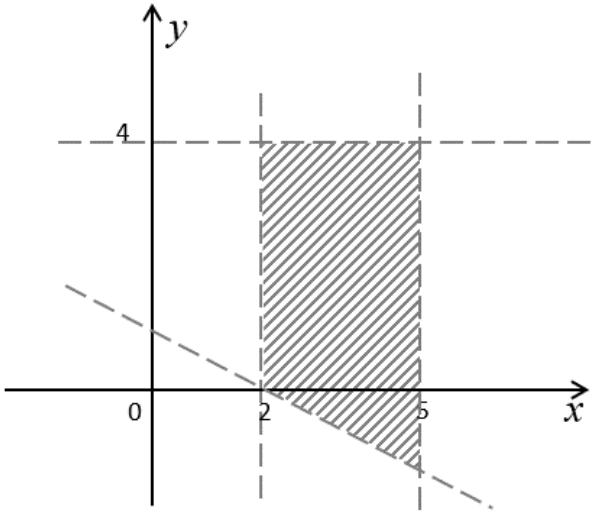
To understand where and why mathematical inequalities are used.

Component 1: short Review

Time: 7 mins

1. On the same number plane sketch:
   a) $y < 4$
   b) $2 \leq x \leq 5$
   c) $y > -\frac{x}{2} + 1$
2. Shade the region where the equations all intersect.
   - Teacher provides answers to questions and highlights particular concepts, as well as issues that may have arisen in student answers (issues not addressed to be noted at end of lesson).
   - Ask students to volunteer their answers, giving positive feedback. Read out a sample answer for all students to listen to and write down. This may come from one of the students or from the sample answers below.

Sample answers



Component 2: **Lesson Purpose/Intention**

Time: 3 mins

The purpose of this lesson is to understand where and for what purpose inequalities are used.

Component 3: Lesson Language Practice

Time: 5 mins

- Read out difficult or unfamiliar words or phrases and ask the students to read them to themselves and then out loud as a class.

Inequality – compares two values, showing if one is less than, greater than, or simply not equal to another value

Region – is a space in the number plane that either is separated by lines or is surrounded by lines.

Minimum –The smallest value.

Maximum – The greatest value.

Cargo – the goods carried by a ship, aircraft, or other large vehicle.

- Ask students the difference between the words '***minimum'*** and **'maximum'.**

Component 4*:* Lesson Activity

Time: 25 mins

Component 4A

- Refer students to the main lesson stimulus below.
- Read out the written text.
- Ask the students if there are any words that they are not familiar with and give descriptions of any words that may be problematic.

An 18-wheel truck stops at a weigh station before passing over a bridge. The weight limit on the bridge is 25 000kg. The cab (front) of the truck 550 kg, and the trailer (back) of the truck weighs 700kg when empty.

Component 4B

- Read out the following questions and ask students to answer in the space on their worksheet.

- In kilograms, how much cargo can the truck carry on the trailer and still be allowed to cross the bridge?
- The mass of a sedan car is 1365kg. How many cars can be loaded onto the truck and still cross the bridge?
- **(Optional)** The truck is required to carry some grain in silos. 20 silos can fit onto the back of the truck. Each silo has a mass of 150kg and has a capacity of 500 liters. A liter of grain has a mass of 2.5 kg. If each silo is full, can the truck cross the bridge?
- Observe students' answers. Ask the students to volunteer their answers, giving positive feedback. Select good sample answers for all students to write down. These may come from the students or from the following sample answers.

Sample answers:

$700 + 550 = 1250$

The mass of the truck is 1250kg. The bridge can handle 25 000kg. The truck can carry

$25000 - 1250 = 23750$kg

$23750 \div 1365 = 17.4$

Thus, the truck can carry 17 cars as you can't have a fraction of a car

Mass of 1 silo = 150 + 500 x 2.5
= 1400 kg

Mass of 20 silos = 20 x 1400
= 28000 kg > 23750kg

This is too heavy. He can only carry 16 full silos (23750 ÷ 1400 = 16.96)

Component 4C

- Read out the following questions and ask students to answer in the space on their worksheet.

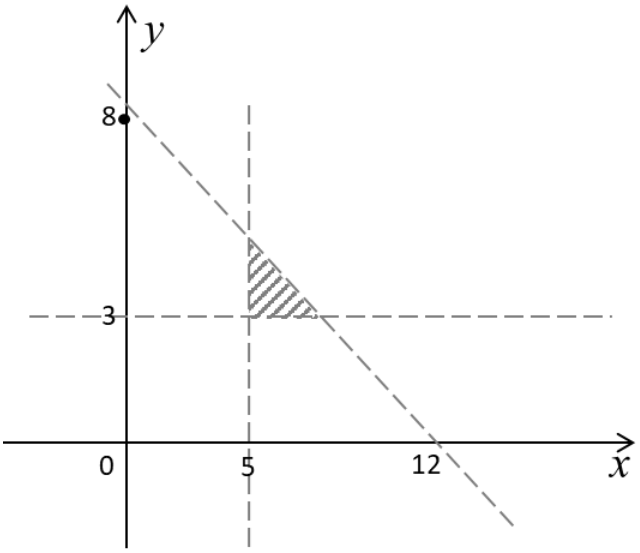
A carpenter wants to buy two types of nails: the first type costs ₱ 6 per kilogram, and the second type costs ₱ 9 per kilogram. He needs at least 5 kg of the first type and at least 3 kg of the second. He needs to spend less than ₱ 75.

1. Using x to represent the amount of the first type and y to represent the second type, state the system of inequalities that represents this situation.
2. Graph these inequalities on a number plane.
3. Shade the area that represents the region of the solution to the number of nails he can buy.
   - Observe students' responses, giving encouragement. Ask the students to volunteer their answers, giving positive feedback. Select good sample answers for all students to write down.

These may come from the students or from the following sample answer.

Sample Answer

- In this example, we will state the systems of inequalities that satisfy the conditions for a carpenter who wants to purchase two types of nails.
  Since x and y are the amounts of nails (in kilograms) from the first and second type, respectively, and the carpenter needs at least 5 kg of the first type and 3 kg of the second, we have the condition $x \geq 5$ and $y \geq 3$.
  As the first type costs \$6 per kilogram and the second type costs \$9 per kilogram, the total price for each type would be $6x$ and $9y$ respectively. The sum of these has to be less than \$75, and thus we have $6x+9y<75$.
  To summarize, the system of inequalities for each condition for the given situation is $x \geq 5$, $y \geq 3$, $6x + 9y < 75$.
- and 3.



Lesson Component 5: Reflection

Time: 5 minutes

- In this component, the teacher initiates and leads a student-focused wrap-up to the main objectives of the lesson. The focus is on the whole lesson experience, including how well what students feel that they take from the lesson relates to what their expectations were for the lesson, as outlined in Component 2 ('Purpose/focus' of the lesson).
- The teacher should facilitate student reflection and discussion, that addresses such questions as:
  - What do you think were the key mathematical concepts addressed in this lesson?
  - Would you rate your level of understanding of the material covered in this lesson as high, moderate, or low?
  - Has the lesson helped you to gain further insight into aspects of the material covered that represent strengths or represent weaknesses?
  - What would you describe as the main barriers, if any, to your ongoing progress and achievement in relation to the topic area addressed in this lesson?
  - What do you think would best assist your ongoing progress and achievement in relation to the topic area?

Mathematics Grade 8 Lesson Plan 11

Relations and Functions

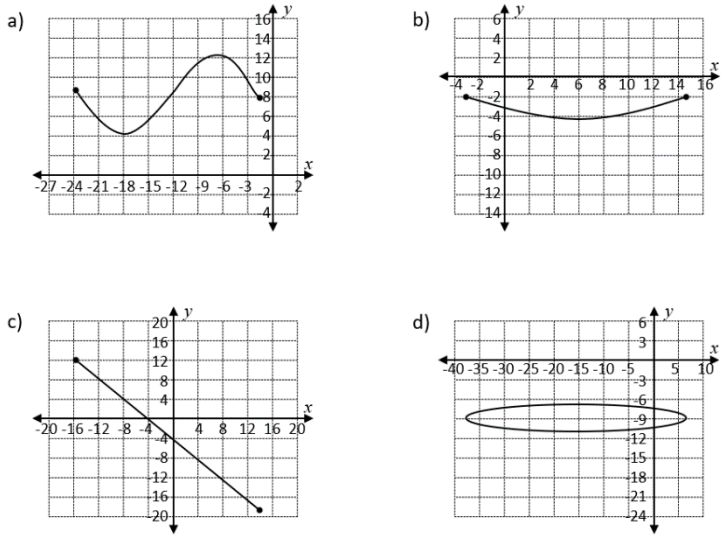
Key Idea

To determine the difference between a relation and a function

Component 1: Short Review

Time: 7 mins

1. What is the domain and range of $x^2 + y^2 = 16$?
2. Evaluate the following functions:
   a) $f(x) = 3x + 8$ when $x = 5$
   b) $f(x) = 2x^2 + 5x - 9$ when $x = -3$
   c) $f(x) = \frac{3x-1}{4x+5}$ when $x = 6$
3. State whether the following graphs represent a relation or a function.



- Teacher provides answers to questions and highlights particular concepts, as well as issues that may have arisen in student answers (issues not addressed to be noted at end of lesson).
- Ask students to volunteer their answers, giving positive feedback. Read out a sample answer for all students to listen to and write down. This may come from one of the students or from the sample answers below.

Sample answers

1. $-4 \leq x \leq 4$……*domain*
   $4 \leq y \leq 4$……..*range*
2. *a)* $f(x) = 3x + 8$ *when* $x = 5$
   $f(5) = 3 \times 5 + 8$
   $f(5) = 23$
   b) $f(x) = 2x^2 + 5x - 9$
   $f(-3) = 2(-3)^2 - 15 - 9$
   $= 18 - 15 - 9$
   $= 3 - 9$
   $= -6$
   c) $f(x) = \frac{3x-1}{4x+5}$
   $f(6) = \frac{3 \times 6 - 1}{4 \times 6 + 5}$
   $f(6) = \frac{18 - 1}{24 + 5}$
   $f(6) = \frac{17}{29}$

3. *a) function*
   b) function
   c) function
   d)relation

Component 2: **Lesson Purpose/Intention**
Time: 2 mins

The purpose of this lesson is to understand difference between relations and functions.

Component 3: Lesson Language Practice
Time: 5 mins

- Read out difficult or unfamiliar words or phrases and ask the students to read them to themselves and then out loud as a class.

Relation – is a set of ordered pairs.

Function – is a set of ordered pairs where there is only one y-value for each x-value.

Domain – is the set of all the possible x values for the ordered pairs.

Range – is the set of all the possible y values for the ordered pairs.

- Ask students the difference between the words, '***relation'*** and ***'function'*.**

Component 4*:* Lesson Activity
Time: 25 mins

Component 4A

- Refer students to the main lesson stimulus and **orient them to the text.**

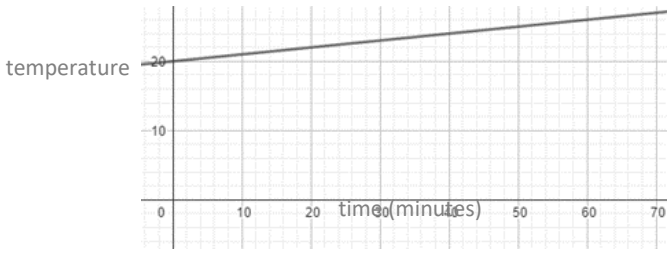
> The temperature in a swimming pool cools down each night to 20°C. When the owner puts the heater on in the morning, the temperature increases at 0.1°C per minute until it reaches 27°C.

Component 4B

- Read out the following questions and ask students to answer in the space on their worksheet.
- Write an expression for the relationship between the temperature P in Celsius degrees, and t, time in minutes.
- What restrictions would there be on the values of P and t?
- What is the domain and range of the function?
- On a number plane, draw a graph of the relationship between pool temperature and time in minutes, during this heating phase.
- Observe students' answers. Ask the students to volunteer their answers, giving positive feedback. Select good sample answers for all students to write down. These may come from the students or from the following sample answers.

Sample answers:

$P = 20 + 0.1t$
$20 \leq P \leq 27, t \geq 0$
$range\ is\ the\ same\ as\ question\ 2, (20\ \leq P \leq 27), domain\ is\ 0 \leq t \leq 70$
$(as\ t = 70\ is\ when\ the\ temperature\ of\ 27°\ is\ reached)$



Component 4C

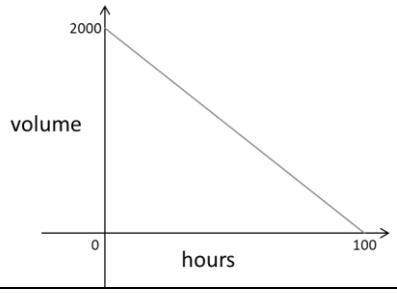
- Read out the following questions and ask students to answer in the space on their worksheet.

A water tank has a capacity of 2 000 liters and is full. Water leaks from two holes at the bottom of the tank so that after 1 hour it has lost 20 liters and after 2 hours has lost 40 liters.

1. What is the independent variable?
2. What is the dependent variable?
3. Write a relationship to connect the dependent and independent variable.
4. What are the domain and range of the function?
5. **(Optional)** Graph the function on a number plane.

- Observe students' responses, giving encouragement. Ask the students to volunteer their answers, giving positive feedback. Select good sample answers for all students to write down. These may come from the students or from the following sample answer.

Sample Answer

1. The independent variable is time.
2. The dependent variable is the amount of water in the tank.
3. $V = 2000 - 20h$
4. Domain is $0 \leq h \leq 100$
   Range is $0 \leq V \leq 2000$
5. 

Lesson Component 5: Reflection

Time: 5 minutes

- In this component, the teacher initiates and leads a student-focused wrap-up to the main objectives of the lesson. The focus relates to what their expectations were for the lesson, as outlined in Component 2 ('Purpose/focus' of the lesson).
  - What do you think were the key mathematical concepts addressed in this lesson?
  - Would you rate your level of understanding of the material as high, moderate, or low?
  - Has the lesson helped you to gain further insight into the material covered?
  - What would you describe as the main barriers to your ongoing progress?
  - What do you think would best assist your progress and achievement?

NOTE: Remember to collect student's worksheets to review and analyze student's learning.

Mathematics Grade 8 Lesson Plan 12

Consolidation 2 Number Plane, Simultaneous Equations and Functions

Key Idea

Review the learning on the Number Plane, Simultaneous Equations and functions.

Component 1: **Short Review**

Time: 7 minutes

- Ask students to answer the following questions.

1. For the line $y = 3x - 2$:
   Q1. What is the gradient?
   Q2. What is the y-intercept?
   Q3. Rewrite the equation in general form.

2. On the same number plane draw the graphs of $y = 2x + 1$ and $y = -4x - 5$.
   Q1. What is the point of intersection?
   Q2. Where does $y = 2x + 1$ cross the x-axis?
   Q3. Find the point of intersection of the two lines algebraically.

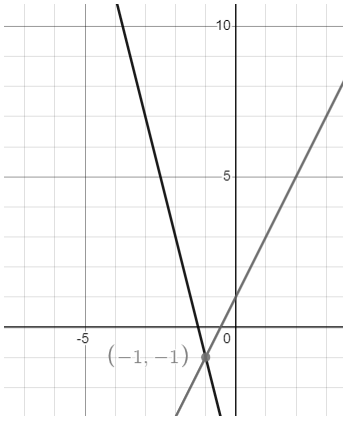
3. Shade the region on the plane where $x + y \leq 1$

4. Explain why $x^2 + y^2 = 1$ is a relation.

5. Ask students to volunteer answers, giving positive feedback.

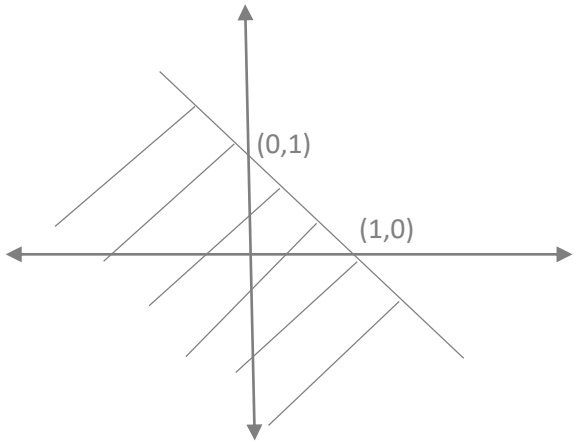
Answers:

1. *Q1. m=3*
   Q2. y=-2
   Q3. $3x - y - 2 = 0$

2. 

   Q1. $(-1, -1)$
   Q2. $x = -\frac{1}{2}$
   Q3. $y = 2x + 1$ *and* $y = -4x - 5$
   Equate both sides
   $2x + 1 = -4x - 5$
   $6x = -6$
   $x = -1$
   Substitute x=-1 into the first equation
   $y = 2x - 1 + 1$
   $y = -2 + 1$
   $y = -1$

3.



4. $x^2 + y^2 = 1$ is a relation because for every x-value there is more than one y-value. Or if a vertical line test was drawn on the graph of $x^2 + y^2 = 1$, then the vertical line would cross at 2 points.

Component 2: **Lesson Purpose/Intention**
Time: 3 minutes
The lesson is about *ensuring the skills learned during the week will be consolidated in this review lesson.*

Component 3: Lesson Language Practice
Time: 5 minutes

- Read out difficult or unfamiliar words or phrases and ask the students to read them to themselves and then out loud as a class.
- Ask the students to practice saying the words in a sentence.
- Ask students to volunteer their answers, giving positive feedback and discussing.

Parallel Lines – *are lines in a plane that are always the same distance apart. Parallel lines never intersect.*
Perpendicular Lines – *are lines that intersect at a right (90 degrees) angle.*
Intercept – *is the point where the line crosses the x-axis, called the x-intercept, and the point where the line crosses the y-axis, called the y-intercept.*
Gradient – *is the slope or steepness of a line when viewing from left to right.*
y-intercept – *where a line cuts the y- axis, where x=0 the x-axis, where y=0.*
Simultaneous – *occurs at the same time.*
x-intercept – *where a line cuts.*
Equation – *a number sentence where one side equals the other.*
Variable – *a quantity that can change by having different values.*
Number Plane – *a two-dimensional number line where the vertical line is called the y-axis and the horizontal is called the x-axis. The x-axis and the y-axis meet at right angles.*
Inequality – *compares two values, showing if one is less than, greater than, or simply not equal to another value.*
Region z – *is a space in the number plane that either is separated by lines or is surrounded by lines.*
Minimum – *The smallest value.*
Maximum – *The greatest value.*
Cargo*-the goods carried by a ship, aircraft, or other large vehicle.*
Equation – *a number sentence where one side equals the other.*
Variable – *a quantity that can change by having different values.*

Component 4*:* Lesson Activity
Time: 25 minutes
Component 4A

- Refer students to the main lesson stimulus below.
- Read out the written text.
- Ask the students if there are any words that they are not familiar with and give descriptions of any words that may be problematic.

> David buys 2 tops and 2 shirts in a shop and in total they cost ₱ 18. Ellie buys 3 tops and 2 shirts in the same shop, and they cost ₱ 22. Form two equations and solve to find the cost of each top and each shirt.

Component 4B

- Observe students' answers. Ask the students to volunteer their answers, giving positive feedback.

Sample answers:
Let x be the number of tops and y be the number of shirts
The equations are:
$2x + 2y = 18$ and $3x + 2y = 22$

Solve the equations simultaneously
$2x + 2y = 18$ …….*a*
$3x + 2y = 22$……*b*
b-a
$x = 4$
Substitute into a
$8 + 2y = 18$
$2y = 10$
$y = 5$
The solution is each top costs ₱ 4 and each shirt costs ₱ 5.

Component 4C

- Read out the following questions and ask students to answer.

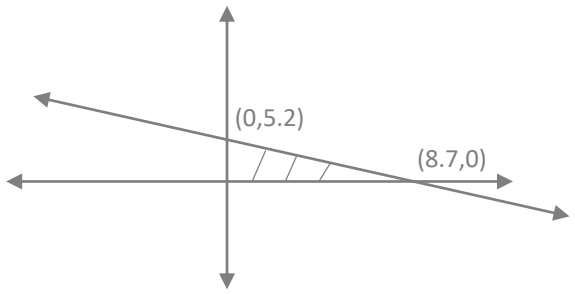
Q1. Jason and Melanie have ₱ 26.30 in total. Melanie has ₱ 10 more than Jason. How much each do Jason and Melanie have?

Sample Answer:
$J + M = 26.30$
$J = M - 10$
$M - 10 + M = 26.30$
$2M - 10 = 26.30$
$2M = 36.30$
$M = 18.15$
$J = 18.15 - 10$
$J = 8.15$

Jason has ₱ 8.15 and Melanie has ₱ 18.15

Q2. **(Optional)** Ken is buying tokens to play games at a fun parlor. A turn on the 'Kongs' uses 3 token and a turn on the 'Cans' uses 5 tokens. He only has enough money to buy 26 tokens. Write an inequality to describe the situation. Shade the region on the number plane and explain why there are limits to where you can shade.

$3x + 5y \leq 26$



The line cannot go below the x-axis or to the left of y-axis because there can be no negative values for the tokens.

Component 5: Lesson Conclusion

Time: 5 minutes

- In this component, the teacher initiates and leads a student-focused wrap-up to the main objectives of the lesson. The focus is on the whole lesson experience, including how well what students feel that they take from the lesson relates to what their expectations were for the lesson, as outlined in Component 2 ('Purpose/focus' of the lesson).
- The teacher should facilitate student reflection and discussion, that addresses such questions as:
    - What do you think were the key mathematical concepts addressed in this lesson?
    - Would you rate your level of understanding of the material covered in this lesson as high, moderate, or low?
    - Has the lesson helped you to gain further insight into aspects of the material covered that represent strengths or represent weaknesses?

Mathematics Grade 8 Lesson Plan 13

If then Statement

Key Idea

Investigates if-then statements.

Component 1: Short Review
Time: 7 mins

1. In the following statements, determine which part is the hypothesis and which is the conclusion:
   a) If today is Tuesday, then tomorrow is Wednesday,
   b) If a truck weighs 200kg, then it weighs 200 000g.
2. Write each statement in the 'if-then' form:
   a) All monkeys love bananas.
   b) Collinear points lie on the same line.
3. Determine if a statement is true or false. If it is false, give an example of why.
   a) If an animal can swim, then it is a fish,
   b) If two angles are congruent, then they are right angles.

- Teacher provides answers to questions and highlights particular concepts, as well as issues that may have arisen in student answers (issues not addressed to be noted at end of lesson).
- Ask students to volunteer their answers, giving positive feedback. Read out a sample answer for all students to listen to and write down. This may come from one of the students or from the sample answers below.

Sample answers

1. a) *Hypothesis →Today is Tuesday*
   Conclusion → Tomorrow is Wednesday
   b) *Hypothesis → A truck weighs 200kg*
   Conclusion → The truck weighs 200 000g

2. a) *If an animal is a monkey, then it loves bananas.*
   b) *If points lie on the same line, then they are collinear.*

3. a) *It is false because other animals can swim, e.g., dog.*
   b) *It is false because two angles can be equal and not necessarily equal 90°.*

Component 2: **Lesson Purpose/Intention**
Time: 3 mins

The purpose of this lesson is to understand the use of conditional or ***if-then statements*** to make decisions based on a situation's circumstances.

Component 3: Lesson Language Practice
Time: 5 mins

- Read out difficult or unfamiliar words or phrases and ask the students to read them to themselves and then out loud as a class.

Hypothesis is a statement or proposition that attempts to explain phenomena or facts. Hypotheses are often tested to see if they are accurate.

Conclusion a judgment or decision reached by reasoning.

Counterexample an example that opposes or contradicts an idea or theory.

- Ask students the difference between the words, '***hypothesis'*** and **'*conclusion'*.**

Component 4*:* Lesson Activity

Time: 25 mins

Component 4A

- Refer students to the main lesson stimulus below.
- Read out the written text.
- Ask the students if there are any words that they are not familiar with and give descriptions of any words that may be problematic.

> For each of the following statements, rewrite them in the if-then form to determine if each conditional statement is true or false. If it is a false statement, provide a counter example.

Component 4B

- Read out the following questions and ask students to answer in the space on their worksheet.
  1. If Shirley hurries, she will arrive on time.
  2. The picnic will be cancelled if it is raining.
  3. Two planes that intersect have many points in common.
  4. Angles along a straight line are supplementary.
- Observe students' answers. Ask the students to volunteer their answers, giving positive feedback. Select good sample answers for all students to write down. These may come from the students or from the following sample answers.

Sample answers:

1. *If Shirley hurries, then she will arrive on time (However, she still may be late even if she hurries)*
2. *If it is raining, then the picnic will be cancelled (this may depend on the nature of the rain. It may just be a light shower and then the picnic could go ahead)*
3. *If lines have many points in common, then they intersect (this is not a true statement)*
4. *If angles are along a straight line, then they are supplementary.*

Component 4C

- Read out the following questions and ask students to answer in the space on their worksheet.
  Question: Consider the statement "If x is a positive integer and a solution to $x + 3 > 4$, then $x > 0$ and $x > 12$." Is this statement true?
- Observe students' responses, giving encouragement. Ask the students to volunteer their answers, giving positive feedback. Select good sample answers for all students to write down. These may come from the students or from the following sample answer.

Sample answer:

Assume x is a positive integer and it is a solution to the inequality $x + 3 > 4$
x must solve both inequalities of $x > 0$ and $x > 12$.
If $x > 12$, then it is also greater than 0.
From $x + 3 > 4$, $x > 1$. However, only values greater than 12 solve the second part of the statement.
Thus, the statement is partially true.

Lesson Component 5: Reflection

Time: 5 minutes

- The teacher should facilitate student reflection and discussion, that addresses such questions as:
  - What do you think were the key mathematical concepts addressed in this lesson?
  - Would you rate your level of understanding of the material as high, moderate, or low?
  - Has the lesson helped you to gain further insight into aspects of the material covered that represent strengths or represent weaknesses?
  - What would you describe as the main barriers to your ongoing progress and achievement?
  - What do you think would best assist your ongoing progress and achievement?

Mathematics Grade 8 Lesson Plan 14

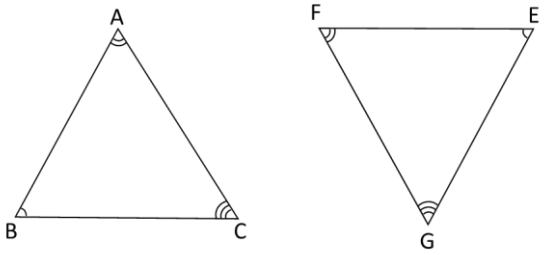
Congruent Triangles

Key Idea

Investigates properties of congruent triangles.

Component 1: Short Review

Time: 7 mins



Questions

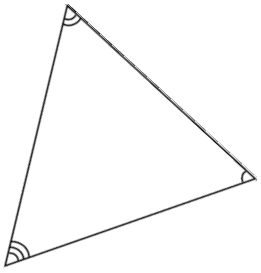
For the triangles shown above:

1. List all the corresponding angles.
2. List all the corresponding sides.
3. Draw a sketch of another triangle in a different position which is congruent to the two shown above.
4. List all the tests you know to prove triangles are congruent.
5. Why do we not use a congruency test involving 3 angles?

- Teacher provides answers to questions and highlights particular concepts, as well as issues that may have arisen in student answers (issues not addressed to be noted at end of lesson).
- Ask students to volunteer their answers, giving positive feedback. Read out a sample answer for all students to listen to and write down. This may come from one of the students or from the sample answers below.

Sample answers:

1. $\angle A = \angle F, \angle B = \angle E, \angle C = \angle G$
2. AB=EF, AC=FG, BC=EG
3. Multiple options possible, e.g.:



4. SSS, SAS, AAS, RHS
5. Because triangles with the same angles can be of any size. They are similar triangles.

Component 2: **Lesson Purpose/Intention**

Time: 3 mins

The purpose of this lesson is to write proofs showing triangles are congruent and using congruence to prove other geometrical facts.

Component 3: Lesson Language Practice

Time: 5 mins

- Read out difficult or unfamiliar words or phrases and ask the students to read them to themselves and then out loud as a class.

Congruent triangles - have the same corresponding angle measures and side lengths.
Corresponding angles that occur on the same side of the transversal line and are equal in size.
Corresponding sides the sides that are in the same position in any different 2-dimensional shapes

- Ask students the difference between the words, '***congruent'*** and **'*corresponding'*.**

Component 4*:* Lesson Activity

Time: 25 mins

Component 4A

- Refer students to the main lesson stimulus below.
- Read out the written text.
- Ask the students if there are any words that they are not familiar with and give descriptions of any words that may be problematic.

Two triangles ABC and PQR are such that; AB = 3.5 cm, BC = 7.1 cm, AC = 5 cm, PQ = 7.1 cm, QR = 5 cm and PR = 3.5 cm.

Component 4B

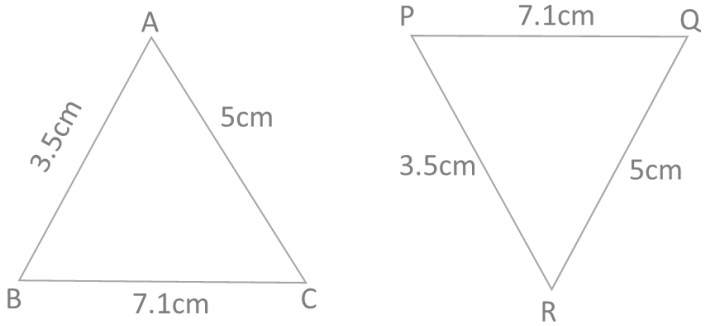
- Read out the following questions and ask students to answer in the space on their worksheet.

1. *Draw a sketch of the triangles.*
2. *Show that the two triangles are congruent.*

- Observe students' answers. Ask the students to volunteer their answers, giving positive feedback. Select good sample answers for all students to write down. These may come from the students or from the following sample answers.

Sample answers:

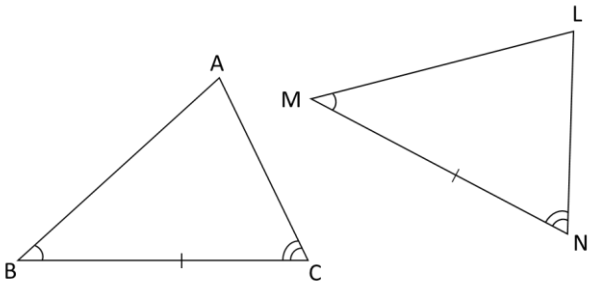
1.



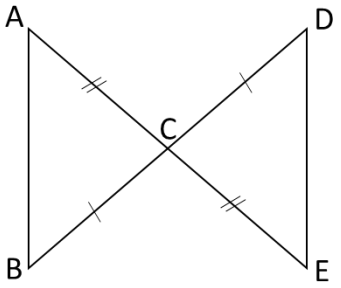
2. AB=PR
   BC=PQ
   AC=QR
   The three sides are equal, so the triangles are congruent. SSS Test.

Component 4C

- Read out the following questions and ask students to answer in the space on their worksheet.
  1. Which congruence rule do we use to confirm that the two triangles below are indeed congruent?



  2. **(Optional)** For the diagram below, show that $\triangle ABC \equiv \triangle DEC$



- Observe students' responses, giving encouragement. Ask the students to volunteer their answers, giving positive feedback. Select good sample answers for all students to write down. These may come from the students or from the following sample answer.

Sample Answer

1. AAS Test

2. AC=CE (C is the midpoint of AE)……..S
   BC=CD (C is the midpoint of BD)……S
   $\angle ACB = \angle DCE$ (Vertically opposite angles)..A
   $\therefore \triangle ABC \equiv \triangle DEC$ from the SAS Test

Lesson Component 5: Reflection

Time: 5 minutes

- In this component, the teacher initiates and leads a student-focused wrap-up to the main objectives of the lesson. The focus is on the whole lesson experience, including how well what students feel that they take from the lesson relates to what their expectations were for the lesson, as outlined in Component 2 ('Purpose/focus' of the lesson).
- The teacher should facilitate student reflection and discussion, that addresses such questions as:
  - What do you think were the key mathematical concepts addressed in this lesson?
  - Would you rate your level of understanding of the material covered in this lesson as high, moderate, or low?
  - Has the lesson helped you to gain further insight into aspects of the material covered that represent strengths or represent weaknesses?
  - What would you describe as the main barriers, if any, to your ongoing progress and achievement in relation to the topic area addressed in this lesson?
  - What do you think would best assist your ongoing progress and achievement in relation to the topic area?

NOTE: Remember to collect student's worksheets to review and analyze student's learning.

Mathematics Grade 8 Lesson Plan 15

Proof and properties of parallel lines cut by a transversal

Key Idea

Proves properties of parallel lines cut by a transversal.

Component 1: Short Review
Time: 7 mins

- Teacher asks students questions (designed to remind them of relevant content completed).
  1. What are points on a straight line called?
  2. What is the sum of supplementary angles?
  3. What is the sum of complementary angles?
  4. How many degrees in a revolution?
  5. What is the angle sum of a triangle?
  6. What is the angle sum of a quadrilateral?
  7. What are two features of a parallelogram?

- Teacher provides answers to questions and highlights particular concepts, as well as issues that may have arisen in student answers (issues not addressed to be noted at end of lesson).

- Ask students to volunteer their answers, giving positive feedback. Read out a sample answer for all students to listen to and write down. This may come from one of the students or from the sample answers below.

Sample answers:

1. Collinear
2. 180°
3. 90°
4. 360°
5. 180°
6. 360°
7. Opposite sides are parallel, Opposite sides are equal length, Diagonally opposite angles are equal.

Component 2: **Lesson Purpose/Intention**
Time: 3 mins

The purpose of this lesson is to show how to prove geometrical facts.

Component 3: Lesson Language Practice
Time: 5 mins

- Read out difficult or unfamiliar words or phrases and ask the students to read them to themselves and then out loud as a class.

Congruence – identical in shape and size
Complementary – Two angles are called complementary when their measures add to 90 degrees.
Supplementary – Two angles are called complementary when their measures add to 90 degrees**.**
Corresponding – Corresponding objects are those that appear in the same place in two similar situations.

- Ask students the difference between the words, **'*complementary*'** and **'*supplementary*'.**

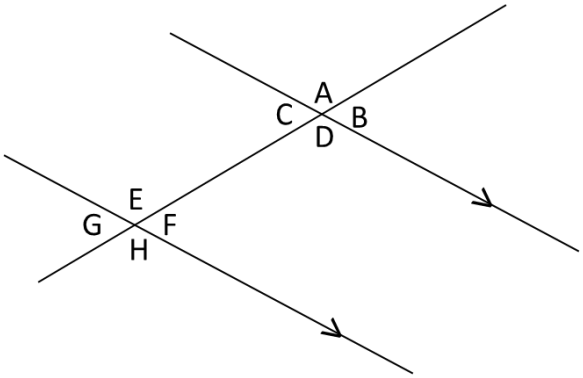
Component 4*:* Lesson Activity

Time: 25 mins

Component 4A

- Refer students to the main lesson stimulus and orient them to the text.

For the diagram below answer the following questions



Component 4B

- Read out the following questions and ask students to answer in the space on their worksheet.
  1. If $\angle G$= 72°, what is the size of $\angle E$? Explain you answer.
  2. What other angles are the same size as $\angle G$?
  3. What is the sum of $\angle E$ and $\angle C$? Explain your answer.
  4. **(Optional)** Name all the other angles that are equal to $\angle A$.
- Observe students' answers. Ask the students to volunteer their answers, giving positive feedback. Select good sample answers for all students to write down. These may come from the students or from the following sample answers.

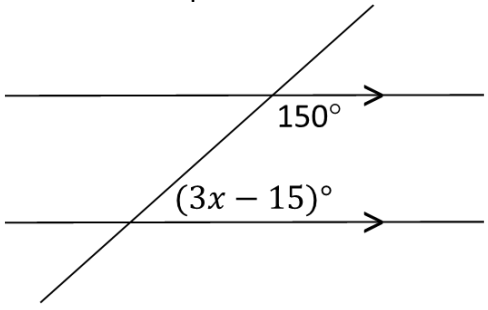
Sample answers:

1. $\angle E$= 108° because $\angle G$ and $\angle E$ lie on a straight line and are supplementary (add up to 180°)
2. $\angle C, \angle F, \angle B$
3. $\angle E + \angle C = 180°$ $\angle C$=$\angle G$ and because they are supplementary then $\angle E + \angle C = 180°$
4. $\angle E, \angle D, \angle H$

Component 4C

- Read out the following questions and ask students to answer in the space on their worksheet.

Find the value of x, that makes these two lines parallel with a transversal crossing them.



- Observe students' responses, giving encouragement. Ask the students to volunteer their answers, giving positive feedback. Select good sample answers for all students to write down. These may come from the students or from the following sample answer.

Sample answers:
If the lines are parallel then $(3x - 15)° + 150° = 180°$, because the angles would be supplementary.
$3x + 135 = 180$
$3x = 45$
$x = 15$

Lesson Component 5: Reflection

Time: 5 minutes

- In this component, the teacher initiates and leads a student-focused wrap-up to the main objectives of the lesson. The focus is on the whole lesson experience, including how well what students feel that they take from the lesson relates to what their expectations were for the lesson, as outlined in Component 2 ('Purpose/focus' of the lesson).
- The teacher should facilitate student reflection and discussion, that addresses such questions as:
    - What do you think were the key mathematical concepts addressed in this lesson?
    - Would you rate your level of understanding of the material covered in this lesson as high, moderate, or low?
    - Has the lesson helped you to gain further insight into aspects of the material covered that represent strengths or represent weaknesses?
    - What would you describe as the main barriers, if any, to your ongoing progress and achievement in relation to the topic area addressed in this lesson?
    - What do you think would best assist your ongoing progress and achievement in relation to the topic area?

NOTE: Remember to collect student's worksheets to review and analyze student's learning.

Mathematics Grade 8 Lesson Plan 16

Probability

Key Idea

Apply knowledge of probability to solve problems.

Component 1: Short Review
Time: 7 mins

- Teacher asks students questions (designed to remind them of relevant content completed).
  Questions:
  1. If I have 5 cards that are numbered 1, 2, 3, 4, 5 in a box and I randomly choose a card, what is the probability that the number on the card is even?
  2. What is the probability that if the teacher picks a student at random from the class that it is a boy?
  3. If the teacher has a bag containing 4 red counters and 3 blue counters, what is the probability if they choose a counter at random that it will be blue?

- Teacher provides answers to questions and highlights particular concepts, as well as issues that may have arisen in student answers (issues not addressed to be noted at end of lesson).
- Ask students to volunteer their answers, giving positive feedback. Read out a sample answer for all students to listen to and write down. This may come from one of the students or from the sample answers below.

Sample answers:

1. $\frac{2}{5}$
2. *The answer will depend on how many girls and boys there are in the class. Answer will be the number of boys divided by the number in the class.*
3. $\frac{3}{7}$

Component 2: **Lesson Purpose/Intention**
Time: 2 mins

The lesson is about learning how to calculate the probability of events.

Component 3: Lesson Language Practice
Time: 5 mins

- Read out difficult or unfamiliar words or phrases and ask the students to read them to themselves and then out loud as a class.

Probability – how likely something is to happen.
Experiment – an activity performed a number of times so the chance of an events happening can be measured.
Outcome of an experiment – is the result of the experiment.
With replacement – if an item is removed in an experiment, it is then replaced for the next activity.
Without replacement – If an item is removed in an experiment, it is not replaced.

- Ask students the difference between the words, '***probability'*** and **'*experiment'*.**

Component 4*:* Lesson Activity

Time: 25 mins

Component 4A

- Refer students to the main lesson stimulus below.
- Read out the written text.
- Ask the students if there are any words that they are not familiar with and give descriptions of any words that may be problematic.

> Paulo wants to design a probability experiment for his class. He uses 12 colored balls. He has 3 different colors of balls: red, white and green. He places the balls in a bag. He then removes a ball from the bag.

Component 4B

- Read out the following questions and ask students to answer in the space on their worksheet.

Questions

Q1. If Paulo wants all the outcomes of the experiment to be equal, how many balls of each color should he place in the bag?

Q2. Draw a diagram to represent the outcomes of the experiment.

Q3. What is the probability of getting a green ball?

Q4. If Paulo takes out a green ball first and does not replace it back into the bag, what is the probability of taking out a green ball on a second draw? Draw a diagram to demonstrate your answer.

Q5. **(Optional)** If Paulo then removes all the balls from the bag and replaces them with a different combination of the 3 colors, how many white balls would have to be in the bag to get a probability of 1/3 for a draw of a white ball?

- Observe students' answers. Ask the students to volunteer their answers, giving positive feedback. Select good sample answers for all students to write down. These may come from the students or from the following sample answers.

Sample answers:

Q1. 4 of each color

Q2. Many diagrams could be used here as long as there is an indication of 4 reds, 4 whites and 4 greens.

Q3. $\frac{4}{12}$ *this should be simplified to* $\frac{1}{3}$

Q4. Once he takes out 1 green ball, there are only 3 green balls left and only 11 balls left in the bag, so $\frac{3}{11}$

Q5. 4

Component 4C

- Read out the following questions and ask students to answer in the space on their worksheet.

1. Design a different combination of colors (that means that the combination would not be 4 of each color) for the 12 balls and calculate the probability of each color from a single draw. If there is a second draw of a ball from the bag, find the difference between the probabilities for 'with replacement' and 'without replacement'.

- Observe students' responses, giving encouragement. Ask the students to volunteer their answers, giving positive feedback. Select good sample answers for all students to write down. These may come from the students or from the following sample answer.

Sample answers:

1. There will be a variety of different answers. Ask students to check with each other to see if their answers are correct. Similarly, the teacher could ask students to share with the class to see if their answers are correct, especially note the different answers for 'with replacement' and 'without replacement'.

Lesson Component 5: Reflection

Time: 5 minutes

- In this component, the teacher initiates and leads a student-focused wrap-up to the main objectives of the lesson. The focus is on the whole lesson experience, including how well what students feel that they take from the lesson relates to what their expectations were for the lesson, as outlined in Component 2 ('Purpose/focus' of the lesson).
- The teacher should facilitate student reflection and discussion, that addresses such questions as:
  - What do you think were the key mathematical concepts addressed in this lesson?
  - Would you rate your level of understanding of the material covered in this lesson as high, moderate, or low?
  - Has the lesson helped you to gain further insight into aspects of the material covered that represent strengths or represent weaknesses?
  - What would you describe as the main barriers, if any, to your ongoing progress and achievement in relation to the topic area addressed in this lesson?
  - What do you think would best assist your ongoing progress and achievement in relation to the topic area?

NOTE: Remember to collect student's worksheets to review and analyze student's learning.

Mathematics Grade 8 Lesson Plan 17

Illustrates experimental and theoretical probability

Key Idea

Demonstrates the difference between experimental and theoretical probability.

Component 1: Short Review

Time: 7 mins

- Ask students to answer the following questions for the situation on their worksheet.

John rolled a 6-sided dice 16 times and recorded the outcomes shown.

Die Outcome	Experimental results
1	II
2	IIII
3	I
4	III
5	IIIII
6	I

Questions

1. What is the probability of rolling a 5?
2. Is this what you expected?
3. Does the table provide information about experimental or theoretical probability?
4. Explain how you know.

- Ask students to volunteer their answers, giving positive feedback. Read out a sample answer for all students to listen to and write down. This may come from one of the students or from the sample answers below.

Sample answers:

1. $\frac{5}{16}$
2. *The expected outcome would be* $\frac{1}{6}$ *which is much lower than* $\frac{5}{16}$ *in the experiment.*
3. *The table provides information about experimental probability.*
4. *We know this because the results are different from what is expected, and the results are different for each roll of the dice.*

Component 2: **Lesson Purpose/Intention**

Time: 3 mins

In this section, we compare experimental probability and theoretical probability. Experimental probability is the probability of an event occurring based on experimental results.

Component 3: Lesson Language Practice

Time: 5 mins

- Read out difficult or unfamiliar words or phrases and ask the students to read them to themselves and then out loud as a class.

Theoretical– the number of favorable outcomes divided by the total number of possible outcomes.

Experimental– describes how frequently an event actually occurred in an experiment.

- Ask students the difference between the words '***theoretical'*** and **'*experimental'*.**
- Ask students to volunteer their answers, giving positive feedback and discussing.
- Ask the students to practice saying the words in a sentence.

Component 4*:* Lesson Activity
Time: 25 mins

Component 4A

- Refer students to the main lesson stimulus below.
- Read out the written text.
- Ask the students if there are any words that they are not familiar with and give descriptions of any words that may be problematic.

Jessie flips two coins 20 times to determine the experimental probability of landing on heads versus tails. Here are his results.

Coin Outcome	Experimental Results
H, H	IIII
H, T	IIIII
T, H	IIIIII
T, T	IIIII

Component 4B

- Read out the following questions and ask students to answer in the space on their worksheet.

Q1. What is the experimental probability of both coins landing on heads?

Q2. Draw a tree diagram to determine the possible theoretical outcomes.

Q3. Calculate the theoretical probability of both coins landing on heads.

Q4. Compare the theoretical probability and experimental probability.

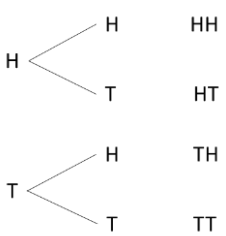
Q5. **(Optional)** What can Jessie do to decrease the difference between the theoretical probability and experimental probability?

- Observe students' answers. Ask the students to volunteer their answers, giving positive feedback. Select good sample answers for all students to write down. These may come from the students or from the following sample answers.

Sample answers:

Q1. $\frac{4}{10}$*, but we would simplify the fraction to* $\frac{2}{5}$

Q2.



Q3. $\frac{1}{4}$

Q4. The experimental and theoretical probabilities are different. The number of times he rolled 2 heads is less than what would be expected.

Q5. The more times 'she rolls the dice the closer the experimental probability and theoretical probability will be.

Component 4C

- Read out the following questions and ask students to answer in the space on their worksheet.
- Jessie decides to complete another experiment. She decides to roll a 6-sided die and toss a coin.

  Q1 What are all the possible theoretical outcomes?
  Q2 What is the probability of rolling a 6 and getting a head together?
  Q3 How many possible theoretical outcomes would there be if Jessie rolled a 6-sided die and tossed 2 coins at the same time?
  Q4 What is the theoretical probability of rolling a 3 and tossing a head and a tail in any order?
- Observe students' responses, giving encouragement. Ask the students to volunteer their answers, giving positive feedback. Select good sample answers for all students to write down. These may come from the students or from the following sample answer.

Sample answers:

Q1. 1H,1T, 2H,2T, 3H,3T, 4H,4T, 5H,5T, 6H,6T

Q2. $\frac{1}{12}$

Q3. 24

Q4. $\frac{2}{24}$ which would be simplified to $\frac{1}{12}$

Component 5: Lesson Conclusion

Time: 5 mins

- In this component, the teacher initiates and leads a student-focused wrap-up to the main objectives of the lesson. The focus is on the whole lesson experience, including how well what students feel that they take from the lesson relates to what their expectations were for the lesson, as outlined in Component 2 ('Purpose/focus' of the lesson).
- The teacher should facilitate student reflection and discussion, that addresses such questions as:
  - What do you think were the key mathematical concepts addressed in this lesson?
  - Would you rate your level of understanding of the material covered in this lesson as high, moderate, or low?
  - Has the lesson helped you to gain further insight into aspects of the material covered that represent strengths or represent weaknesses?
  - What would you describe as the main barriers, if any, to your ongoing progress and achievement in relation to the topic area addressed in this lesson?
  - What do you think would best assist your ongoing progress and achievement in relation to the topic area?

NOTE: Remember to collect student's worksheets to review and analyze student's learning.

Mathematics Grade 8 Lesson Plan 18

Consolidation 3 If then, Congruence, Parallel Lines and Probability

Key Idea

Review the learning on If then statements, congruence, parallel lines and probability.

Component 1: **Short Review**

Time: 7 minutes

- Ask students to answer the following questions.
  1. Rewrite the following statements as an 'if-then' statement.
     a) All students like geometry
     b) The angles in an equilateral triangle are all equal
  2. Names all the tests for congruent triangles
  3. If a transversal crosses a pair of parallel lines, then the angles formed are co-interior, corresponding or …?
  4. If there are 10 cards, labelled 1 to 10, are shuffled and laid on a table, the probability of selecting an even number is…..?

- Ask students to volunteer answers, giving positive feedback.

Sample answers:

1.

a) If you are a student, then you like geometry.

b) If the triangle is equilateral, then the angles are all equal.

2. SSS, SAS, AAS and RHS

3. Alternate

4. $\frac{5}{10}$ *or* $\frac{1}{2}$

Component 2: **Lesson Purpose/Intention**

Time: 3 minutes

R*eview the learning on **If then** statements, congruence, parallel lines and probability.*

Component 3: Lesson Language Practice

Time: 5 minutes

- Read out difficult or unfamiliar words or phrases and ask the students to read them to themselves and then out loud as a class.
- Ask the students to practice saying the words in a sentence.
- Ask students to volunteer their answers, giving positive feedback and discussing.

Hypothesis, Conclusion, Counterexample, Congruent triangles, Corresponding angles, Corresponding sides, complementary, supplementary, corresponding, Probability, Experiment, Outcome of an experiment, With replacement, Without replacement, Theoretical, Experimental

Choose 5 words from the above list and use them in a sentence.

Component 4*:* Lesson Activity

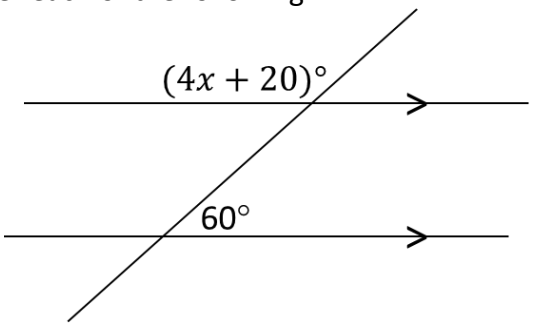
Time: 25 minutes

Component 4A

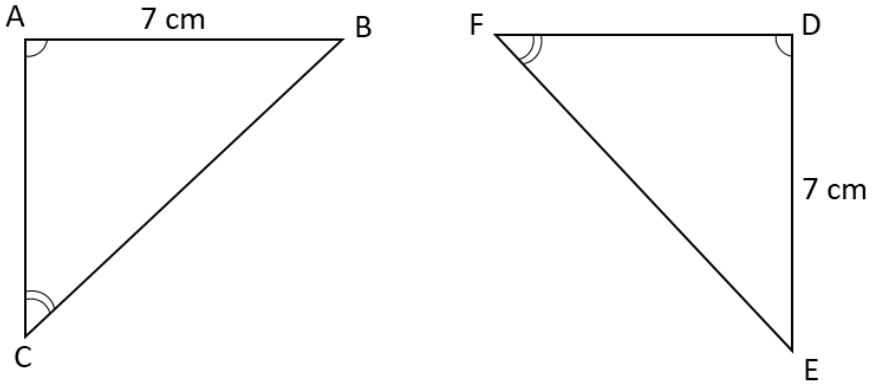
- Refer students to the main lesson stimulus below.
- Ask the students if there are any aspects that they are not familiar with and give descriptions of any aspects that may be problematic.

Consider each of the following:

1.



2.



Component 4B

1. Calculate the value of x.

2. Prove that ΔABC≡ΔDEF

Sample Answers

1. The angle on the same horizontal line as 60°is 120°as the angles are supplementary.
   Thus, $4x + 20 = 120$
   $4x = 100$
   $x = 25$

2. AB=DE (given)
   Angle ACB=Angle DFE (from diagram)
   Angle CAB= Angle FDE (from diagram)
   Therefore ΔABC≡ΔDEF (AAS test)

Component 4C

1. Joan decides to buy a triple scoop ice cream. She can choose from 5 different flavors, strawberry, vanilla, chocolate, blueberry and sherbet. She can only have one scoop of the flavor she chooses. How many different combinations of ice cream can she have?

2. A tire manufacturing company kept a record of the distance covered before a tire needed to be replaced. The table shows the results of 1000 cases.

Distance(in km)	Less than 4000	4000 to 9000	9001 to 14000	More than 14000
Frequency	20	210	325	445

If a tire is bought from this company, what is the probability that:

a) it has to be substituted before 4000 km is covered?
b) it will last more than 9000 km?
c) it has to be replaced after 4000 km and less than 14000 km is covered by it?

Sample Answers:

1. There are 5 different choices of her first scoop, 4 different choices for her second scoop and 3 different choices for her third scoop. Therefore, she has 5 X 4 X 3 different choices. So she has 60 different combinations of ice cream!!
2.

a) There are 1000 cases and 20 for less than 4000.

$$P=\frac{20}{1000}=\frac{1}{50}$$

b) More than 9000 = 325 + 445

=770

$$P=\frac{770}{1000}=\frac{77}{100}$$

c) More than 4000 and less than 14000 is 210+325.

210+325=535

$$P=\frac{535}{1000}=\frac{107}{200}$$

Component 5: Lesson Conclusion

Time: 5 minutes

- In this component, the teacher initiates and leads a student-focused wrap-up to the main objectives of the lesson. The focus is on the whole lesson experience, including how well what students feel that they take from the lesson relates to what their expectations were for the lesson, as outlined in Component 2 ('Purpose/focus' of the lesson).
- The teacher should facilitate student reflection and discussion, that addresses such questions as:
  - What do you think were the key mathematical concepts addressed in this lesson?
  - Would you rate your level of understanding of the material covered in this lesson as high, moderate, or low?
  - Has the lesson helped you to gain further insight into aspects of the material covered that represent strengths or represent weaknesses?
  - What would you describe as the main barriers, if any, to your ongoing progress and achievement in relation to the topic area addressed in this lesson?
  - What do you think would best assist your ongoing progress and achievement in relation to the topic area?

For inquiries or feedback, please write or call:

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