

- Get students to measure the angles on their book using a protractor. Have a few students say what the angle measures are. Then, write ' $m\angle POS = 115^\circ$ ', ' $m\angle POR = 65^\circ$ ', ' $m\angle ROQ = 115^\circ$ ' and ' $m\angle SOQ = 65^\circ$ ' on the board.

Stage: Abstract Representation

This is the first time students apply two different properties of angles to one figure. In this stage, they learn that a set of angles at a point can also have vertically opposite angles. With this knowledge, they can move on to solve problems involving angles in figures by applying more than one property of angles.

- Write ' $m\angle POS + m\angle POR + m\angle ROQ + m\angle SOQ = 115^\circ + 65^\circ + 115^\circ + 65^\circ = 360^\circ$ ' on the board.
- Highlight to students that $\angle POS$, $\angle POR$, $\angle ROQ$ and $\angle SOQ$ are angles at a point. The sum of their angle measures is 360° .
- Point out to students that the angles at a point are also vertically opposite angles.

❖ Blended Learning Program ❖

From PR1ME Mathematics Interactive Edition:

Let's Do (CB p. 110)

Assign the tasks to students as classwork for formative assessment. Use the corresponding lesson notes to identify the objectives of each task and address remediation needs.

Exercise 1 (PB pp. 89–91)

Assign the tasks to students as classwork for further formative assessment. Use the corresponding lesson notes to identify the objectives of each task and address remediation needs.

From PR1ME Mathematics Coursework Book:

Coursework Book Practice 1 (CWB pp. 92–93)

Assign all tasks to students as homework. Use the following notes to identify the skills needed for each task and address remediation needs.

Practice 1 (CWB pp. 92–93)

Class practice (For Print-based program):

Task 1 requires students to measure the size of angles using a protractor, then find the sum of the angle measures and recognize angles on a line.

Remediation

Tasks 1(a)–(c): Reteach measuring an angle using a protractor. Copy the first figure on CWB p. 90 on the board. Then, guide students to place the protractor properly, with the center of the protractor at Point O. Read the protractor from the left to the right to find the measure of $\angle a$. Read the protractor from the right to the left to find the measure of $\angle c$. To find the measure of $\angle b$, place the baseline of the protractor on either of the lines touching $\angle b$ and the center of the protractor at Point O.

Tasks 1(d)–1(e): Reteach identification of angles on a line. Copy the figure from Task 1 on the board. Guide students to see that the sum of the angle measures is 180° , hence the angles are on a line.

Teaching tips

Task 1

- When reteaching, follow the same procedure as the teaching example in Learn (CWB pp. 90).
- Point out to students that they can extend the lines with a pencil to make it easier for them to measure the angles with a protractor.
- Reiterate to students the importance of reading the correct scale on the protractor.

Independent practice (For Print-based program):

Task 2 requires students to identify angles on a line and use the property of angles at a point to state the sum of the angle measures. Students should not be using a protractor for this task.

Task 3 requires students to use a protractor to find unknown angle measures, then find their sum.

Task 4 requires students to use a protractor to find unknown angle measures, then identify and name the pairs of vertically opposite angles.

For answers, go to CW Manual p. 151.

❖ Blended Learning Program ❖

From PR1ME Mathematics Interactive Edition:

Practice 1 (CB p. 111)

Assign the tasks to students as classwork for summative assessment. Use the corresponding lesson notes to identify the objectives of each task and address remediation needs.

Lesson 2: Finding Unknown Measures of Angles

Duration: 1 h 40 min

❖ Blended Learning Program ❖

From PR1ME Mathematics Interactive Edition:

Let's Learn (CB p. 112)

Go through the teaching examples with students for concept development. Use the detailed lesson plan given in the corresponding lesson notes to carry out the teaching.

Learn

Finding unknown measures of angles (CWB p. 94)

Learning Outcome:

- Find the unknown measure of an angle involving angles on a line, angles at a point and vertically opposite angles

(a)

Stage: Pictorial Representation

In this stage, students will learn to identify useful information that will enable them to find an unknown angle measure in a given figure. They are required to apply their knowledge of properties of angles and the information they have gathered to find the unknown angle measure. Students are not required to use a protractor.

- Refer students to the figure in (a) on CWB p. 94. Highlight to them that XOY is a line and $\angle XOP$ and $\angle POY$ are angles on Line XOY.
- Explain to students that they are required to find the unknown measure of $\angle XOP$.
- Lead them to see that the measure of $\angle POY$ is given in the figure, and the measure is 125° .
- If necessary, draw a part-whole bar model to illustrate the strategy that students can use to find the answer. Explain to them that the parts of the bar model represent the measures of the angles on the line, and the whole represents their sum, which is 180° .

Stage: Abstract Representation

Students will now find an unknown angle measure using their knowledge of the property of angles on a line and the information given in the figure.

- Remind students that the sum of angle measures on a line is 180° .
- Highlight to them that there are two angles on the line XOY, and the measure of $\angle POY$ is given.
- Point out to students that to find the unknown angle measure, they have to subtract the measure of $\angle POY$ from the sum.
- Write ' $m\angle XOP = 180^\circ - 125^\circ = 55^\circ$ ' on the board.

(b)

Stages: Pictorial Representation and Abstract Representation

In this example, students will learn to find an unknown angle measure using their knowledge of the property of angles at a point and the information given in the figure. They are not required to use a protractor.

- Refer students to the figure in (b) on CWB p. 94. Highlight to them that there are three angles that meet at a point. Two of the angle measures are 70° and 140° , and the angle measure of $\angle a$ is unknown.
- Lead students to see that they have to find the unknown measure of $\angle a$.
- Have students recall the property of the sum of angle measures at a point. Reiterate to them that the sum of angle measures at a point is 360° .
- Point out to students that to find the measure of $\angle a$, they have to subtract the measures of the two given angle measures from the sum.
- Write ' $m\angle a = 360^\circ - 70^\circ - 140^\circ = 150^\circ$ ' on the board.

(c)

Stages: Pictorial Representation and Abstract Representation

In this example, students will learn to find an unknown angle measure using their knowledge of the property of vertically opposite angles and the information given in the figure. They are not required to use a protractor.

- Refer students to the figure in (c) on CWB p. 94. Highlight to them that Line AOB and Line COD are lines that cross each other at Point O.
- Guide students to see that $\angle AOC$ and $\angle DOB$ are vertically opposite angles.
- Get them to recall that the measures of vertically opposite angles are equal.
- Highlight to students that since $\angle AOC$ and $\angle DOB$ are vertically opposite angles, $m\angle AOC = m\angle DOB$.
- Write ' $m\angle DOB = 65^\circ$ ' on the board.

❖ Blended Learning Program ❖

From PR1ME Mathematics Interactive Edition:

Let's Do (CB p. 113)

Assign the tasks to students as classwork for formative assessment. Use the corresponding lesson notes to identify the objectives of each task and address remediation needs.

Exercise 2 (PB pp. 92–94)

Assign the tasks to students as classwork for further formative assessment. Use the corresponding lesson notes to identify the objectives of each task and address remediation needs.

From PR1ME Mathematics Coursework Book:

Coursework Book Practice 2 (CWB pp. 95–96)

Assign all tasks to students as homework. Use the following notes to identify the skills needed for each task and address remediation needs.

Practice 2 (CWB pp. 95–96)

Class practice (For Print-based program):

Task 1 requires students to apply the property of the sum of angle measures on a line to find an unknown angle measure.

Remediation

Task 1: Reteach finding an unknown angle measure when there are two angles on a line and one of the angle measures is given. Copy the figure from Task 1 (a) on CWB p. 95 on the board. Highlight to students that the sum of the angle measures is 180° , and the measure of $\angle QOA$ is 105° . Draw a part-whole bar model on the board to help them visualize the information, with the parts representing each of the two angle measures on the line and the whole representing their sum. Point out to students that to find the measure of $\angle POA$, they have to subtract the known angle measure from the whole.

Teaching tips

Task 1

- When reteaching, follow the same procedure as part (a) of the teaching example in Learn (CWB pp. 94).
- Highlight to students that no matter how many angles there are on a line, the sum of their angle measures is always 180° .

Independent practice (For Print-based program):

Task 2 requires students to apply the property of the sum of angle measures at a point to find an unknown angle measure.

Task 3 requires students to apply the property of vertically opposite angles to find an unknown angle measure. They can also apply the property of the sum of angles on a line to find the unknown angle.

Task 4 requires students to apply the property of the sum of angle measures on a line to find an unknown angle measure.

Task 5 requires students to apply the property of the sum of angle measures at a point to find an unknown angle measure.

Task 6 requires students to apply the property of vertically opposite angles to find an unknown angle measure. They can also apply the property of the sum of angles on a line to find the unknown angle.

For answers, go to CW Manual p. 151.

❖ Blended Learning Program ❖

From PR1ME Mathematics Interactive Edition:

Let's Learn (CB p. 114)

Go through the teaching examples with students for concept development. Use the detailed lesson plan given in the corresponding lesson notes to carry out the teaching.

Learn

Finding unknown measures of angles (CWB p. 97)

Learning Outcome:

- Find the unknown measure of an angle involving angles on a line, angles at a point and vertically opposite angles

(a)

Stages: Pictorial Representation and Abstract Representation

In this example, students will learn to find two unknown angle measures in a figure using their knowledge of the different properties of angles and identifying useful information given in the figure.

- Refer students to the figure in (a) on CWB p. 97. Highlight to them that Line AOB and Line COD are lines that cross each other at Point O.
- Lead students to see that they have to find the unknown measures of $\angle DOB$ and $\angle AOD$.
- Guide students to see that $\angle AOC$ and $\angle DOB$ are vertically opposite angles. Have them recall that the measures of vertically opposite angles are equal.
- Write ' $m\angle DOB = m\angle AOC = 73^\circ$ ' on the board.
- Highlight to students that $\angle AOC$ is also an angle on the line COD together with the unknown angle, $\angle AOD$.
- Have students recall the property of the sum of angles on a line. Then, lead them to see that they have to subtract the measure of $\angle AOC$ from 180° to find the measure of $\angle AOD$.
- Write ' $m\angle AOD = 180^\circ - 73^\circ = 107^\circ$ ' on the board.

(b)

Stage: Pictorial Representation

In this example, students will learn to find an unknown angle measure by first finding another unknown angle measure in a figure. Similar to the earlier example, they will be using their knowledge of the different properties of angles and identifying useful information given in the figure. This is an introduction to problems that involves more than one step. Through this example, students will learn that they may be expected to find the measure of an intermediate angle before they can get the final answer.

- Refer students to the figure in (b) on CWB p. 97. Highlight to them that Line TOU and Line VOW are lines that cross each other at Point O.
- Lead students to see that they have to find the unknown measure of $\angle XOY$.
- Have students name the pairs of vertically opposite angles. They should be able to see that $\angle TOV$ and $\angle WOU$ are vertically opposite angles. Have them recall that the measures of vertically opposite angles are equal.
- Write ' $m\angle TOV = m\angle WOU = 138^\circ$ ' on the board.
- Point out to students that $\angle WOU$ is made up of $\angle WOX$ and $\angle XOY$. Then, lead them to see that they have to subtract the measure of $\angle WOX$ from the measure of $\angle WOU$ to find the measure of $\angle XOY$.
- Write ' $m\angle XOY = 138^\circ - 53^\circ = 85^\circ$ ' on the board.

❖ Blended Learning Program ❖

From PR1ME Mathematics Interactive Edition:

Let's Do (CB p. 114)

Assign the tasks to students as classwork for formative assessment. Use the corresponding lesson notes to identify the objectives of each task and address remediation needs.

Exercise 3 (PB pp. 95–96)

Assign the tasks to students as classwork for further formative assessment. Use the corresponding lesson notes to identify the objectives of each task and address remediation needs.

From PRIME Mathematics Coursework Book:

Coursework Book Practice 3 (CWB p. 98)

Assign all tasks to students as homework. Use the following notes to identify the skills needed for each task and address remediation needs.

Practice 3 (CWB p. 98)

Class practice (For Print-based program):

Task 1 requires students to apply the properties of the sum of angle measures on a line and vertically opposite angles to find two unknown angle measures in a figure.

Remediation

Task 1: Reteach identifying angles on a line, vertically opposite angles and their properties. Copy the figure from Task 1 on CWB p. 98 on the board. Highlight to students that $\angle EOH$ and $\angle HOF$ are angles on a line, so the sum of their angle measures is 180° . Draw a part-whole bar model on the board to help students visualize the information, with the parts representing each of the two angle measures on the line and the whole representing their sum. Point out to them that the measure of $\angle EOH$ is given. To find the measure of $\angle HOF$, they have to subtract 133° from 180° . Highlight that $\angle HOF$ and $\angle EOG$ are vertically opposite angles, so their angle measures are equal.

Teaching tips

Task 1

- When reteaching, follow the same procedure as part (a) of the teaching example in Learn (CWB pp. 97).
- Point out to students that they should identify pairs of vertically opposite angles first if the figure involves two lines that cross each other.

Independent practice (For Print-based program):

Task 2 requires students to apply the property of vertically opposite angles to find an unknown angle measure in a figure.

Task 3 requires students to apply the properties of vertically opposite angles and the sum of angle measures on a line to find two unknown angle measures in a figure.

For answers, go to CW Manual p. 151.

❖ *Blended Learning Program* ❖

From PRIME Mathematics Interactive Edition:

Practice 2 (CB pp. 115–116)

Assign the tasks to students as classwork for summative assessment. Use the corresponding lesson notes to identify the objectives of each task and address remediation needs.

Lesson 3: Problem Solving

Duration: 1 h 20 min

❖ *Blended Learning Program* ❖

From PRIME Mathematics Interactive Edition:

Mind stretcher (CB pp. 117–118)

Go through the problem with students. Use the detailed lesson plan given in the corresponding lesson notes to carry out the teaching.

Learn

Mind stretcher

Learning Outcome:

- Solve a non-routine problem on angles using the strategy of making a supposition

Materials:

- 1 copy of Mind stretcher (BM4.4) per student
- 1 copy of Angles (BM4.5)

Overview

This problem requires students to apply their knowledge of the properties of vertically opposite angles, angles at a point, and angles on a line. This strategy allows students to make reasonable assumptions by examining the information provided in the question. The assumptions make it easier for students to further investigate the problem. Go through the problem using the 4-step Understand-Plan-Answer-Check process.

Distribute a copy of Mind stretcher (BM4.4) to each student. Have them underline the key information. This helps them to understand the problem and interpret it correctly.

1. Understand the problem.

- Refer students to the figure on BM4.4. Get them to count the total number of angles in the figure.
- Have students recall that the measures of $\angle a$ and $\angle c$ are equal. Then, ask them what they have to find.
- Lead students to understand that they have to find the fewest number of angle measures they need to know in order to find every angle measure in the figure.

2. Plan what to do.

- Point out to students that they can make suppositions to help them solve the problem.
- Guide students to choose a small number of known angle measures first, then increase the number of known angles until they are able to find the measures of all the other angles.

3. Work out the Answer.

Supposition 1

- Make a supposition that the measure of $\angle a$ is known. Show students Angles (BM4.5) and color $\angle a$ red.
- Point out that the measure of $\angle a$ is equal to the measure of $\angle c$. Then, color $\angle c$ red.