



Unit Description

Title	Triangles and Quadrangles
Age of students/grade	13 years
Length of the unit	2 x 50 minutes
Mathematical topic	Basic properties of triangles and quadrangles
Prerequisite knowledge	<ul style="list-style-type: none">• Basic geometric figures
Materials needed	<ul style="list-style-type: none">• Introductory slide (for lesson 1)• Cards for team forming (for lesson 1)• Assignment sheets “Quadrangles and Triangles” (for lesson 1)• Presentations and/or posters created by students (for lesson 2)
Objectives	<p>The student</p> <ul style="list-style-type: none">• can name the basic properties of triangles and quadrangles• can name the basic differences between triangles and quadrangles• can name the properties of specific triangles (rectangular, isosceles, equilateral) and specific quadrangles (square, rectangle, parallelogram, rhombus, deltoid, trapezoid)• can identify triangles and quadrangles in pictures of everyday life situations• can cooperate with other students to solve problems
Notes on work with migrant students	<ul style="list-style-type: none">• Students (migrant and non-migrant) can bring pictures from stations of their lives to find triangular and quadrangular forms in them

Lesson plan:**Lesson 1 (50 minutes) – Introduction of quadrangles and triangles**

Time	Method	Content and comments
ca. 5 min	Exposition and Teacher-student-communication	Students are shown various pictures from everyday life (see “introductory slide”, and/or pictures students have brought with them). They are asked to guess what the topic of the coming lessons would be.
ca. 10 min	Teacher-student-communication	Brainstorming: “Which quadrangles/triangles do you know”. Students can come to the blackboard, write the name of a quadrangle/triangle they know, and make a sketch of it
ca. 25 min (6x3 min work time, plus time for changing stations)	Station learning in groups	Preparation: <ul style="list-style-type: none">- Students form 6 teams (students draw cards)- 6 tables are prepared for station learning- Assignment sheets are placed on the 6 tables Students work in teams for 3 minutes per station and note down their answers. The teacher notifies the teams when it is time to switch, then all team switch to the next station.
ca. 5 min	Assignment – homework	Each team draws the name of a specific quadrangle / triangle from a bag/box/... The following names are available: <ul style="list-style-type: none">- Rectangle and square- Parallelogram- Rhombus- Deltoid- Trapezoid- Rectangular triangle- Isosceles and equilateral triangle Students are given the following assignment as homework: Research all the important details about the square or triangle you have drawn, such as <ul style="list-style-type: none">- What makes it special? Are there any special features regarding side lengths, angles, parallelism, symmetry ...- Which important equations apply to this quadrilateral or triangle?- Explain the calculation of area and circumference?- Is it related to other quadrilaterals/triangles? What do they have in common? Students should give a short 5-minute presentation on this in the coming lesson as a team. Preferably with a poster or PowerPoint-presentation (students can choose which). In addition, they are to prepare a handout with all the important information on it, which will be distributed to all other students in the next lesson
ca. 5 min	Teacher-student-communication	Students can ask questions about the learning stations and/or about the homework assignment

Lesson 2 (50 minutes) – Specific quadrangles and triangles

Time	Method	Content and comments
ca. 5 min	Exposition	Teacher schedules the order of the presentation of the various teams.
ca. 35 min	Team presentations	The students present the results of their assignment (see above) in the following order: <ul style="list-style-type: none">- Team “Rectangle and square”- Team “Parallelogram”- Team “Rhombus”- Team “Deltoid”- Team “Trapezoid”- Team “Rectangular triangle”- Team “Isosceles and equilateral triangle”
ca. 10 min	Teacher-student-communication	All important properties and equations are repeated and summarized

Introductory slide



Cards for team forming

 Rectangle and square	Parallelogram and rhombus
Deltoid	Trapezoid
Rectangular triangle	Isosceles and equilateral triangle

Assignments for station learning
(summary for teachers)

Description of stations		
Station	Preparation and materials	Description and tasks
Station 1: Properties of quadrangles	Cards with different quadrangles on them are laid out.	The students should work together to describe and discuss the properties of the quadrangles shown.
Station 2: Classifying quadrangles	Cards with different quadrangles on them are laid out.	The students should classify the quadrangles shown, e.g.: Is a square a rectangle? Why, or why not?
Station 3: Constructing quadrangles	Drawing paper, ruler and compasses are provided at the table.	The students should draw different quadrangles and measure the properties such as lengths and angles.
Station 4: Puzzles	- See work sheet	The students are given mathematical puzzles about quadrangles and triangles. The students should solve the puzzle.
Station 5: Constructing triangles	Drawing paper, ruler and compasses are provided at the table.	The students should draw different triangles and measure the properties such as lengths and angles.
Station 6: Similarity of triangles	Cards with different triangles on them are laid out.	The students examine the different pictures of triangles and identify pairs of triangles. They should establish criteria for recognising whether two triangles are similar.

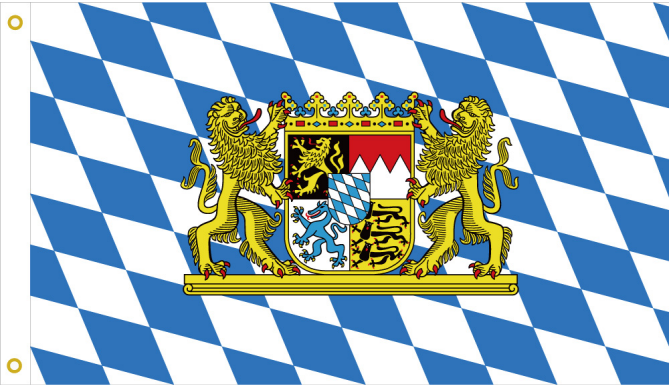
Assignments for station learning
(for students; to be distributed on the 6 tables, one assignment per table)

STATION 1: Properties of quadrangles

Task:

Describe the properties of the quadrangles shown and discuss them together as a team. Mention the number of sides, angles, side lengths and possible symmetries as well as the parallelism of sides.











STATION 2: Classifying quadrangles



Task:

Try to classify the quadrangles shown and answer the following questions:

- Is every square also a rectangle?
- Is a rhombus also a parallelogram?
- Is every quadrangle a deltoid?
- Is a square also a rhombus?
- Is a parallelogram also a rectangle?

Can you find any other connections or classifications?





STATION 3: Constructing quadrangles

Task:

Try to draw different quadrangles using the enclosed instructions.

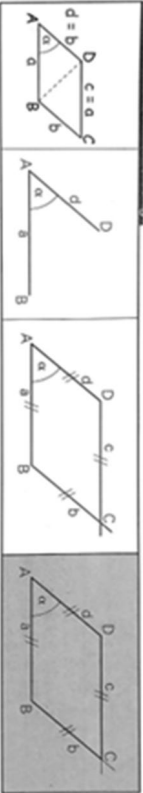
E.g.: Parallelogram: $a = 5 \text{ cm} / b = 3 \text{ cm} / \alpha = 45^\circ$

Construction of a parallelogram / a rhombus

(see Expedition Mathematik 2, p 239-240)

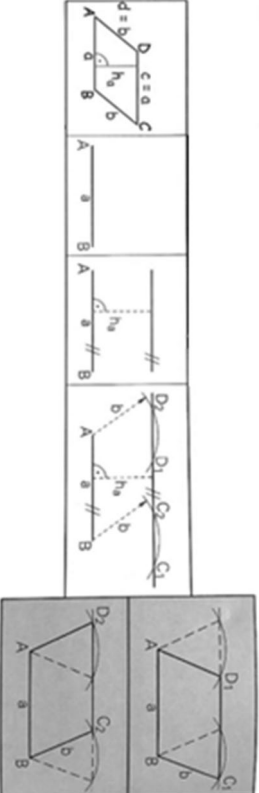
Given: a, b, α

1. Draw side a
2. Draw angle α at vertex A
3. Measure (or transfer) side b (one gets vertex D and side d)
4. Construct side c by parallel translation of a
5. Construct side b by parallel translation of d
6. One gets vertex C



Given: a, h_a, α

1. Draw side a
2. Draw height h_a (normal to a) in the given length
3. Draw a line parallel to a through the end point of the height by parallel translation of a
4. Measure side b with the compass
5. Use the compass first in vertex A , then in vertex B , to transfer the length of b and thereby construct the vertices C and D (one gets 2 solutions)

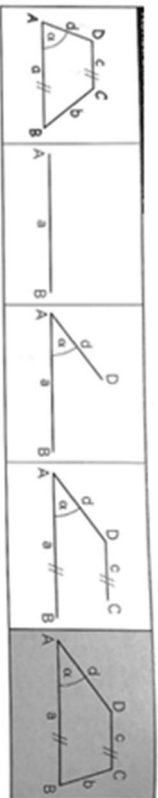


Construction of a trapezoid

(see Expedition Mathematik 2, p 246)

Given: a, c, d, α

1. Draw side a
2. Draw angle α at vertex A
3. Measure (or transfer) side d (one gets vertex D and side d)
4. Construct side c by parallel translation of a and using the given length of c (one gets vertex C)
5. Connect vertices C and B (one gets side b)



Construction of a deltoid

(see Expedition Mathematik 2, p 246)

Given: a, b, e

1. Draw diagonal e
2. Measure length a with the compass, put the compass needle into vertex A and transfer length a on both sides
3. Measure length b with the compass, put the compass needle into vertex C and transfer length b on both sides
4. Intersect compass lines to get vertices B and D
5. Connect vertices to form the sides of the deltoid



STATION 4: Puzzles



- Task:**
Try to solve the following puzzles together as a team. Which figures are referred to in the following statements? Can there sometimes be more than one answer?
- FIGURE 1: A rectangle with sides of equal length.
- FIGURE 2: A specific parallelogram with equally long sides.
- FIGURE 3: Opposite sides are parallel!
- FIGURE 4: It has three vertices and two equally long sides.
- FIGURE 5: It has three sides and a right angle.
- FIGURE 6: The diagonals are normal to each other.
- FIGURE 7: At least two sides are parallel.
- FIGURE 8: In this parallelogram adjacent sides are normal to each other.
- FIGURE 9: All three sides are equally long.
- FIGURE 10: At least one diagonal is cut in half by the other diagonal.
- FIGURE 11: Two pairs of parallel sides.

STATION 5: Constructing triangles



Task:

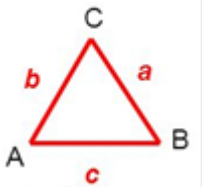
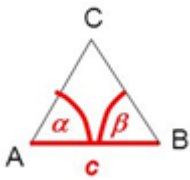
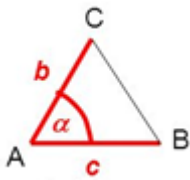
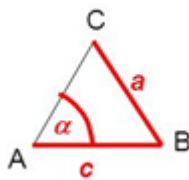
Try to draw different triangles with the help of the enclosed instructions.
You may use any of the tools provided on the table.

Triangle 1: $a = 6\text{ cm} / b = 7\text{ cm} / 8\text{ cm}$

Triangle 2: $c = 35\text{ mm} / b = 43\text{ mm} / \alpha = 55^\circ$

Triangle 3: $c = 42\text{ mm} / \alpha = 40^\circ / \beta = 70^\circ$

Triangle 4: $c = 30\text{ mm} / b = 36\text{ mm} / \beta = 45^\circ$

side-side-side	angle-side-angle	side-angle-side	Side-side-angle
<p>Example: $c = 5\text{ cm}$ $a = 6\text{ cm}$ $b = 6\text{ cm}$</p>  <p>Construction:</p> <ul style="list-style-type: none">- Draw side c- Draw an arc of radius b with centre A- Draw an arc of radius a with centre B- Intersect the two arcs to get vertex C	<p>Example: $c = 5\text{ cm}$ $\alpha = 60^\circ$ $\beta = 70^\circ$</p>  <p>Construction:</p> <ul style="list-style-type: none">- Draw side c- Draw angle α in vertex A and mark its end point- Draw angle β in vertex B and mark its end point- Connect vertices A and B with the corresponding marks by lines- Intersect the lines to get vertex C	<p>Example: $c = 5\text{ cm}$ $\alpha = 60^\circ$ $b = 6.5\text{ cm}$</p>  <p>Construction:</p> <ul style="list-style-type: none">- Draw side c- Draw angle α in vertex A and mark its end point- Connect vertex A with the mark by a line- Draw an arc of radius b with centre A- Intersect the arc with the line to get vertex C	<p>Example: $c = 5\text{ cm}$ $\alpha = 60^\circ$ $a = 7\text{ cm}$</p>  <p>Construction:</p> <ul style="list-style-type: none">- Draw side c- Draw angle α in vertex A and mark its end point- Connect vertex A with the mark by a line- Draw an arc of radius a with centre B- Intersect the arc with the line to get vertex C

STATION 6: Similar triangles



Task:

Try to identify pairs of similar triangles shown here. Are there any? As a team, establish criteria that will help you to recognise similar triangles!

