YuMi Deadly Maths

Year 7 Teacher Resource:

MG – Angle connections

Prepared by the YuMi Deadly Centre
Faculty of Education, QUT

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QUT

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ACKNOWLEDGEMENT

We acknowledge the traditional owners and custodians of the lands
in which the mathematics ideas for this resource were developed,
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Prepared by the YuMi Deadly Centre
Queensland University of Technology
Kelvin Grove, Queensland, 4059

ydc.qut.edu.au

Year 7 Measurement and Geometry

Angle connections

Learning goal Students will use angle relationships to find the value of corresponding, alternate and co-interior angles.

Content description Measurement and Geometry – Geometric reasoning

- Identify corresponding, alternate and co-interior angles when two parallel straight lines are crossed by a transversal (ACMMG163)
- Investigate conditions for two lines to be parallel and solve simple numerical problems using reasoning (ACMMG164)

Big idea Geometry – line and angle, equivalence

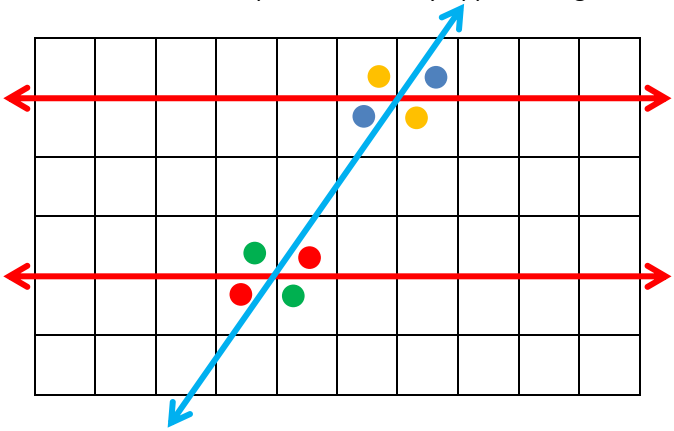
Resources Maths Mat, elastics, large counters, clear plastic rotagram, grid paper, coloured pencils

Reality

Local knowledge Discuss where students see parallel lines in their local environment, e.g. the sun's rays, blue lines in notepads, brickwork, tiles, railway lines, road double white lines. *What makes these lines parallel?* [They are infinite lines that are equidistant apart; they never meet or cross.]

Prior experience *What can you tell me about angles on a straight line?* [They are supplementary or equal to 180°.] *What name is given to lines that cross?* [intersecting lines]. *What are the angles called at the point where the lines intersect?* [vertically opposite angles]. *Make vertically opposite angles with your arms. What letter shape is formed?* [X].

Kinaesthetic Maths Mat: Have students take two elastics of the same colour and make two parallel lines that are horizontal. Two other students take an elastic of a different colour and cross the two parallel lines. *This line that goes over the two parallel lines is called a transversal. How many sets of vertically opposite angles have been formed?* [four]. Have students place the same coloured counter in each of the four pairs of vertically opposite angles.



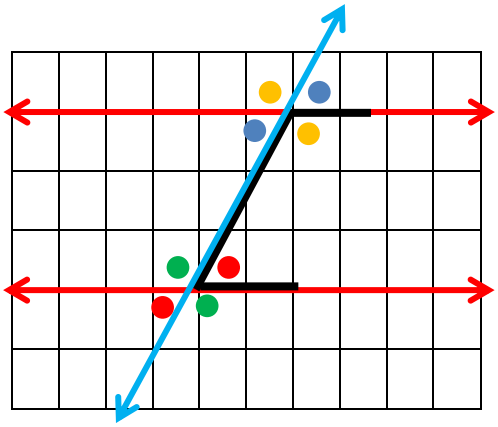
Tell me the colour of the pairs of angles that are equal. [orange = orange, blue = blue, red = red, green = green; counters of the same colour are vertically opposite].

Abstraction

Body *What could you predict about the sets of angles on these parallel lines? Do any angles on the top line look the same as angles on the bottom line?* [The orange angles look the same as the green angles and the blue angles look the same as the red angles.] Take the clear plastic rotagram and turn it so that the measure of the top orange angle is formed. Hold that angle firmly on the rotagram so that it remains constant and place it over the top green angle. *What do you notice?* [The arms of the green angle coincide with the arms of the orange angle.] *What does that tell us?* [The amount of turn in the orange angle is equal to the amount of turn in the green angle, so the green angle is equal to or congruent with the orange angle.] *What can you now say about the blue and red angles?* [They are also equal.]

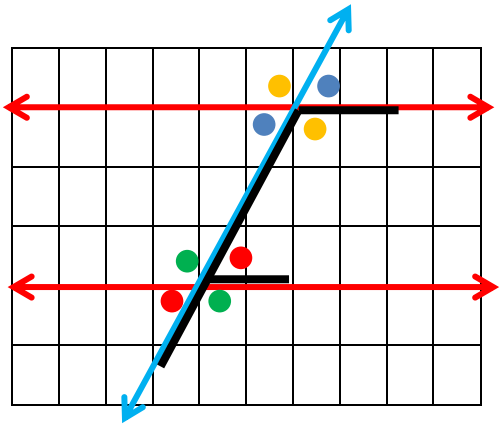
Why? [The blue angles equal 180° minus the orange angle {angles on a straight line equal 180°} and the red angles equal 180° minus the green angle that is the same as the orange angle.] *What is the sum of an orange angle and a blue angle?* [180°]. *What is the sum of a green angle and a red angle?* [180°]. *If the orange angle is the same as or equals the green angle, what is the sum of the orange angle and the red angle?* [180°].

Using the black elastic, examine the shapes of the angles the transversal forms with the parallel lines.



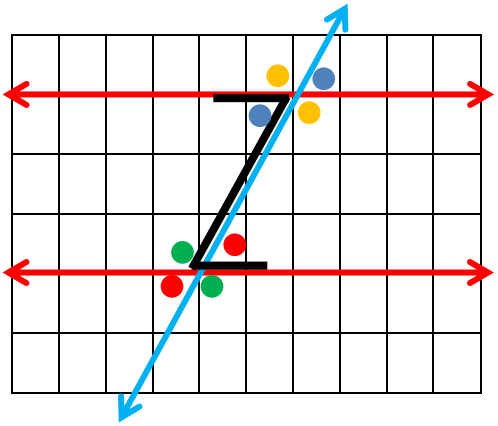
If the black line shape was rotated 90° or a quarter turn anticlockwise, what letter shape would it be? [U]
Are the orange and red angles inside or outside the black lines that form the U? [inside or interior]
What is the sum of the orange and red angles? [180°]
*So, we can say that **co-interior angles** between parallel lines forming a U shape are **supplementary** or **add to 180°**.*

Can you find another set of co-interior angles? [blue and green]



What letter shape has been made with the large and small black elastics? [F]
What can you tell me about the orange and green angles that are under the arms of the black elastics and on the same side of the transversal? [They are equal.]
If we reflected the F vertically around the transversal, would the blue and red angles be equal? [Yes]
*So, we can say that **corresponding angles** on parallel lines forming an F are always **equal**.*

*Corresponding angles sit either **below** or **above** the arms of the "F" on the **same side** of the transversal.*



What letter shape has been made with the black elastic this time? [Z]
Are the blue and the red on the same side of the transversal? [No, they are on opposite sides or alternate sides between the parallel lines.]
What does alternate mean? [Go from one side to the other.]
What can you tell me about the blue and red angles? [They are equal.]
*So we can say **alternate angles** forming a Z between the parallel lines are **equal**.*

Can you find another set of alternate angles? [orange and green]

*How many **pairs of co-interior angles** are there between parallel lines?* [2]. *How many **pairs of corresponding angles** are there on parallel lines?* [4]. *How many pairs of **alternate angles** are there between parallel lines?* [2].

Hand

On the Maths Mat make a pair of vertical parallel lines with one transversal. Have two students stand in squares that are alternate, corresponding or co-interior. Note that there is more than one way to represent these angles.

When students understand the properties of these angles, provide examples where the measure of one angle is given and students say what the other alternate or corresponding angle is, or calculate the measure of the other co-interior angle.

Grid paper: Students draw transversals on sets of parallel lines that are horizontally, vertically, obliquely parallel. They then name each angle with letters, e.g. a to h, and identify the angles that are co-interior, corresponding or alternate.

Mind

Students visualise corresponding, alternate, co-interior angles in their minds and trace the letter pattern in the air. Reverse: *See in your mind angles that make F, Z, U: What is the name for each of these?*

Creativity

Students create a piece of abstract art using their knowledge of angles on parallel lines.

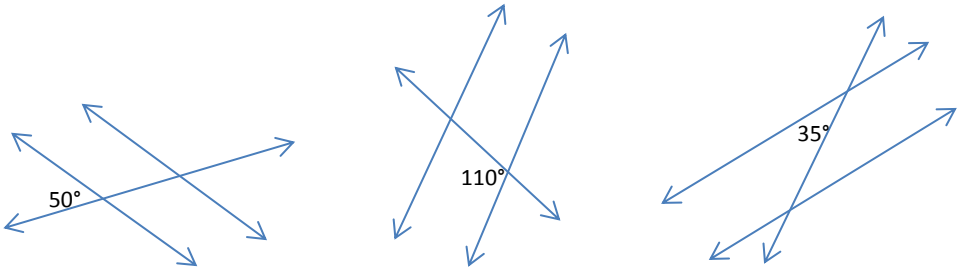
Mathematics

Language/ symbols

parallel lines, angles on a straight line, supplementary, vertically opposite angles, transversal, intersecting, corresponding angle, alternate angle, co-interior angle, horizontal, vertical, oblique

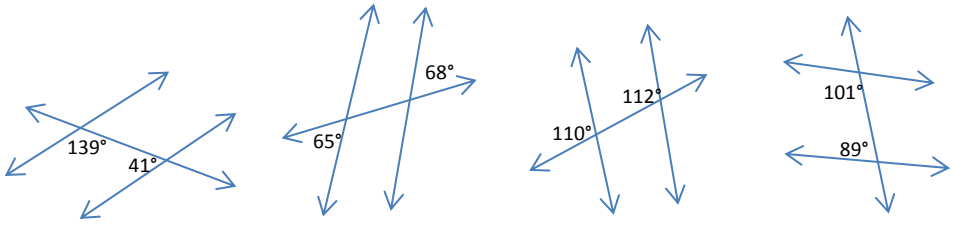
Practice

1. Students draw and calculate the size of all the angles from the size of the given angle (not drawn to scale).



A. **B.** **C.**

2. Students identify which set/s of lines are parallel from their knowledge of the properties of angles on parallel lines. Give reasons.



D. **E.** **F.** **G.**

3. Students make their own set of angles on parallel lines. Estimate and record the size of the angles by using the properties of these angles. Give to a partner to check estimations and calculations.

Connections

Relate to parallelograms, hexagons, octagons, 3D shapes where faces are parallel.

Reflection

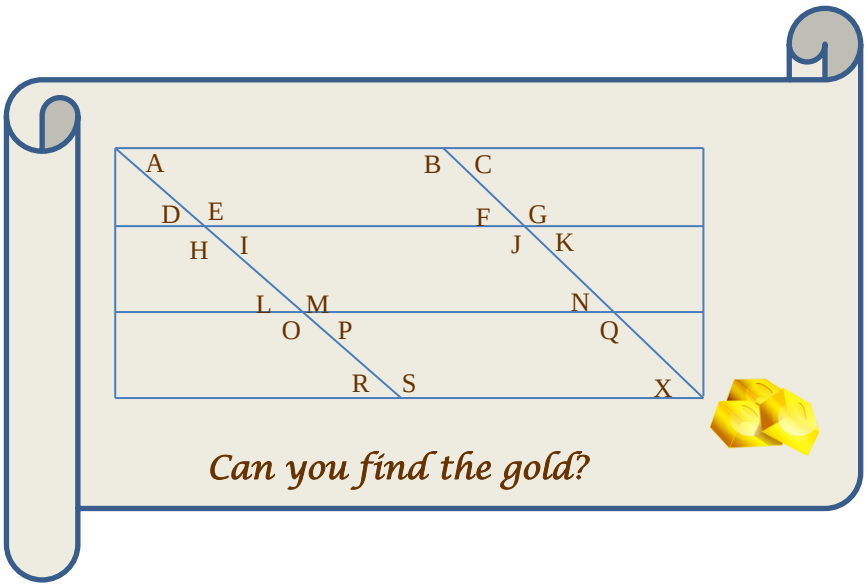
Validation

Students check their partner's work from 3. above and discuss situations where the knowledge of angles and parallel lines is needed and used in the real world, e.g. drawing plans for buildings, art and design, construction, surveying.

Application/ problems

Provide applications and problems for students to apply to different real-world contexts independently; e.g. A gold prospector has been given an old map consisting of four

horizontal parallel lines that are transversed by two oblique parallel lines. The gold will be found starting at A and passing through, in any order, at least one set of corresponding angles, one set of alternate angles and one set of co-interior angles to reach the gold at X. There is more than one way to reach the gold. Explain your path in your maths pad.



Extension

Flexibility. Students are able to apply their knowledge of angle properties on parallel lines to find the measure of a given angle/s using a variety of angle relationships to make their calculation.

Reversing. From their knowledge of the properties of angles on parallel lines, students are able to move between calculating the size of an angle to proving lines are parallel using angle relationships.

Generalising. *Lines are parallel when they continue infinitely and remain equidistant apart. Alternate and corresponding angles formed by a transversal crossing parallel lines are of equal value and co-interior angles are supplementary (add to 180°).*

Changing parameters. Investigate angles in regular 2D and 3D shapes and angles formed by transversals in cross-sections of similar figures. Examine conventions for labelling lines and angles.

Teacher's notes

- Alert students to the fact that diagrams are not always drawn to scale in which case the value of angles needs to be calculated using their knowledge of angle relationships and properties.
- Students need to be taught the skill of visualising: closing their eyes and seeing pictures in their minds, making mental images; e.g. show a picture of an angle, students look at it, remove the picture, students then close their eyes and see the picture in their mind, then make a mental picture of a different angle.
- Suggestions in Local Knowledge are only a guide. It is very important that examples in Reality are taken from the local environment that have significance to the local culture and come from the students' experience of their local environment.
- Useful websites for resources: www.rrr.edu.au; https://www.qcaa.qld.edu.au/3035.html
- Explicit teaching that aligns with students' understanding is part of every section of the RAMR cycle and has particular emphasis in the Mathematics section. The RAMR cycle is not always linear but may necessitate revisiting the previous stage/s at any given point.
- Reflection on the concept may happen at any stage of the RAMR cycle to reinforce the concept being taught. Validation, Application, and the last two parts of Extension should not be undertaken until students have mastered the mathematical concept as students need the foundation in order to be able to validate, apply, generalise and change parameters.

