DISCOVERING THE POLYHEDRA

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Title	**Discovering the polyhedra**
Authorship	Carmen Trulls Medina
School	IES Francesc Ferrer I Guàrdia from Sant Joan Despí
Students' CEFR Level (A1, A2...)	A2
Grade	2nd ESO
Content area(s)	Mathematics, Geometry
Number of sessions (4, 6 or 9)	6 + 1
Teacher(s) involved	Carmen Trulls Medina
Key words	Polyhedron, edges, vertices, sides, platonic solids, area, volume

1. MY PROJECT

Introduction: Geometry is a very important field within mathematics. The process of understanding the space and the relationship among segments, lines, faces, polyhedra or three-D shapes sometimes becomes a hard issue. In this PBL project I try to facilitate this process through experiencing the construction of models, the viewing of slides and You-Tube videos, the reading of texts, and other activities that have been prepared. All this framework of activities has been woven with the language. The production (writing and speaking) and understanding (reading and listening) of language is facilitated through scaffolding (vocabulary, lists, games, ICT activities, language structures). I hope that you enjoy the process of learning!

Driving question: How are the polyhedra that you can discover in your High School?

Final product:

1. **Polyhedron models** of the discoveries.

2. **Oral presentation** about the found polyhedra, their main characteristics, their situation and the models that have been built. The audience will be students of the same class and, if possible, others of 2nd ESO and 3rd ESO

2. GOALS	2. HOW DO YOU KNOW STUDENTS ARE MAKING PROGRESS? (assessment criteria)
1. Learn what a polyhedron is.	**1.1.** Students can explain what a polyhedra is. **1.2.** They can describe their main characteristics.
2.Distinguish among the different types of polyhedra.	**2.1.** They can explain the differences among the different kinds of polyhedra.
3. Build some polyhedra models.	**3.1.** They are able to build some polyhedra models by using flat developments.
4. Identify the polyhedra in High School.	**4.1.** The students can look for and identify the volumes in the High School that pair with the models.
5. Calculate the area and the volume of some polyhedra.	**5.1.** The students are able to calculate the area and volume of some polyhedra.
6. Work in a collaborative way	**6.1.** They can work collaboratively preparing an oral presentation and giving a setout of the models
7. Give an oral presentation about the findings and the work that has been carried out.	**7.1.** They can give an oral presentation about all the work that has been developed and their recent discoveries.

3. CURRICULUM CONNECTIONS
SPECIFIC COMPETENCES AND KEY CONTENTS

Subject-matter curriculum		Foreign language curriculum	
Specific Competences	**Key Contents**	**Specific Competences**	**Key Contents**
<u>Resolució de problemes</u> **1.** Traduir un problema a llenguatge matemàtic o a una representació matemàtica utilitzant variables, símbols, diagrames i models adequats. **2.** Emprar conceptes, eines i estratègies matemàtiques per resoldre problemes. <u>Raonament i prova</u> **6.**Emprar el raonament matemàtic en entorns no matemàtics	**8.** Sentit espacial i representació de figures tridimensionals. **9.** Figures geomètriques, característiques, propietats i processos de construcció. **12**. Relacions mètriques i càlcul de mesures en figures.	<u>Comunicació oral</u> **1**. Obtenir informació I interpretar textos orals de la vida quotidiana, dels mitjans de comunicació i de l'àmbit acadèmic. **2.** Planificar i producir textos orals de tipología diversa adequats a la situación comunicativa. **3.** Emprar estratègies d'interacció oral d'acord amb la situació comunicativa per iniciar, mantenir i acabar el discurs.	**1.** Comprensió oral : global, literal i interpretativa **2.** Estratègies de comprensió oral **3.** Estratègies de producció oral **4.** Estratègies d'interacció oral **5.** Lectura en veu alta **7.** Comprensió escrita : global, literal, interpretativa i valorativa **8.** Estratègies de comprensió escrita

<u>Connexions</u> **8.**Identificar les matemàtiques implicades en situacions properes i acadèmiques i cercar situacions que es puguin relacionar amb idees matemàtiques concretes. <u>Comunicació i representació</u> **9.** Representar un concepte o relació matemàtica de diverses maneres i usar el canvi de representació com a estratègia de treball matemàtic. **12.** Seleccionar i usar tecnologies diverses per gestionar i mostrar informació, i visualitzar idees o processos matemàtics		<u>Comprensió lectora</u> **4.** Aplicar estratègies d'interacció per obtenir informació i interpretar el contingut de textos escrits d'estructura clara de la vida quotidiana, dels mitjans de comunicació i de l'àmbit acadèmic.	

4. 21st CENTURY COMPETENCES			
Collaboration	**X**	Information, media and technology	**X**
Communication	**X**	Leadership & Responsibility	**X**
Critical Thinking and Problem Solving	**X**	Initiative & Self-direction	**X**
Creativity & Innovation	**X**	Social & Cross-cultural	**X**
Others:			

5. KEY COMPETENCES			
Communicative, linguistic and audiovisual competence	**X**	Digital competence	**X**
Mathematical competence	**X**	Social and civic competence	**X**
Interaction with the physical world competence	**X**	Learning to learn competence	**X**
Cultural & artistic competence	**X**	Personal initiative and entrepreneurship competence	**X**

6. CONTENT (Knowledge and Skills)

CONTENT-RELATED KNOWLEDGE	CONTENT-RELATED SKILLS
*Description, features and classification of the polyhedra. *Identification of the regular polyhedra (platonic solids) *Acknowledge of the shape of the objects in the High School. *Calculation of the area and volume of the polyhedra.	*Exploring and analyzing the polyhedra through the models. *Describing and explaining the characteristics of the polyhedra *Building models of the polyhedra. *Identifying the polyhedra in the High School. *Calculating the area and volume. *Experimenting with three dimensional geometric shapes. *Working collaboratively. *Explaining the findings to the students in an oral presentation.

7. REFERENCES

- Part of the pictures are mine,
- Other images are with free use, or free use with acknowledge.
- Flat developments are from *Gijs Korthals Altes www.korthalsaltes.com Copyright © 1998*
- Some pictures and a text for reading are from Wikipedia.

8. COMMENTS (optional)

9. ACKNOWLEDGEMENTS (optional)

I would like to thank my husband and my three children for their patience during this work.

Skills: R: reading , S:speaking, L: listening, W: writing, I: Interaction
Interaction: T-S: teacher-student, S-S: student-student, SG: small groups, WG: whole group, S-Expert, S-World
Assessment: PA: Peer assessment, SA: Self-assessment, TA: Teacher assessment, AT: Assessment tools

10. UNIT OVERVIEW

Session	Activities+	Timing	Skills	Interaction	ICT	Assessment
1	**1.0.** Introduction	5'	L	T-S		
	1.1. Brainstorming about polyhedra.	5'	S, L, I	S-S	countdown clock	TA
	1.2. Listening to explanations and you-tube video.	10'	L	T-S		
	1.3. Looking and classifying pictures.	10'	S I math	SG	Instant classroom	SA
	1.4. Building a prism with cardboard.	10'	L, artistic, math	Individual	Hands-on activity	SA, TA
	1.5. Identifying types of prisms I. Sink the fleet.	10'	R, L, S	S-S	countdown clock	
	1.6. Identifying types of prisms II. Fast Listening	8'	L	SG		SA
	1.7. Recap vocabulary before leaving the class	2'	S	T-S		

2	**2.1** Building a prism with a plane development or net. Afterwards, writing down its main features	15'	L, W, S math	T-S S-S		SA
	2.2 Calculating the area and the volume of a prism	17'	R, L, math	S-S		TA
	2.3. Looking for a prism in my High School.	10'	R, L, math	T-S, S-S	Google Docs	SA
	2.4 Preparing a text for the exposition.	15'	W, math	S-S WG	padlet	TA
	2.5. Recapping vocabulary before leaving the class	3'	S	S-S		TA
3	**3.1** Getting in touch with pyramids.	10'	R	SG	quizlet	SA
	3.2 Building a pyramid with cardboard	10'	L, math artistic	Individual	Hands-on activity	SA
	3.3. Fast running with new knowledges: elements and types of the pyramids	10'	R, L math	SG, WG	countdown clock Instant classroom	PA
	3.4 Practicing the recently acquired knowledges	12'	R	S-S		
	3.5 Building a pyramid with a plane development. Afterwards, writing down its main features	15'	L, W.S math	S-S	Hands-on activity	SA
	3.6 Saying goodbye to the mates	3'	S	S-S		
4	**4.1** Greeting the students. Recapping.	2'	S, L	T-S		
	4.2 Jigsaw with the area and volume of the pyramids	10'	R, S math	S-S		TA
	4.3 Watching a video about volumes	5'	L, math			SA
	4.4 Looking for a pyramid in the High School	15'	R, I, math	S-S	Google Docs	SA

	4.5 Preparing a text for the exposition.	15'	W, math		padlet	TA
	4.6 Saying goodbye to the mates	3'	S	S-S		
5	**5.1** Greeting the students. Recapping what the students already know.	10'	S, L	T-S, S-S		
	5.2 Explaining the new topic. Reading basic definitions. Think-pair-share	10'	L, R, math	Ind, S-S, SG,WG	countdown clock google presentation	SA
	5.3 Viewing two videos	10'	L, math	individual		
	5.4 Building a regular polyhedron with a plane development. Later, writing down its main features	15'	L, W, S math	individual	Hands-on activity	SA
	5.5 Looking for polyhedra in the High School	15'	math, L	S-S	Google Docs	SA
	5.6 Saying goodbye to the mates	3'	S	S-S		
6	**6.1** Greeting the students.	2'	L	T-S		
	6.2 Knowing about the dual polyhedra	10'	L, math	Individual		SA
	6.3. Answering a challenging question: Is the Euler's rule true?	8'	L, Math	S-S		TA
	6.4 Reading about the platonic solids	20'	R, S math	S-S SG		TA
	6.5 Preparing the last text for the exposition.	20'	W, math	S-S, SG	*Padlet* *Google presentation*	PA, TA
7	**7.1** Presentation of the students.	It can vary	S, math,	SG-WG S-WG	*Google presentation* or PowerPoint Models box	TA

11. SESSION PLANNING

SESSION 1: GETTING IN TOUCH WITH POLYHEDRA. PRISMS.

Objectives of the session: 1. Learn what a polyhedron is.
2. Learn what a prism is. Distinguish among different types of prisms.

Content-obligatory language for the session:

Polyhedron, polyhedra, faces, sides, vertex, vertices, edges, prism, height, cube, cuboid, regular prism, polygon, apothem, perimeter, build, flat development, three-dimensional shape, knot, strings, cardboard, a pair of scissors, shoe box, whiteboard, blackboard, because, so, for example, for instance

How are you? Fine thanks; I'm good; See you next time; I think that.....; This is a ....; It is not a.....; I'm done; might you help me? Can you lend me.....? can I borrow you...? How do you say .....in English? I think it is....., There is..., there are.....;

	Activities					
1.0	**Introduction.** First greetings of the session. Explanations of the final product to the students, so that they know what they are going to do, to learn and how they are going to be assessed. Material: Sheet of paper for their glossary. It will be used in all sessions. https://drive.google.com/open?id=1dgGmQWoVj0jGkbM2-IGAK4t2fX9Y92UY https://drive.google.com/open?id=1LwZDfqpDLDksEvpb2tejeqqpki1UZCz3	5'	L	T-S		
1.1	**Brainstorming about polyhedra.** The students, working in pairs think about what polyhedron could be. They are given smalls whiteboards where they can write their answers. Material: Small whiteboards and markers. They are also given a sheet of paper of their glossary throughout the six sessions *countdown clock: https://www.online-stopwatch.com/countdown/* Assessment: teacher assessment. Check https://drive.google.com/open?id=1o7EBLjhZaO5k5UemPUBtNgcoR7fVR-NN	5'	S L I	S-S	*countdown clock*	TA

1.2	**Listening to explanations and you-tube video.** Material: two You-Tube videos. Shoebox for each student. https://www.youtube.com/watch?v=39ZNHHNCptk https://www.youtube.com/watch?v=Brajow_CNAs&index=9&list=PLeI49DfUaMH0qdacoFnVvHZL31q1QyIsu&t=107s	10'	L	T-S	*You-Tube videos***	
1.3	**Looking and classifying pictures**. The students are grouped in fours or five. Each group is given a pack of flashcards with pictures. They have to put them into three columns: one for polyhedra, other for 3-D shapes but not polyhedra, and the last one for polygons. Later, the teacher will give the right answers. Material: Flashcards. https://drive.google.com/open?id=1yVmuqoxccEnxRv3DLwraVz4eRdJDWNW6 *Instant classroom: https://www.superteachertools.us/instantclassroom/#.XFtF2qr0mUk* Assessment: self-assessment. Hand Signals	10'	S, I math	SG	*Instant classroom*	SA
1.4	**Building a prism with cardboard**. The teacher hands out a piece of cardboard to the students. Each student must draw two regular polygons inscribed in a circle. They can be squares, pentagons, hexagons, octagons, decagons or dodecagons. The teacher will supervise the election so that there is a variety in the class. If necessary, he will change the polygon chosen. Each student will cut as many pieces of string as the vertices the polygon has. The strings must go through both cardboards and end with a knot. Material: Cardboard, strings, scissors, compass, ruler, pencil, rubber. https://drive.google.com/open?id=1P8ZRJJNi3gqSetgJqRgapV1kTS29VQ90 Some vocabulary on the blackboard to help the students talk: I'm done. can you help me? can I borrow you…….? can you lend me……? This is..., It is not..., there is..., there are..., Assessment: teacher assessment with a checklist and self-assessment diary https://drive.google.com/open?id=1RhwTOOGz9Fw_7yy2LD__rjCuOGmdXgkl https://drive.google.com/open?id=1vohWbrWpuv4e41Lnk6O3Rk_Ug-gBhslJ	10'	L math artistic	Indivi dual	*Hands-on activity**	SA TA
1.5	**Identifying types of prisms I. Sink the fleet**. The teacher will explain what they have obtained. Afterwards, the students will be asked to read a brief text with basic definitions. While reading the text, if necessary, the students can ask any vocabulary questions. The teacher will write those new words up on the blackboard. Later the students will play in pairs "sink the fleet" with a prepared grid. Material: Brief text with visual support about prisms. Grids for playing (two grids for each student). https://drive.google.com/open?id=1oaWLDXsl5HsQt1Zk4l-Lin6d5qj81Int	10'	R, L, S	S-S	*countdown clock*	
1.6	**Identifying types of prisms II. Fast Listening**. Activity in threes or fours. The teacher will give out cards with the drawings of prisms to each group. Later, she will name sixteen prisms. The students will have to order the images as they listen to them. Material: https://drive.google.com/open?id=1s1rMledEyfe0bdwecy9csRCOLRPN3vvH *Instant classroom: https://www.superteachertools.us/instantclassroom/#.XFtF2qr0mUk* Assessment: self-assessment. Traffic lights https://drive.google.com/open?id=1FXubdDxiLjyTFhRMV6K1Y34ppd0SS3Rr	8'	L	SG	*Instant classroom*	SA

1.7	**Recap vocabulary before leaving the class.** Every student must say a new word to the teacher before leaving the class. Once they have told her the word, they leave. If the class is numerous, they can use instead, an exit card. Assessment: The activity is the assessment.	2'	S			

SESSION 2: WORKING WITH PRISMS

Objectives of the session:
1. Description, features and classification of the prisms.
2. Calculation of the area and volume of the prisms
3. Finding and studying a prism from the High School.
4. Preparing the final presentation of prisms.

Content-obligatory language for the session:

Polyhedron, polyhedra, faces, sides, vertex, vertices, edges, prism, height, cube, cuboid, regular prism, polygon, apothem, perimeter, build, flat development, three-dimensional shape, lateral area, base area, area, surface, square centimetre, cubic centimetre, write down, features, calculator, give and lend; numbers in tens: twenty, thirty, forty, fifty, sixty, seventy, eighty, ninety: numbers in teens: thirteen, fourteen, fifteen, sixteen, seventeen, eighteen, nineteen, because, for instance,

How are you? Fine thanks; I'm good; See you next time; See you next day; Have a nice weekend! Its volume is equal to....; Its surface is equal to.....; This prism has.....; The height of this prism is.....; I don't understand this.; My results are not the same as ....; I'm done; metre and meter, centimetre and centimetre; Its volume is equal to....; Its surface is equal to.....; This prism has.....; The height of this prism is....., to begin with....., to conclude....., My prism has.....; There is..., there are..., How do you say.....in English? because, for instance, it means that...,

	Activities					
2.1	**Building a prism with a flat development. Afterward, writing down its main features.** The teacher hands out a plane development of different prisms to each student. They will have to build their own prism. Once they have got the prism, they will have to write down its main features. Afterwards, they will explain to their mate how their prism is. Material: flat development prism, and material for writing the main characteristics https://drive.google.com/open?id=1eHldG2JxnNYYccTlrQuRhvcgRXN_b4zr https://drive.google.com/open?id=1uJ2ftyAgaonbF-oaGglCi25lw0C4zay6 A pair of scissors, glue, a ruler in good shape, the glossary Assessment: assessment diary. https://drive.google.com/open?id=1wcqibsYbsFtoJx71kSrOEYJAJ9_zAv3B	15'	L, W, S math artistic	Indivi dual T-S S-S	*Hands-on activity** **Even though it is not ICT, it is a special activity*	SA
2.2	**Calculating the area and the volume of a prism.** Looking carefully at the recently obtained prism, now it is time to calculate its area and volume. Firstly, the students will read three cardboards Student 1 cardboard one and three; Student 2, cardboard 2. Afterwards, they will explain to each other what they have understood. The teacher will be around listening what the students say, and like a busy bee he will go from pair to pair, he will make sure that the students have understood correctly and that they speak in English. He will also facilitate communication. From that moment, they can calculate the recently built prism's area and volume. Material: https://drive.google.com/open?id=1kT0EW_BxuraqFzqa2fwV_4GheoMbo-6F Calculator, pen, pencil, ruler in good shape. Assessment: The teacher revises the results and fills a checklist. https://drive.google.com/open?id=1IfPPqeENKaHqTLfwblnnKG1djgKwUDHZ	17'	R, L math	S-S		TA
2.3	**Looking for a prism in my High School. Working with it.** Now it is time to look for a prism from the High School. The students will be able to walk around and once they have found it, they will draw it on a prepared sheet of paper. Afterwards they will make measurements and will write them down. Finally, the student can make new calculations. Once they are done, they can fill collaboratively a chart with the main features of some prisms in a Google Docs Material: https://drive.google.com/open?id=1B9AXin3GvWCuqWzuva6novYaJGGb5KqR https://drive.google.com/open?id=1f2RZNuB_r9xBHj11wRDt79zLkaFwOCC-Ce37hoHTZMg Pencil, eraser, ruler Assessment: self-assessment. Traffic lights https://drive.google.com/open?id=1FXubdDxiLjyTFhRMV6K1Y34ppd0SS3Rr	10'	R, L math	T-S S-S	*Google Docs*	SA

2.4	**Preparing a text for the exposition.** Brainstorm with the words that the students have already used. The students work in pairs and introduce the words in the chart of the collaborative application. To follow with, the students must write some linguistic frames. By doing so, they can begin their texts. Finally, they will add the calculations that they have already done of the model and of the real object. Material: https://es.padlet.com/ctrulls2/qqckzj8iqsl2 https://drive.google.com/open?id=1TRFOSwxs9Hxb_NSM9D8chz5RJvAHm0Wc laptops or mobiles, pen, glossary list. Assessment: teacher assessment. Check https://drive.google.com/open?id=1NcsR1ZVP4bDKV5hHtm4XDaFqdmSzTDHF	15'	W, math	S-S WG	*padlet*	TA
2.5	**Recap vocabulary before leaving the class**. Every student must say a new word to the teacher before leaving the class. Once they have told her the word, they leave. If the class is numerous, they can use instead, an exit card. Assessment: The activity is the assessment.	3'	S	T-S		TA

SESSION 3: GETTING IN TOUCH WITH PYRAMIDS

Objectives of the session: **1.** Learn what a pyramid is
2. Description, features, and classification of the pyramids.

Content-obligatory language for the session:

Polyhedron, polyhedra, faces, sides, vertex, vertices, edges, height, polygon, apothem, perimeter, build, flat development, three-dimensional shape, write down, features, pyramid, right pyramid, oblique pyramid, regular pyramid, cardboard, a pair of scissors, cut , cut out, rubber, pencil, ruler, string, compass, flashcard, through ,across, according to, knot, because, for example, for instance,

How are you? Fine thanks; I'm good; See you next time; See you next day; Have a nice weekend! We had a good time! It has been a pleasure working with you; I'm done; Might you help me? Can you give me...? Can you lend me.....? Can I borrow you.....? it is okay? Is it well written? To be like..., I don't understand this calculation, can you explain it to me? How do you say...in English? In other words, what do you think? I agree, I don't agree,

	Activities					
3.1	**Getting in touch with pyramids**. A quizlet game with flashcards. The purpose of the game is to recap vocabulary and knowledge. The students work in pairs. Material: https://quizlet.com/369029832/getting-in-touch-with-polyhedra-diagram/ Material: mobiles or laptops Assessment: self-assessment. Traffic lights. The students use the traffic lights to indicate if they have understood the new concepts. https://drive.google.com/open?id=1FXubdDxiLjyTFhRMV6K1Y34ppd0SS3Rr	10'	R math	SG	*quizlet*	*SA*
3.2	**Building a pyramid with cardboard:** The teacher hands out a piece of cardboard to the students. Each student must draw one regular polygon inscribed in a circle. It can be a square, a pentagon, a hexagon, an octagon, a decagon or even a dodecagon. The teacher will supervise the election so that there is a variety in the class. If necessary, he will change the chosen polygon. Each student will cut as many pieces of string as the vertices the polygon has. The strings must go through the cardboards and end with a knot. All the strings must end in one knot. Material: Cardboard, strings, scissors, compass, ruler, pencil, rubber. Some vocabulary on the blackboard to help the students talk: I'm done. Can you help me? can I borrow you…….? Can you lend me……? It is like……. I'm done! Assessment: teacher's check and self-assessment diary https://drive.google.com/open?id=1XgtCWvfsEyNuM-13lmF12YiMOPj7wHgF https://drive.google.com/open?id=120w3v0pGIcFkkrjeNEzMPatrD5Qu9jFZ	10'	L math artistic	Indivi dual	*Hands-on activity** **Even though it is not ICT, it is a special activity*	*SA* *TA*

3.3	**Fast running with new knowledge: elements and types of the pyramids**. The students will work in small groups. The information is given with four flashcards. One of the students (student A) has to get out of the group, and as fast as he can, read the information that is in another place and later repeats to the group by heart. The students of the group will write down the sentences given by student A. The reading, memorizing and repeating task of the student A can be changed so that all the members of the group participate in the same way. Afterwards, the groups will share the information with the class with the summarizing help of the teacher. Material: https://drive.google.com/open?id=195ggQxmLCVWT60Lms0Ob3WxRi9h8Rn5k *Instant classroom: https://www.superteachertools.us/instantclassroom/#.XFtF2gr0mUk* *Countdown clock: https://www.online-stopwatch.com/countdown/* Some vocabulary on the blackboard to help the students talk: Is it well written? Is it okay? It is like……., can you explain it to me? Assessment: Peer-assessment with hand signals.	10'	R, L math	SW WG	*Countdown clock* *Instant classroom*	PA
3.4	**Practicing and recapping the recently acquired knowledge.** Working in pairs the students play a mimicry game. Working in pairs, the students are given some cards with a noun. Each student takes half of the amount and describes by mimicry the word to the mate. The mate has to find out the noun. Once one of the students finishes his/her cards, the other student begins. Material: https://drive.google.com/open?id=1WtWIobdEOO9gxKVlBe0LR0uFeaKoA3as	12'	R	S-S		
3.5	**Building a pyramid with a flat development. Afterward, writing down its main features.** The teacher hands out a plane development of different pyramids to each student. They will have to build their own prism. Once they have got the prism, they will have to write down its main features. Later, they will explain to their mate how their prism is. Material: flat development pyramid and material for writing the main characteristics https://drive.google.com/open?id=1yz1Vg8l5VGdZreQEpvCDTAEn1386UrN2 https://drive.google.com/open?id=1rLvYm2MFYxoQE2BYRFqQ6JLjaQK7omJ8 A pair of scissors, glue, a ruler in good shape Assessment: diary assessment. https://drive.google.com/open?id=120w3v0pGIcFkkrjeNEzMPatrD5Qu9jFZ	15'	L, S, math artistic	S-S	*Hands-on activity**	*SA*
3.6	**Saying goodbye to the mates.** The class is over, and the students must turn to one mate and say goodbye. The teacher provides five structures on the blackboard in order to help them. The teacher doesn't intervene. Five structures to help a bit: It has been a pleasure working with you, we had a good time, see you next time, see you next day, till next …	3'	S	S-S		

SESSION 4: WORKING WITH PYRAMIDS

Objectives of the session: **1.** Calculation of the area and volume of the pyramids
2. Finding and studying a prism from the High School.
3. Preparing the final presentation of prisms.

Content-obligatory language for the session:

Polyhedron, polyhedra, faces, sides, vertex, vertices, edges, prism, height, cube, cuboid, regular prism, polygon, apothem, perimeter, build, flat development, three-dimensional shape, lateral area, base area, area, surface, square centimetre, cubic centimetre, write down, features, calculator, pyramid, right pyramid, oblique pyramid, lines, paragraph, according to, knot

How are you? Fine thanks; I'm good; See you next time; See you next day; Have a nice weekend! We had a good time! Its volume is equal to....; The area of my pyramid.

mid, I'm done, purpose, tell, told, have told,

	Activities					
4.1	**Greeting the students.** The teacher greets the students by asking how they are, and they answer. The basic structures will be: How are you? Fine thanks; I'm good; and others that the students could add, for instance: I have a cold, I have a headache, I'm half asleep., The teacher reminds the students to keep the glossary nearby.	2'	S, L	T-S		

4.2	**Jigsaw with the area of the pyramids**. Firstly, the students will read a brief text. Student 1 cardboard 1; Student 2, cardboard 2. Later students with cardboard 1 join others with the same number. Afterwards, they join a mate with different cardboard and explain to each other what they have understood. The teacher will be around listening what the students say, and like a busy bee, he will go from pair to pair, he will make sure that the students have understood correctly and that they speak in English. He will also facilitate communication. Later they can practice calculating the model and some other examples. Materials: https://drive.google.com/open?id=1HsaNxTVwA9vcWn3fJHdjY95icklp0983 Some vocabulary on the blackboard to help the students talk: area, height, lateral area, base area, square centimetre, write down, according to, paragraph, right pyramid, apothem, I'm done, Assessment: The teacher revises the results and fills a checklist. https://drive.google.com/open?id=1tM6Lxq0c2W90GQySnG5gBY6-Hu7Vl42P	15'	R, S math	S-S		TA
4.3	**Watching a video about volumes** Material: https://www.youtube.com/watch?v=qXC8uzy_HFw After watching the video, the teacher asks some questions in order to know if the students have really understood the purpose of the video. Questions like: What has the video told us? What was the purpose of the video? What does the hand of the video do? She students write down the basic idea of the video and calculate the volume of the model. They can use the materials for activity 4.2 Assessment: self-assessment. Traffic lights. https://drive.google.com/open?id=1FXubdDxiLjyTFhRMV6K1Y34ppd0SS3Rr	15'	L math		*You-Tube videos***	SA
4.4	**Looking for a pyramid in the High School. Working with it.** Now it's time to look for a pyramid from the High School. The students will be able to walk around and once they have found it, they will draw it on a prepared sheet of paper. Afterwards they will make measurements and will write them down. Later, the students can make new calculations. Once they are done, they can fill collaboratively a chart with the main features of some prisms in a Google Docs. Material: https://drive.google.com/open?id=1-UsyEYszLmQK9bYQnIAKeE0FnVJiRFh2 https://drive.google.com/open?id=1f2RZNuB_r9xBHj11wRDt79zLkaFwOCC-Ce37hoHTZMg Pencil, eraser, ruler. Assessment: self-assessment. Traffic lights https://drive.google.com/open?id=1FXubdDxiLjyTFhRMV6K1Y34ppd0SS3Rr	10'	R, L, math	S-S	*Google Docs*	SA

4.5	**Preparing a text for the exposition**. The students are given the necessary scaffolding to feel accompanied and confident: an initial brainstorming of vocabulary and a posterior list of language frames. They can use the frames and the lists prepared in the padlet for activity 2.4 Material: https://drive.google.com/open?id=1fq1kfd1BMANdgSq2w33yGJuzMcgB6uV1 https://es.padlet.com/ctrulls2/qqckzj8iqsl2 Assessment: teacher assessment. The teacher revises the results and fills a checklist. https://drive.google.com/open?id=1_agDBL0FsIj8iOIkb9FSLoS2_ZR9JxEr	15'	W math		*padlet*	*TA*
4.6	**Saying goodbye to the mates.** The class is over, and the students must turn to one mate and say goodbye. The teacher provides five structures on the blackboard in order to help them. The teacher doesn't intervene. Four structures: It has been a pleasure working with you, we had a good time, see you next time, see you next day, till next ……;	3'	S	S-S		

SESSION 5: REGULAR POLYHEDRA. LOVE AT FIRST SIGHT

Objectives of the session:
1. Knowing what a regular polyhedron is.
2. Distinguishing the platonic solids
3. Main features of the five platonic solids

Content-obligatory language for the session:

Polyhedron, polyhedra, regular polyhedron, faces, sides, vertex, vertices, edges, height, polygon, apothem, perimeter, build, cube, tetrahedron, octahedron, icosahedron, dodecahedron, platonic solids, underline, marker, meaning, mean, wooden, volume, congruent, rule, law, sum, subtraction, plus, minus,

How are you? Fine thanks; I'm good; See you next time; See you next day; Have a nice weekend! We had a good time! I'm done! What do you think about.....? What do you mean? It is made of ....., It has been a pleasure working with you, till next ……; it has been fun; I hope to see you next day; next day will be the last day.

	Activities					
5.1	**Greeting the students. Recapping the vocabulary that the students already know.** The teacher throws a ball to a student and he has to say a word from the last session, then the student throws the ball to another student, and so on. Material: A ball. Preferably not too big, a tennis or a plastic ball.	10'	S, L	T-S	*countdown clock*	

5.2	**Explaining the new topic. Reading basic definitions. Think-pair-share.** The teacher introduces a new category of polyhedra: the regular polyhedra also called the platonic solids. Now the teacher hands out a flashcard to each student. The students must underline the words that they don't understand and guess possible meanings. Afterwards, the students stand up and look for a mate to whom they have not spoken yet. Then, they explain what they know. Afterwards, each pair of students looks for another pair to explicate their thoughts. When the time is over, the students come back to their sit. Later, the teacher asks if someone can explain the information to the rest of the class. He will help with questions to facilitate the answers. If necessary, he can explain his doubts. Meanwhile, there is an image on the whiteboard with the 5 platonic solids. Material: https://drive.google.com/open?id=1kOciXUJzmvJtuLMxLecHAL1aZfsZzj071oBJeamJCjM *countdown clock: https://www.online-stopwatch.com/countdown/* Assessment: self-assessment. Traffic lights. https://drive.google.com/open?id=1FXubdDxiLjyTFhRMV6K1Y34ppd0SS3Rr	10'	R, L math	I S-S SG WC	*countdown clock* *Google presentation*	SA
5.3	**Viewing two videos:** the teacher projects two You-Tube videos. Material: https://www.youtube.com/watch?v=gVzu1_12FUc https://www.youtube.com/watch?v=C36h00d7xGs	10'	L math	E-S	*You-Tube videos***	
5.4	**Building a regular polyhedron with a plane development. Afterwards, writing down its main features.** The teacher hands out a plane development of different regular polyhedra to each student. They will have to build their own polyhedron. Later, they will have to write down its main features on the student's booklet. Once they are done, they will explain to their mate how their polyhedron is. Material: https://drive.google.com/open?id=1Uj5roBClxtSYnFSZRgTGxoWED_BH34MT https://drive.google.com/open?id=15VrNeqCn-osQdnEMSOR1jLwqKxHM3lLi A pair of scissors, glue, a ruler in good shape Assessment: diary assessment. https://drive.google.com/open?id=1LFr6wqwJIWEBp4XuW79wvMWskendXuM7	15'	W,S,L math	Ind	*Hands-on activity **	SA

5.5	**Looking for polyhedra in the High School.** It's the last time that our students look around their environment searching for polyhedra. Possibly this time it will be very difficult to find what they want. The teacher waits till they seem tired or maybe a bit deceitful. Then he shows some solutions and models distributed randomly in the class. Later, the students can fill collaboratively a chart with the main features of the platonic solids. Material: Some objects distributed in the class. I will hide some polyhedra in the class and nearby the class. https://drive.google.com/open?id=1f2RZNuB_r9xBHj11wRDt79zLkaFwOCC-Ce37hoHTZMg Assessment: self- assessment. Traffic lights. The students show whether they have filled the charts and if everything is understood. https://drive.google.com/open?id=1FXubdDxiLjyTFhRMV6K1Y34ppd0SS3Rr	15'	L math	S-S	*Google Docs*	SA
5.6	**Saying goodbye to the mates.** The class is over, and the students must turn to one mate and say goodbye. The teacher provides some structures on the blackboard in order to help the students. The teacher doesn't intervene. It has been a pleasure working with you, we had a good time, see you next time, see you next day, till next ……; It has been fun; I hope to see you next day; next day will be the last day.	3'	S	S-S		

SESSION 6: REGULAR POLYHEDRA. KNOWING THEM BETTER

Objectives of the session:
1. Calculation of the area of the polyhedra
2. Acknowledge of the Euler's formula
3. Wrapping up our PBL. Last preparations.

Content-obligatory language for the session:

Polyhedron, polyhedra, regular polyhedron, faces, sides, vertex, vertices, edges, height, polygon, apothem, perimeter, build, cube, tetrahedron, octahedron, icosahedron, dodecahedron, platonic solids, underline, marker, meaning, mean, wooden, volume, congruent, rule, law, sum, subtraction, plus, minus, wooden, because, so, for example, for instance

How are you? Fine thanks; I'm good; See you next time; See you next day; Have a nice weekend! We had a good time! I'm done! What do you think about.....? What do you mean? It is made of ....., The faces meet at the vertex; How do you say.....in English? There is..., There are...., I think it is.....

	Activities					
6.1	**Greeting the students.** Material: Teacher's voice and good humor. Meanwhile, there is a gif on the whiteboard of the class. https://drive.google.com/open?id=1kOciXUJzmvJtuLMxLecHAL1aZfsZzj071oBJeamJCjM it is a presentation, but it has been stopped on the first slide.	2'	L	T-S		
6.2	**Knowing about the dual polyhedra** Material: https://drive.google.com/open?id=1kOciXUJzmvJtuLMxLecHAL1aZfsZzj071oBJeamJCjM https://www.youtube.com/watch?time_continue=40&v=KKs9vkYxAps https://www.youtube.com/watch?v=BsaOP5NMcCM (two specific parts 0:00-2:06 and 4:05-8:17) Assessment: self- assessment. Traffic lights. The students show if they have understood the videos. https://drive.google.com/open?id=1FXubdDxiLjyTFhRMV6K1Y34ppd0SS3Rr	10'	math L	Ind.	*You-Tube videos* **	SA

6.3	**Answering a challenging question: Is the Euler's rule true?** The students are given a flashcard with the Euler's formula. Working in pairs they prove its veracity. They can use all of their models and later add the information to previous prepared texts. Material: https://drive.google.com/open?id=1-hd81ua1qlxM9-ywSLL-h79-5CD_fwsM Assessment: Teacher Assessment. Check https://drive.google.com/open?id=1m0Jq-sdJMGEnX5Ux28WIvyNW1kg74Txj	8'	math L	S-S		TA
6.4	**Reading about the platonic solids.** The students are given the necessary scaffolding to understand a text. Firstly, a glossary with pictures, later some questions to facilitate the process of understanding (three levels). After sharing the information and possible answers with their mate, they can share again doubts and outcomes with other pairs. Material: https://drive.google.com/open?id=1-tNXIbplfavcUQOu-rMSwQMlFDVr3yoH Assessment: Teacher assessment. Check. https://drive.google.com/open?id=13MY3FrJpcePQCyj1aaAqk3t8LydRwk2w	20'	R, S math	S-S SG		*TA*
6.5	**Preparing the last text for the exposition.** Its time to recap all the texts and add the last one. In the beginning, the students can write on a prepared sheet of paper, but later, they can summarize all the information and findings in a Google presentation or a power point. If necessary, they can use the previous information of the padlet. During the days before the presentation, the tasks are developed in pairs, but this final day will be different: The students work in small groups, threes, fours or fives, depending on the number of students in the class. There will be a distribution of roles in order to help the teamwork. However, all of them must perform in the presentation. In the presentation the students will set out the built models. (remember: at least two by student) Material: https://es.padlet.com/ctrulls2/qqckzj8iqsl2 https://drive.google.com/open?id=1BvcwOzK35gf85jSYqtMS-yutCNJepuS5 "slides" o presentation (Google or PowerPoint) Assessment: Teacher assessment with a checklist and peer assessment with another checklist https://drive.google.com/open?id=1DAcXRFu71ccWNnxZdVIR6zNDis-jX5jy https://drive.google.com/open?id=19U18mOT0S8cp82ZYDEHTfK8_bollMR6c	20'	W, Math	S-S, SG	*padlet* *Google Presentation or PowerPoint*	PA TA

SESSION 7: PRESENTATION

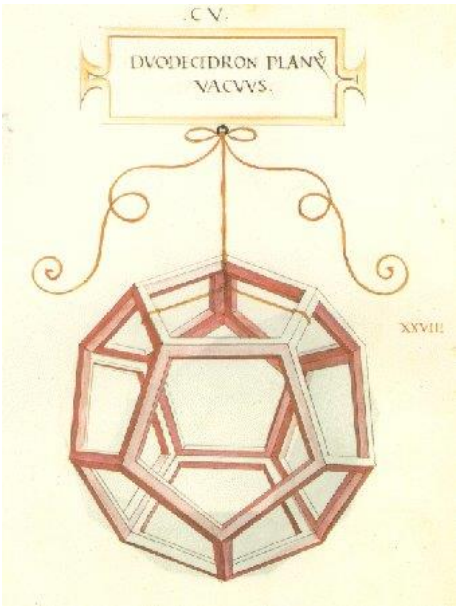
Objectives of the session:
1. **Oral presentation** about the found polyhedra, their main characteristics, their situation and the models that have been built. The audience will be students of the same class and, if possible, others of 2nd ESO and 3rd ESO.
2. **Display** of the models.

Content-obligatory language for the session:
In this session, the teacher doesn't provide new language inputs. The students will be the protagonists and they will have to deal with the words, the vocabulary, and the topic. The first steps are already done and now it is time to enjoy the presentation.

	Activities					
7.1	**Presentation of the students.** The duration of the performance can vary, depending on the work prepared by the students and the number of students or groups. They will be helped by the slides, PowerPoint or Google Presentation that they have prepared. They will also exhibit their own box of models Material: Projector and computer, presentation prepared by the students, the students' box of polyhedra. Assessment: Teacher assessment: Rubric. (oral presentation, model box, and attitude) https://drive.google.com/open?id=1MnGKLcqP1ZbvInx3fxV2DLAHMfpyLjAz	It can vary	Math S	SG-WG	*Google Presentation or PowerPoint*	*TA Rubrik*

Hands-on activity: * *Even though it is not an ICT, it is a special activity.*
*You-Tube video: ** Even though it is not actually an ICT, some classifications consider teaching You-Tube videos as ICT.*

MATERIALS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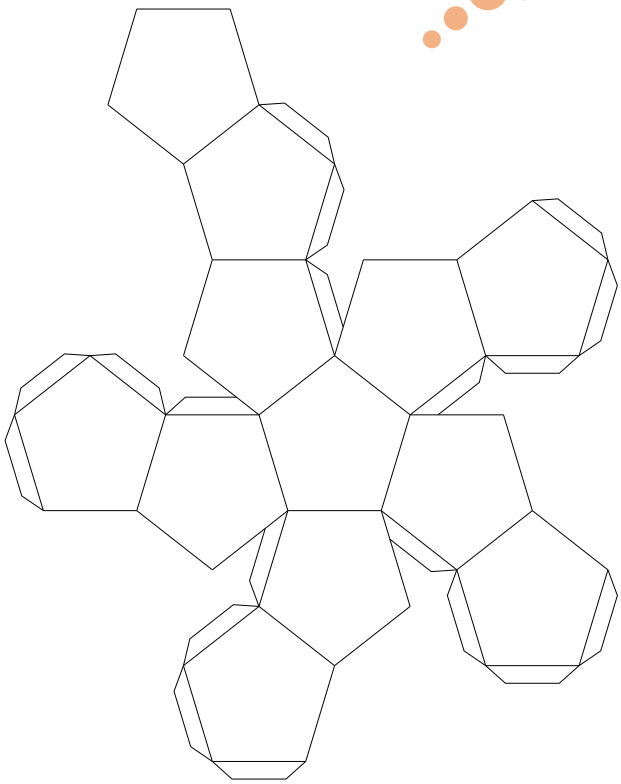


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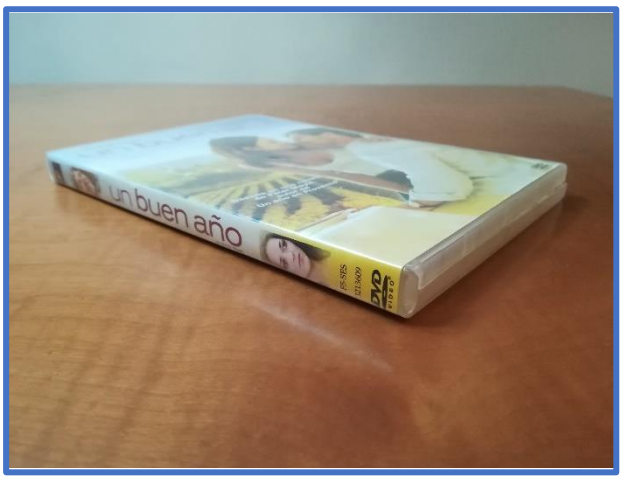
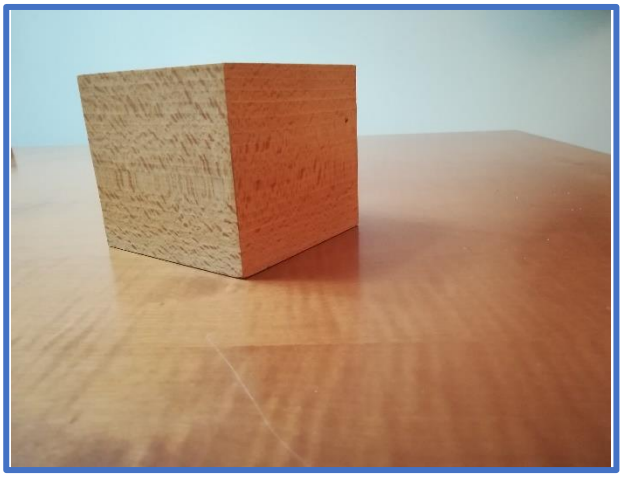
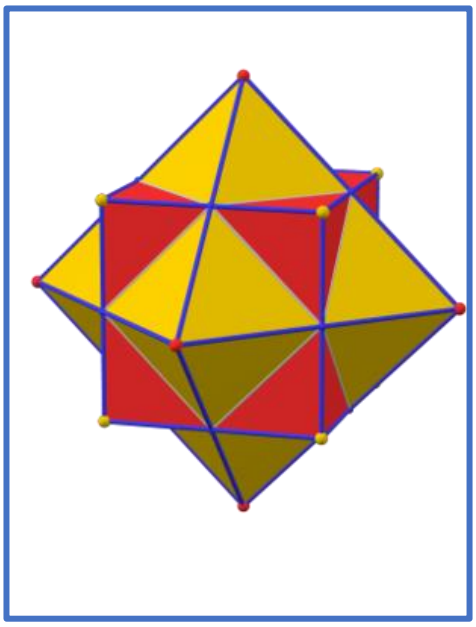
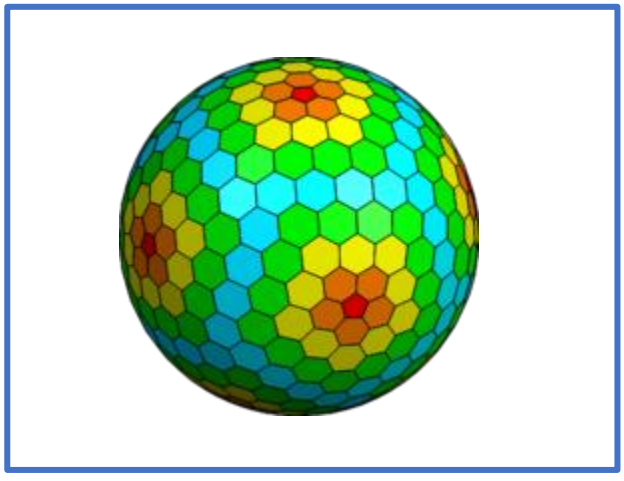
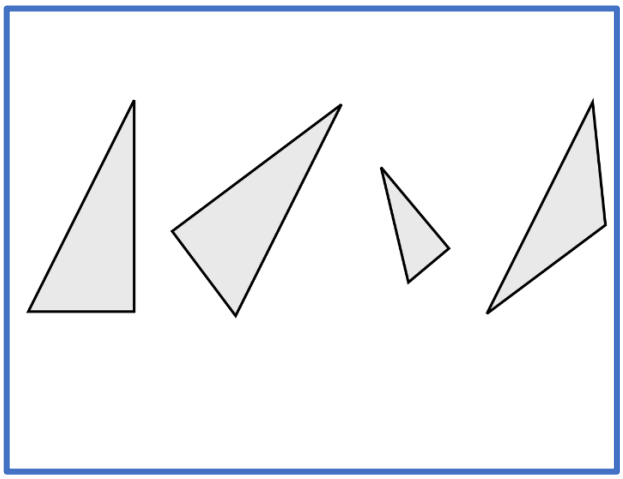
Materials for activity 1.3

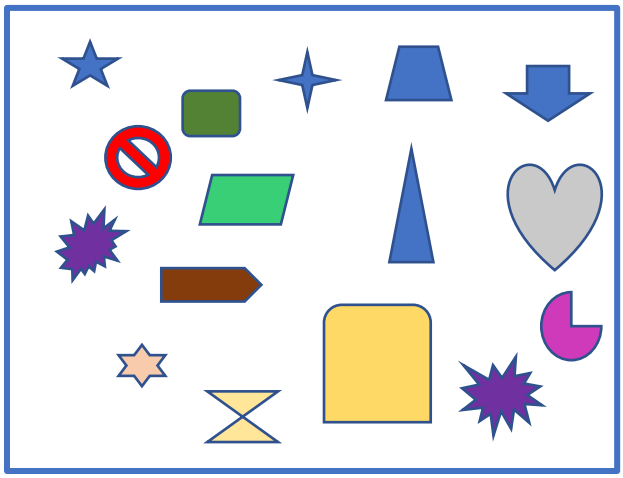


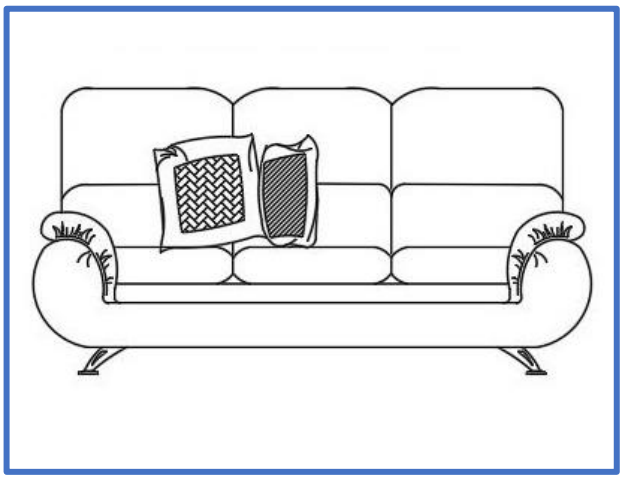


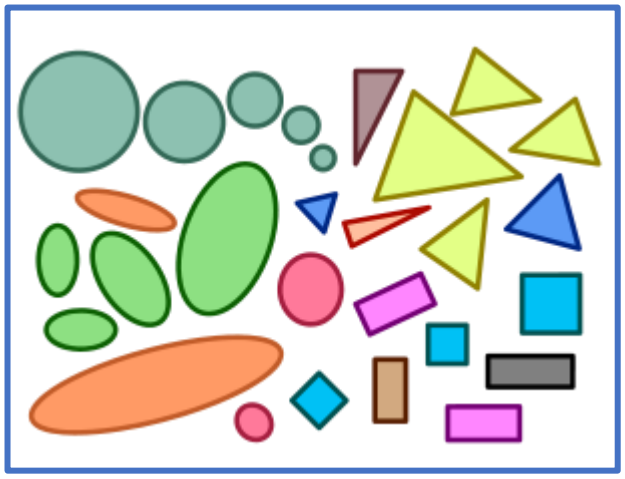


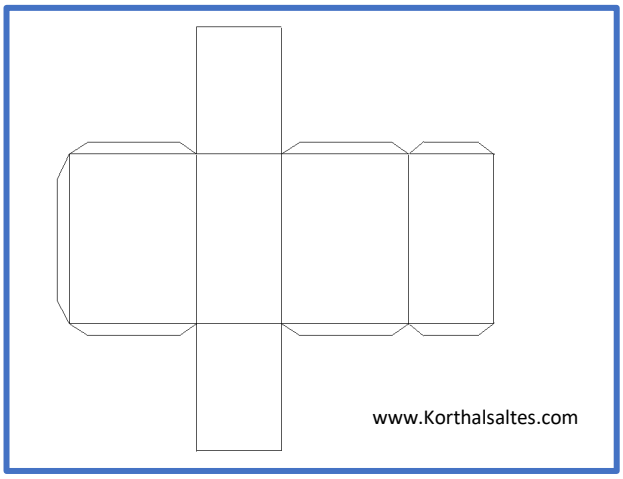








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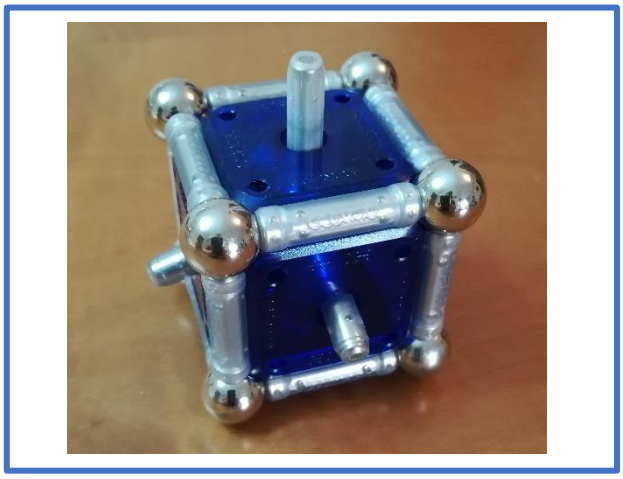

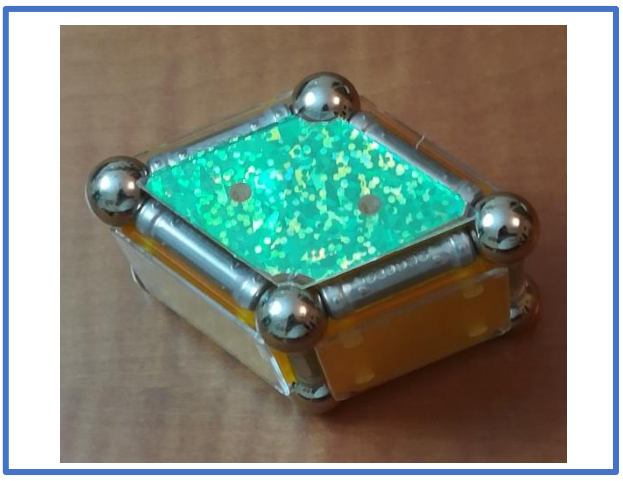

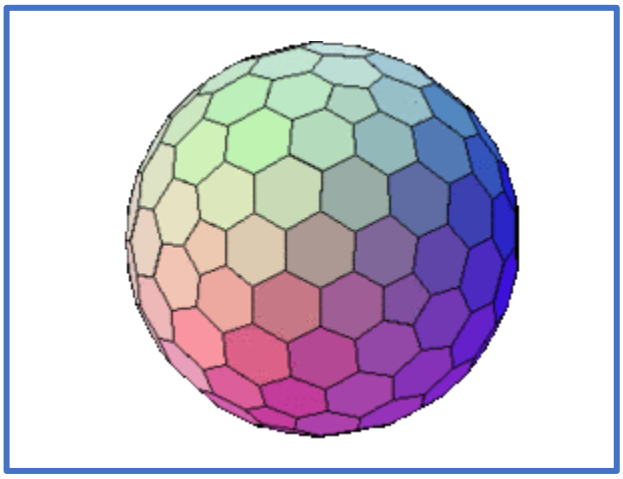

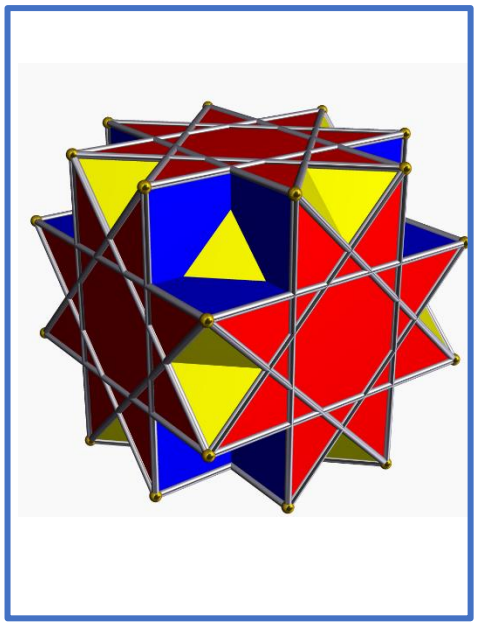

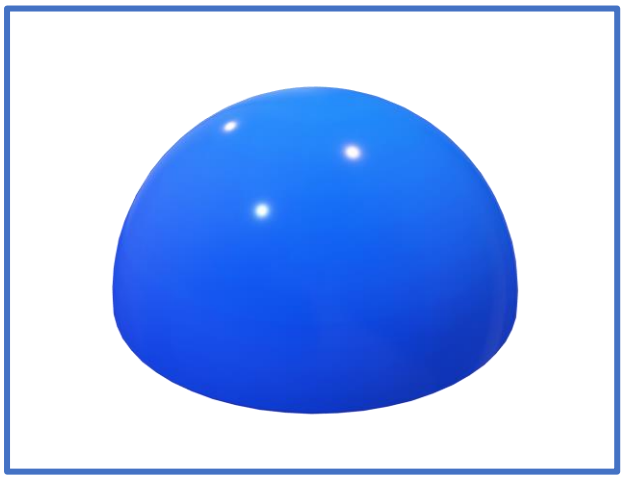

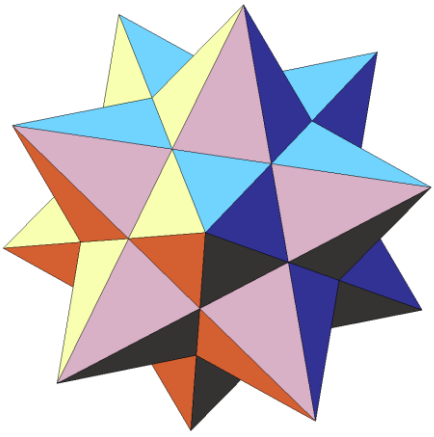

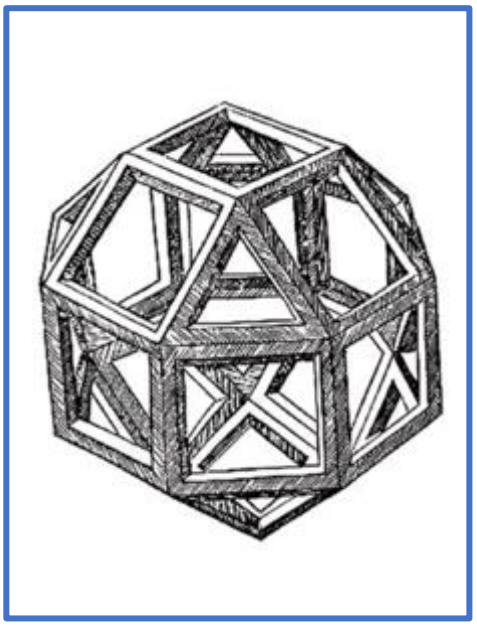

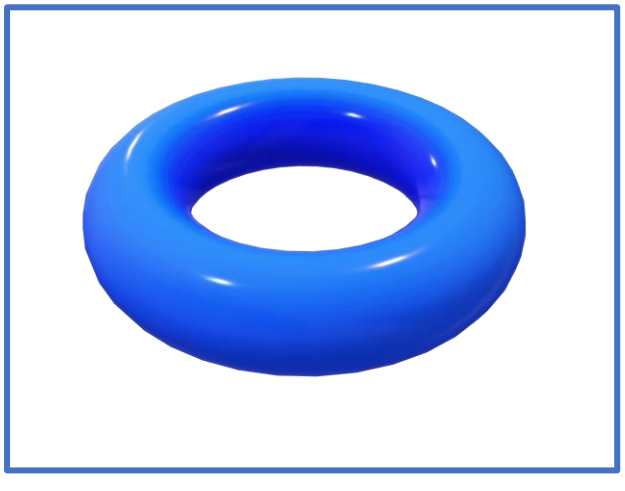

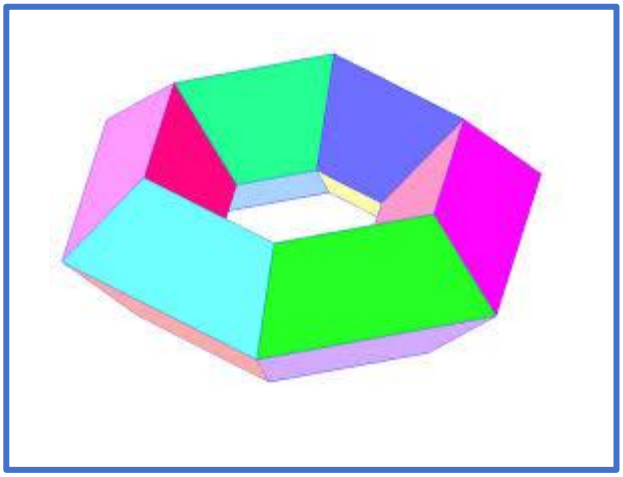

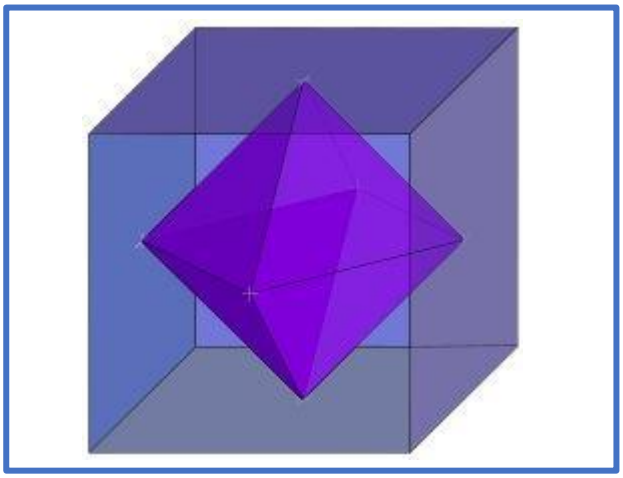

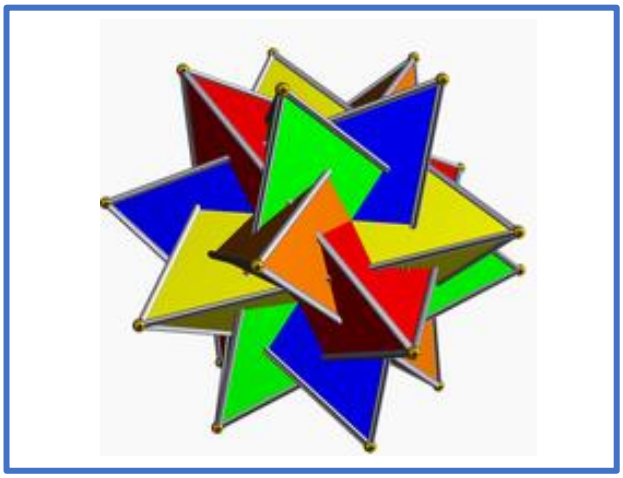

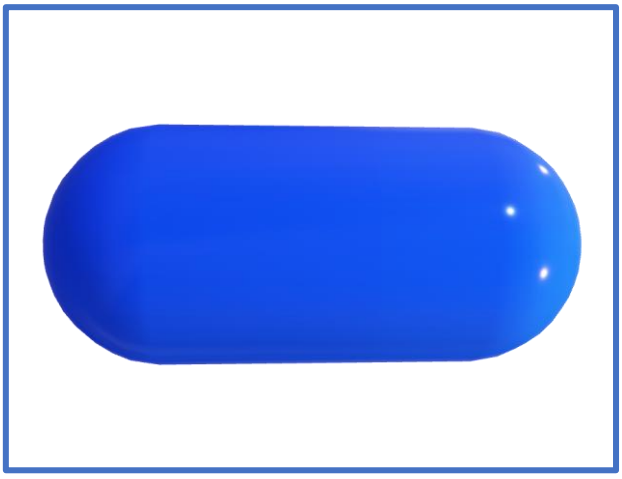

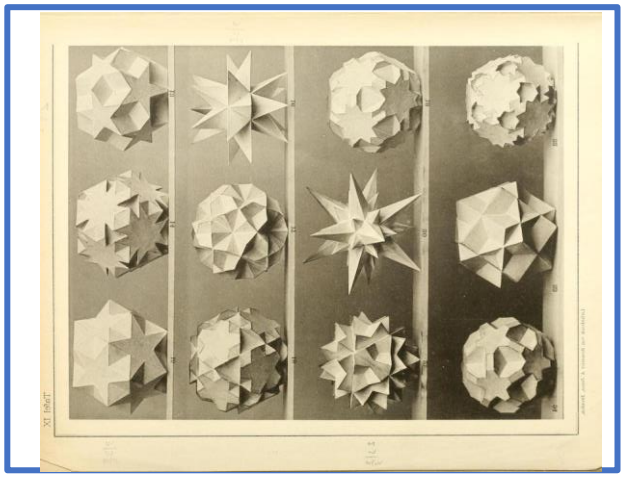

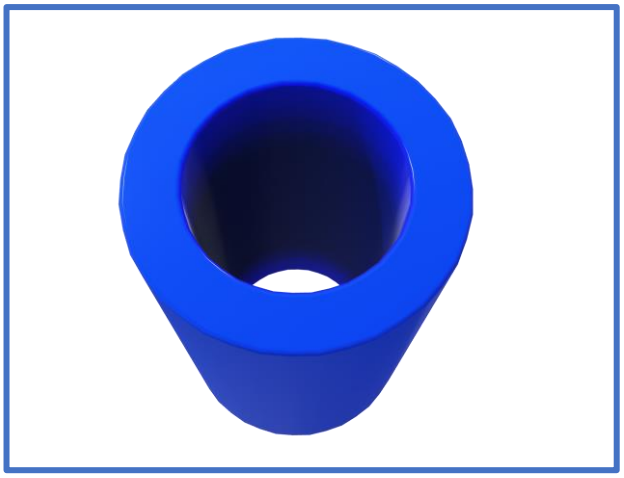

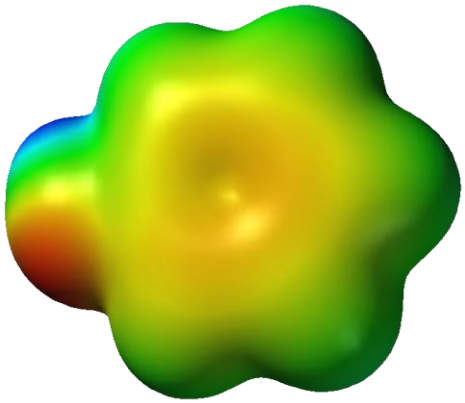


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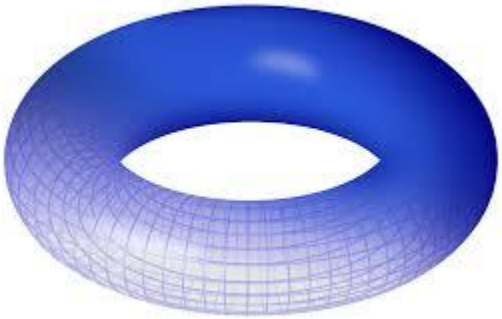

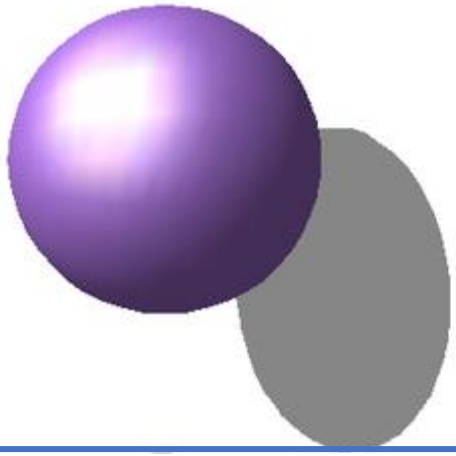

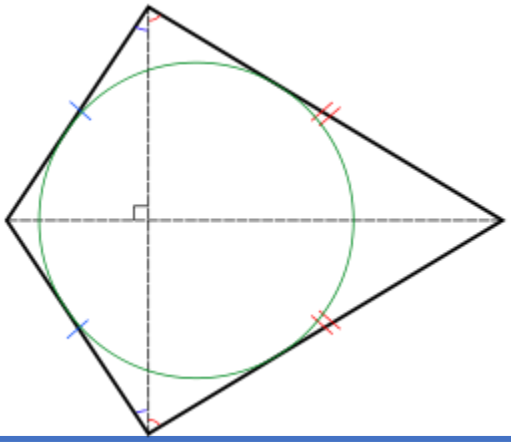

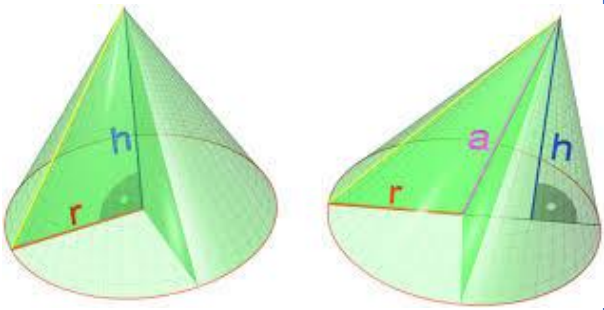
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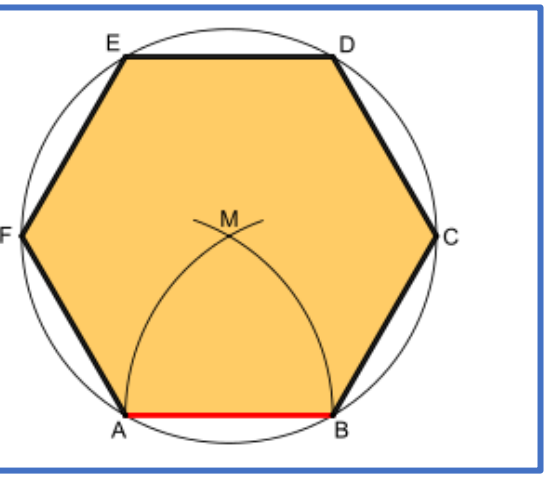
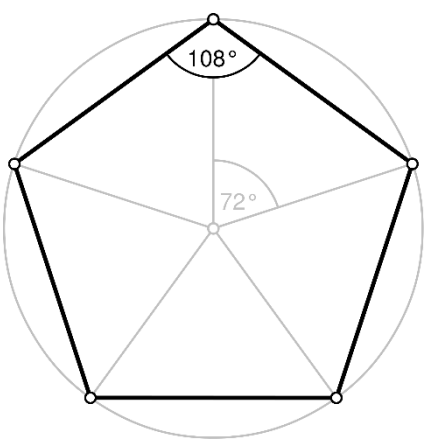

E
D
F
M
C
A
B

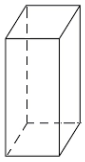

108°
72°

Materials for activity 1.4

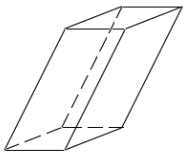
Materials for activity 1.4

The volume that you have obtained is a prism.

If the pentagons are aligned you can build a straight prism but if they are not, the prism will be oblique.



Right prism



Oblique prism

Move both ends and acknowledge the difference!! Can you point the height in both cases?

- Look carefully at the lateral polygons. What polygon do you think they are? How many polygons are there? Compare the results with your partner.

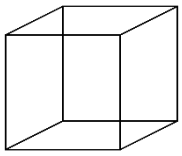
Materials for activity 1.5

Prisms are classified according to the polygon of the base. Therefore, they can be triangular, quadrangular, pentagonal, hexagonal, heptagonal, octagonal and so on.

There are though, **two special** names:

- If the base is a rectangle, then the prism is called **cuboid.**

- If the base is a square and the height of the prism is the same as the side of the square, then the prism is called **cube.**



All those prisms whose base is a regular polygon care called **regular prisms**

Let’s play to sink the fleet! Distribute the following ships: one of three, two of two squares and three of one square.

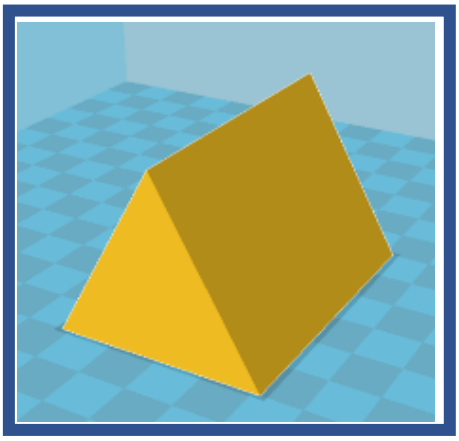
My fleet of prisms

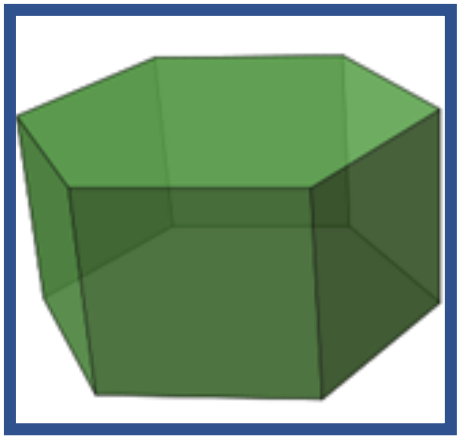
base	triangle	rectangle	quadrangle	pentagon	hexagon	heptagon	octagon	nonagon	decagon
right									
oblique									
regular									

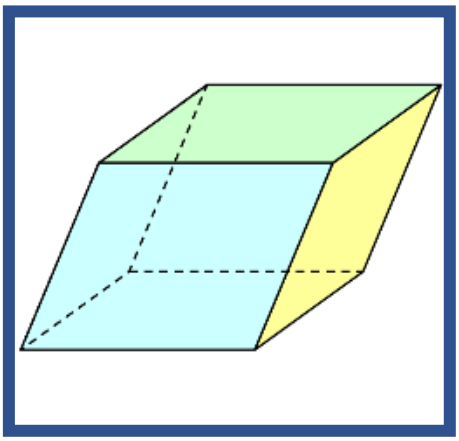
My mate’s fleet of prisms

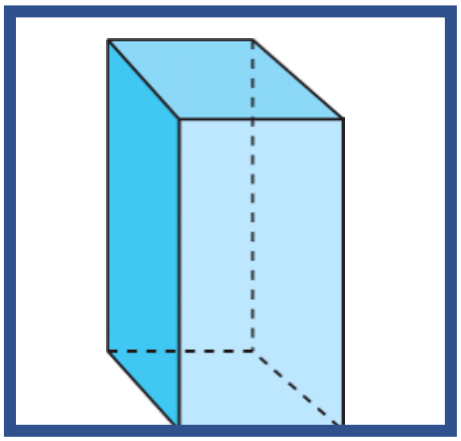
base	triangle	rectangle	quadrangle	pentagon	hexagon	heptagon	octagon	nonagon	decagon
right									
oblique									
regular									

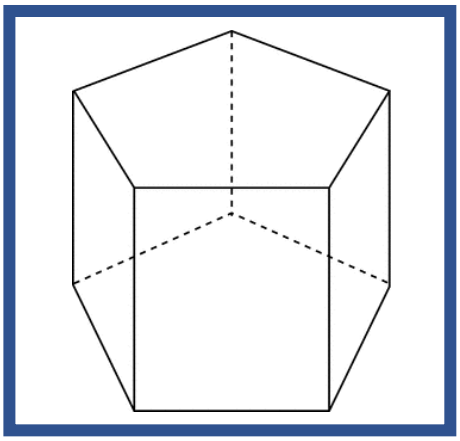
Materials for activity 1.6

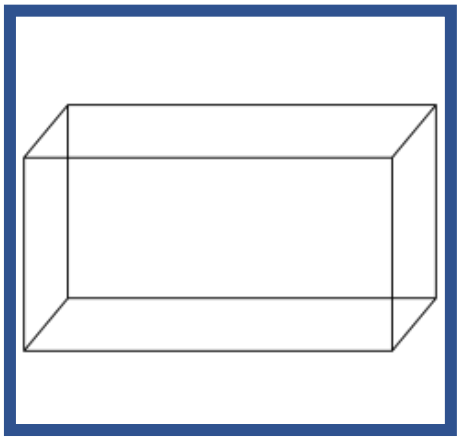


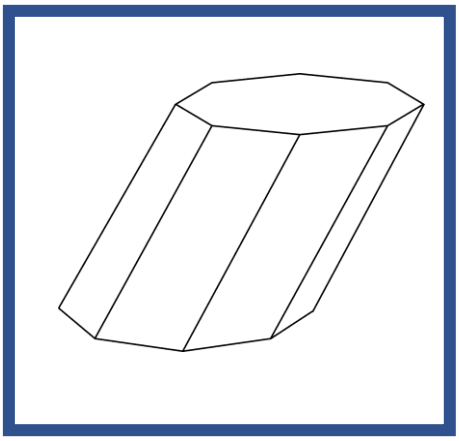


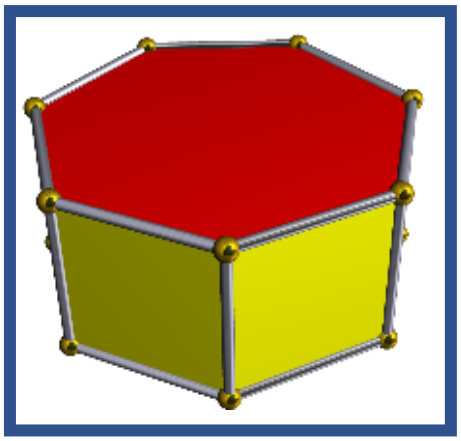


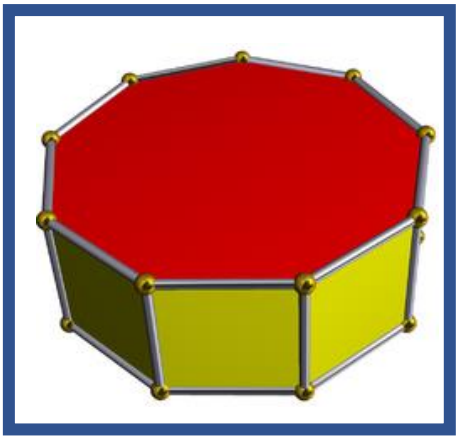


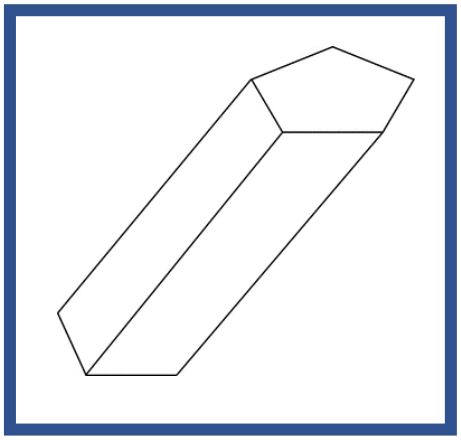


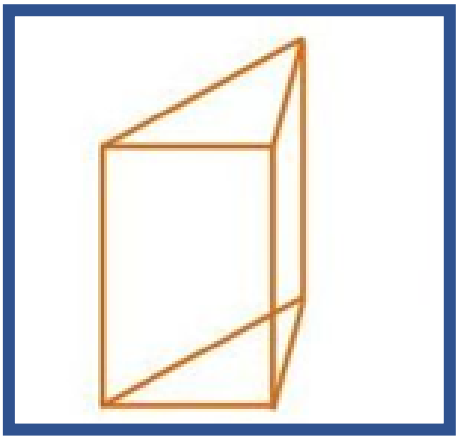


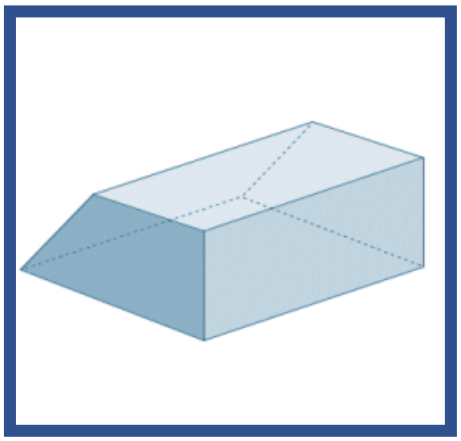


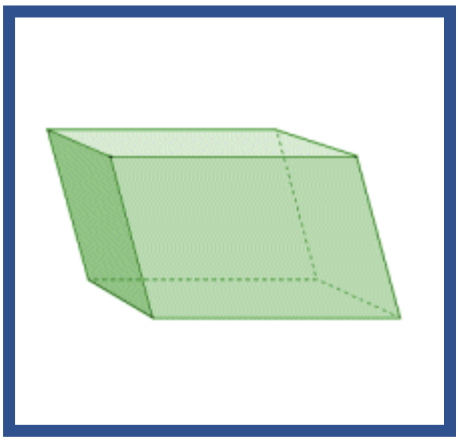


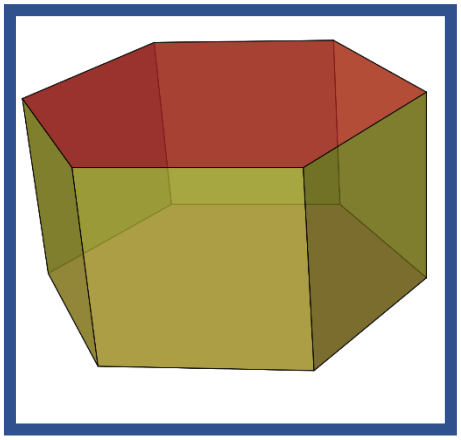


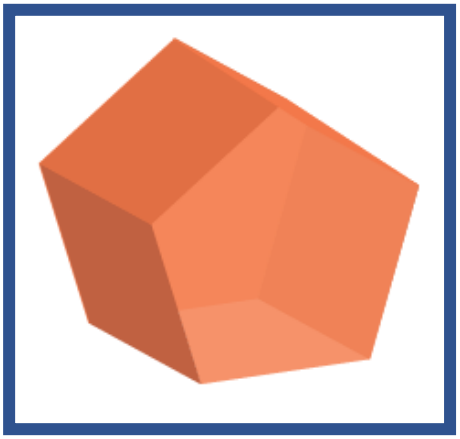


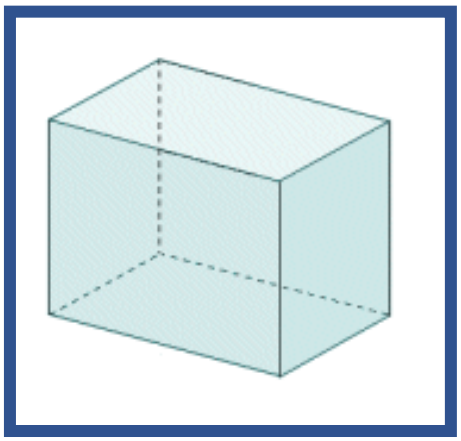












Materials for activity 2.1

MAIN CHARACTERISTICS

Once you have got your own prism, write down its main features:

Vertices: _____

Faces: _____

Edges: _____

Regular or irregular: _____

Type: _____

Number of lateral rectangles: _____

Height: _____

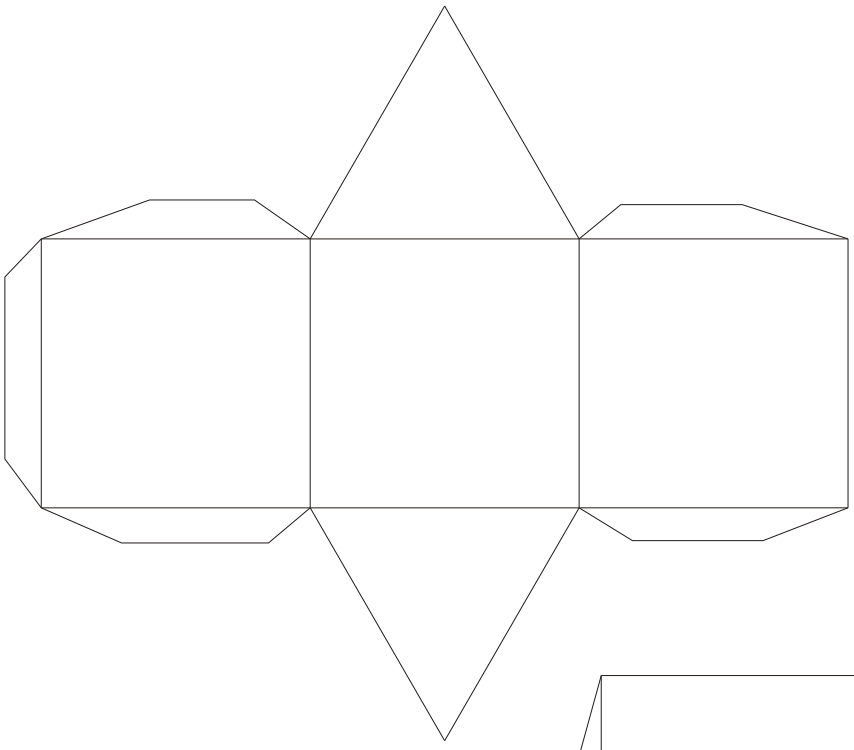
Polygon of the base: _____

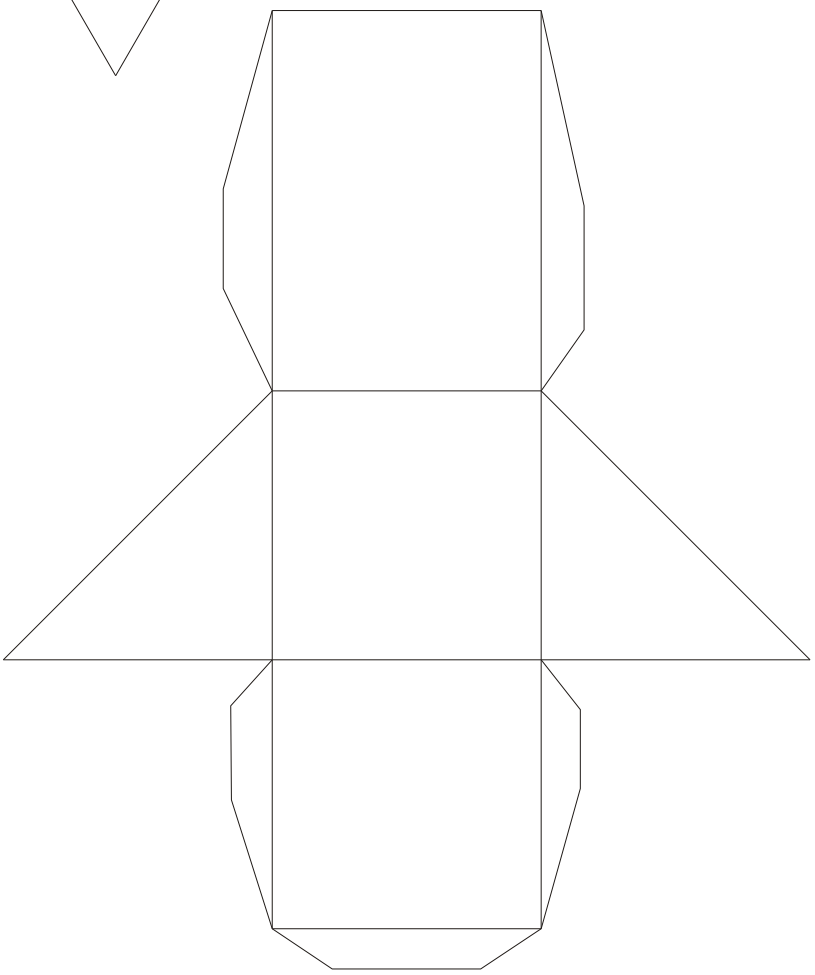
Side of the base: _____

Perimeter of the base: _____

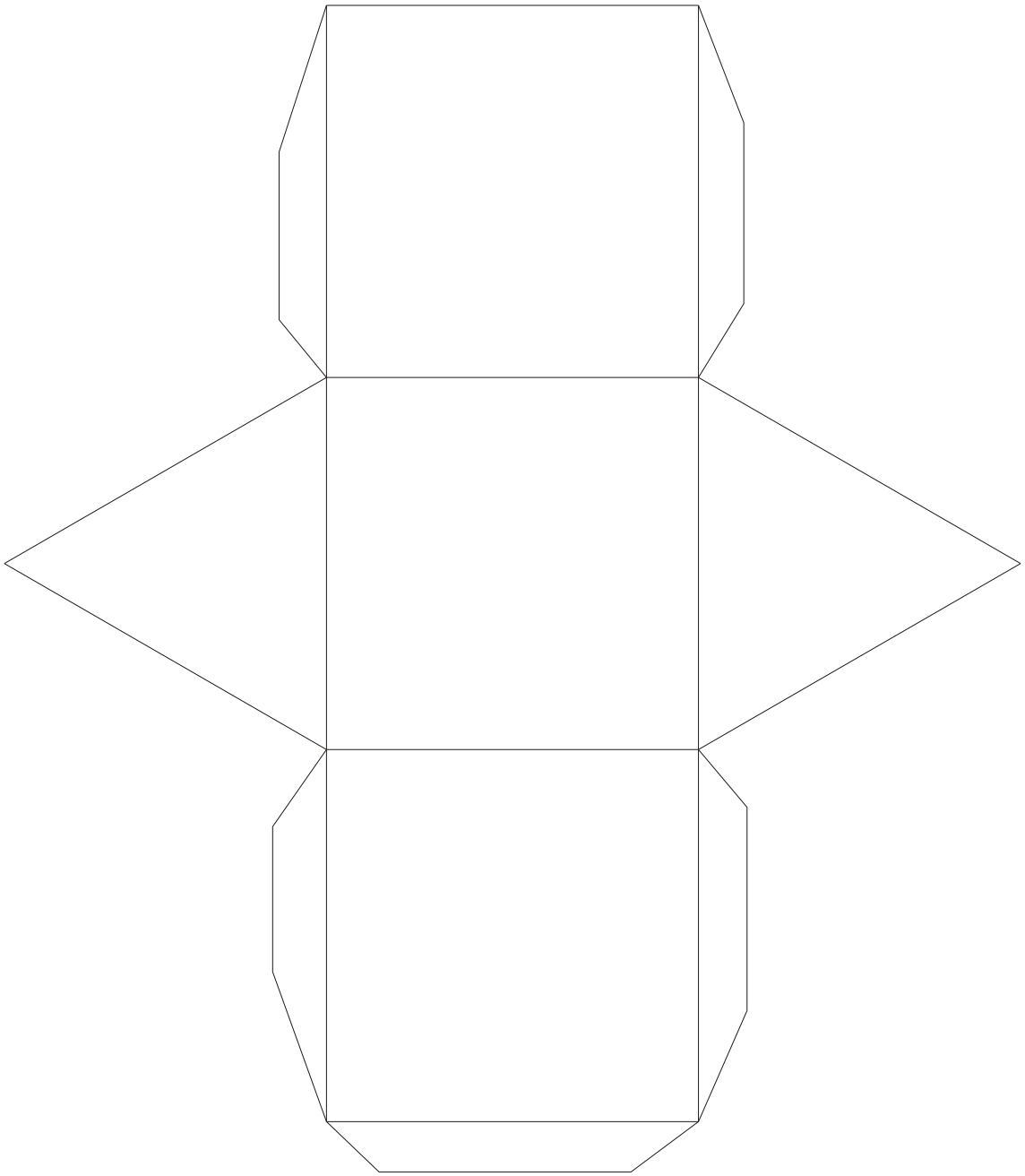
FLAT DEVELOPMENTS OF PRISMS

Triangular prisms

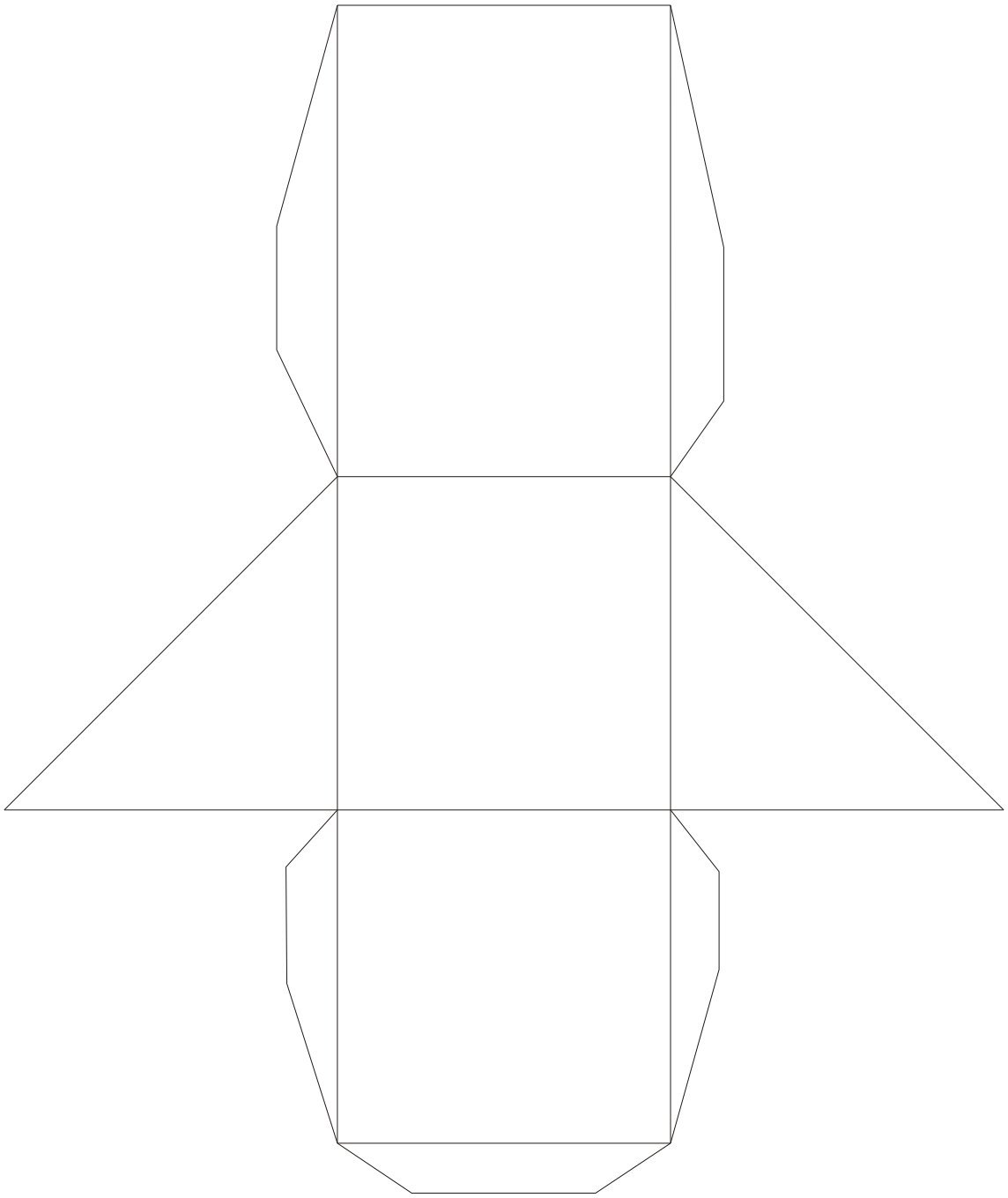




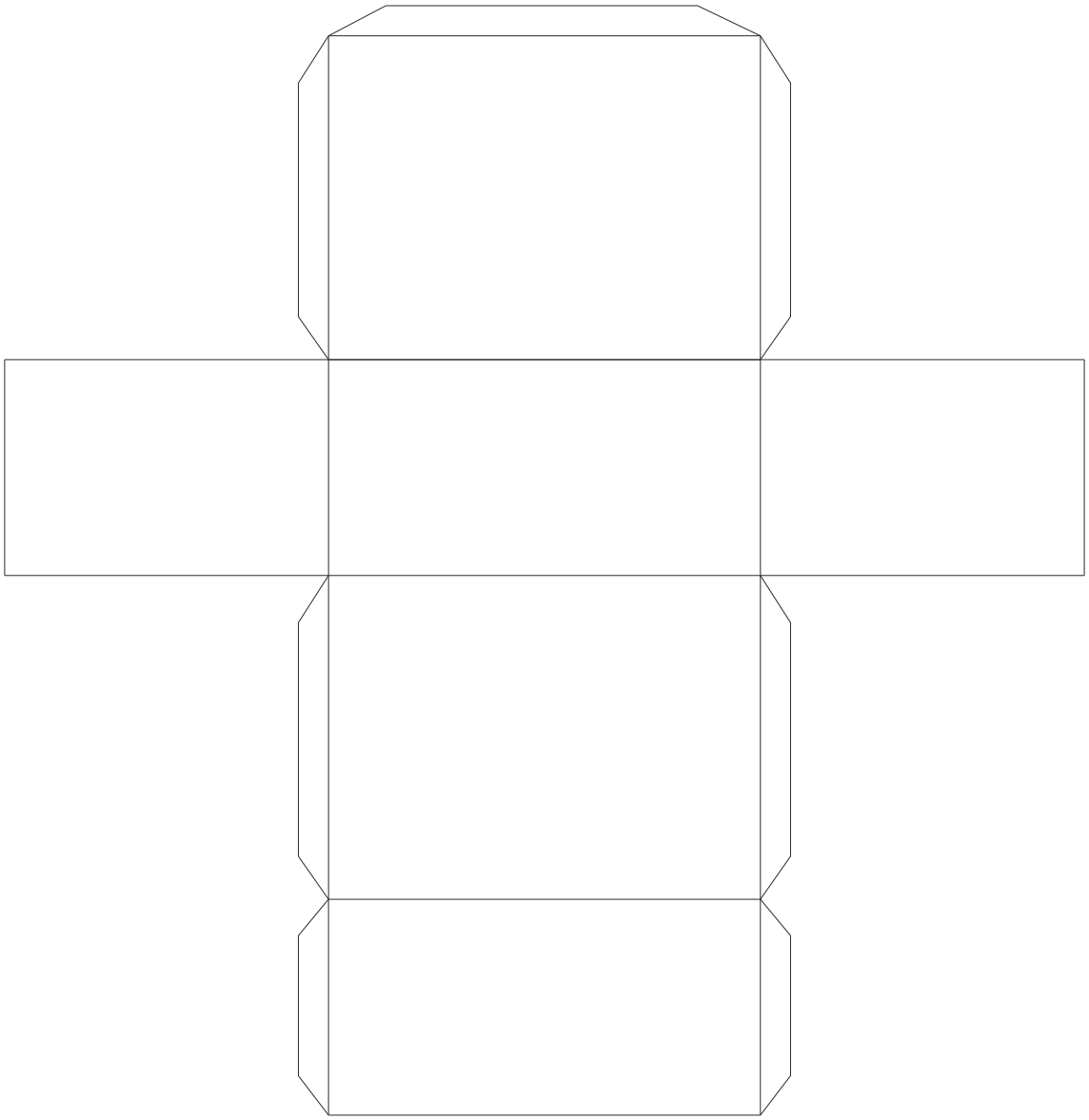
Triangular prism



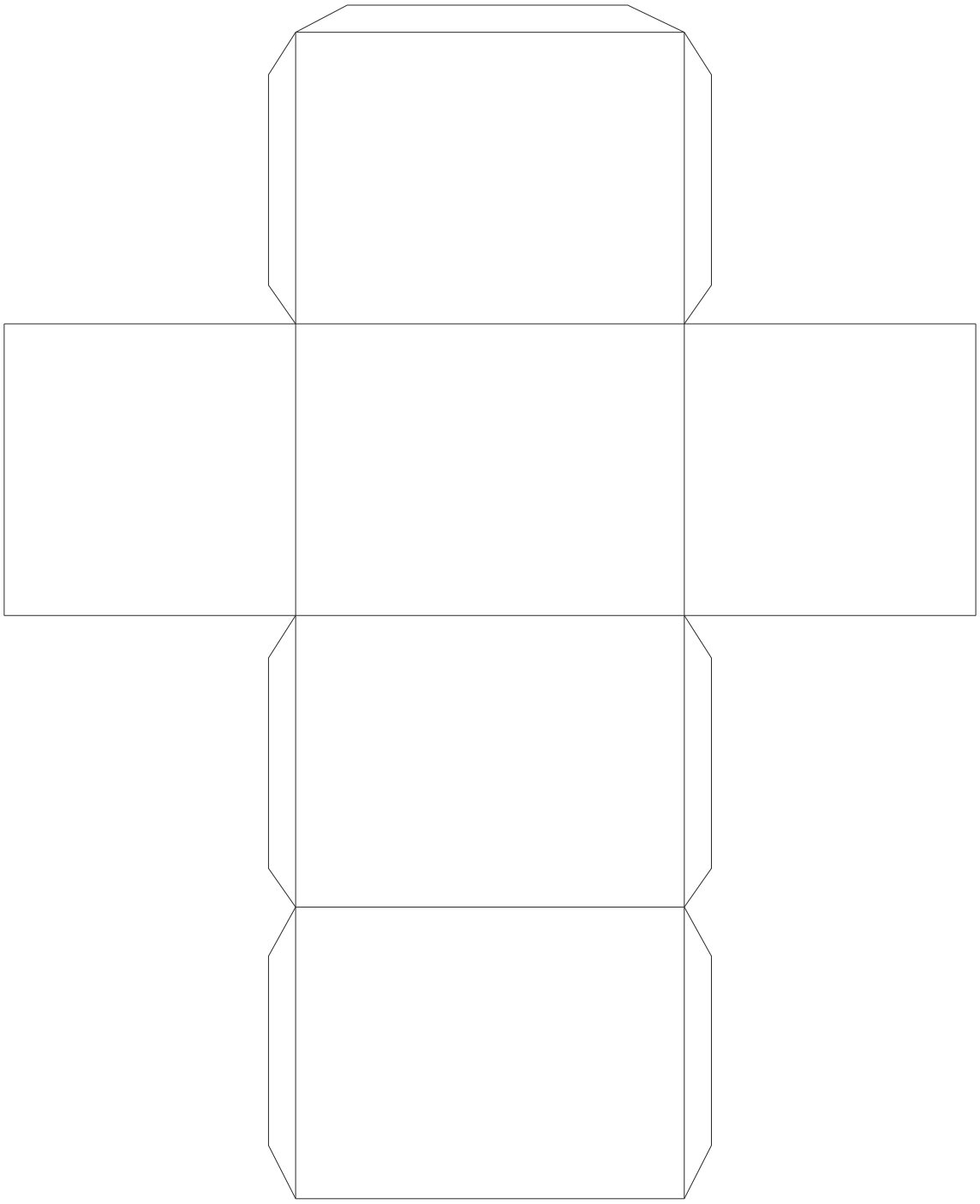
Triangular prism



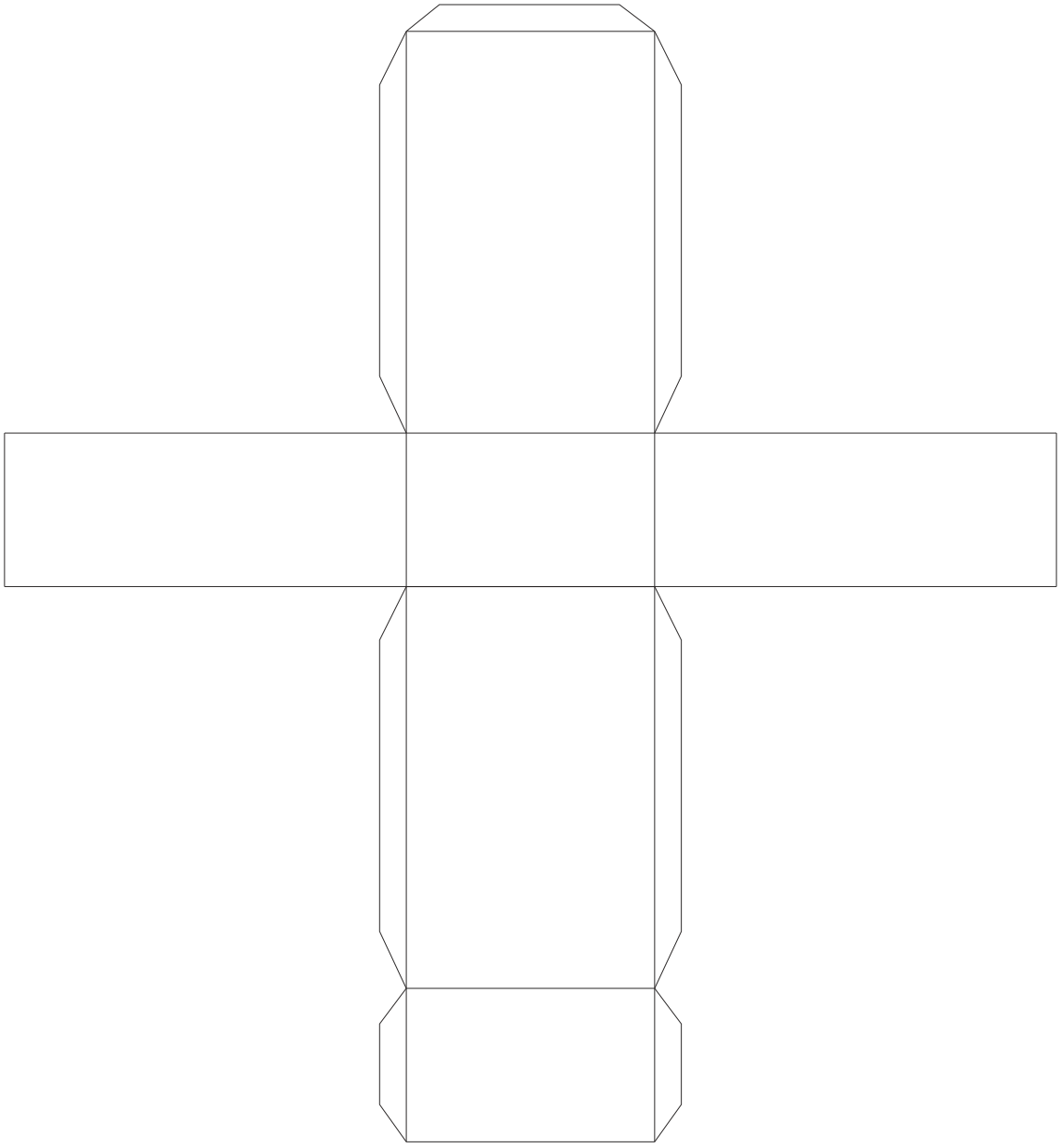
Rectangular prism



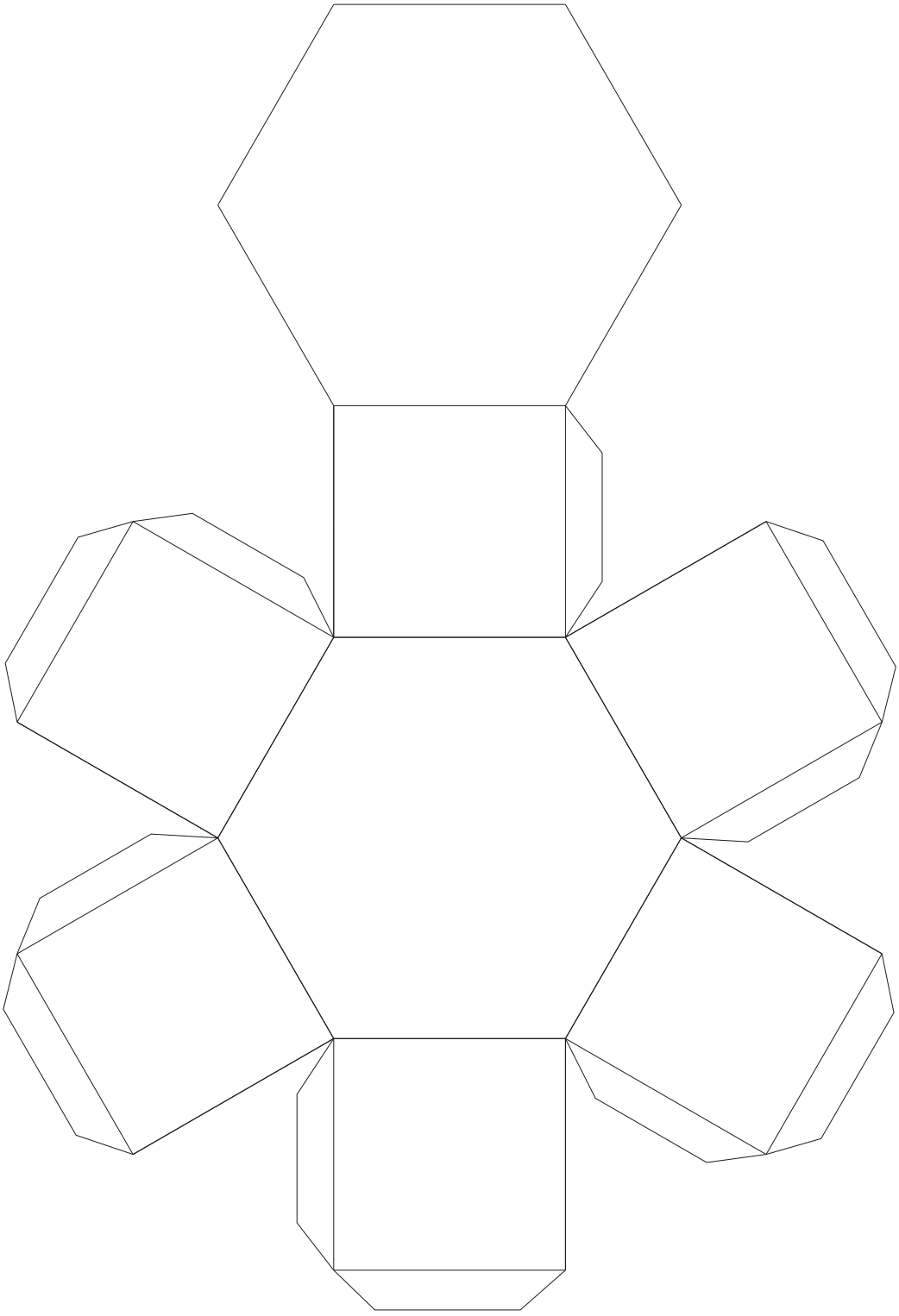
Rectangular prism



Rectangular prism

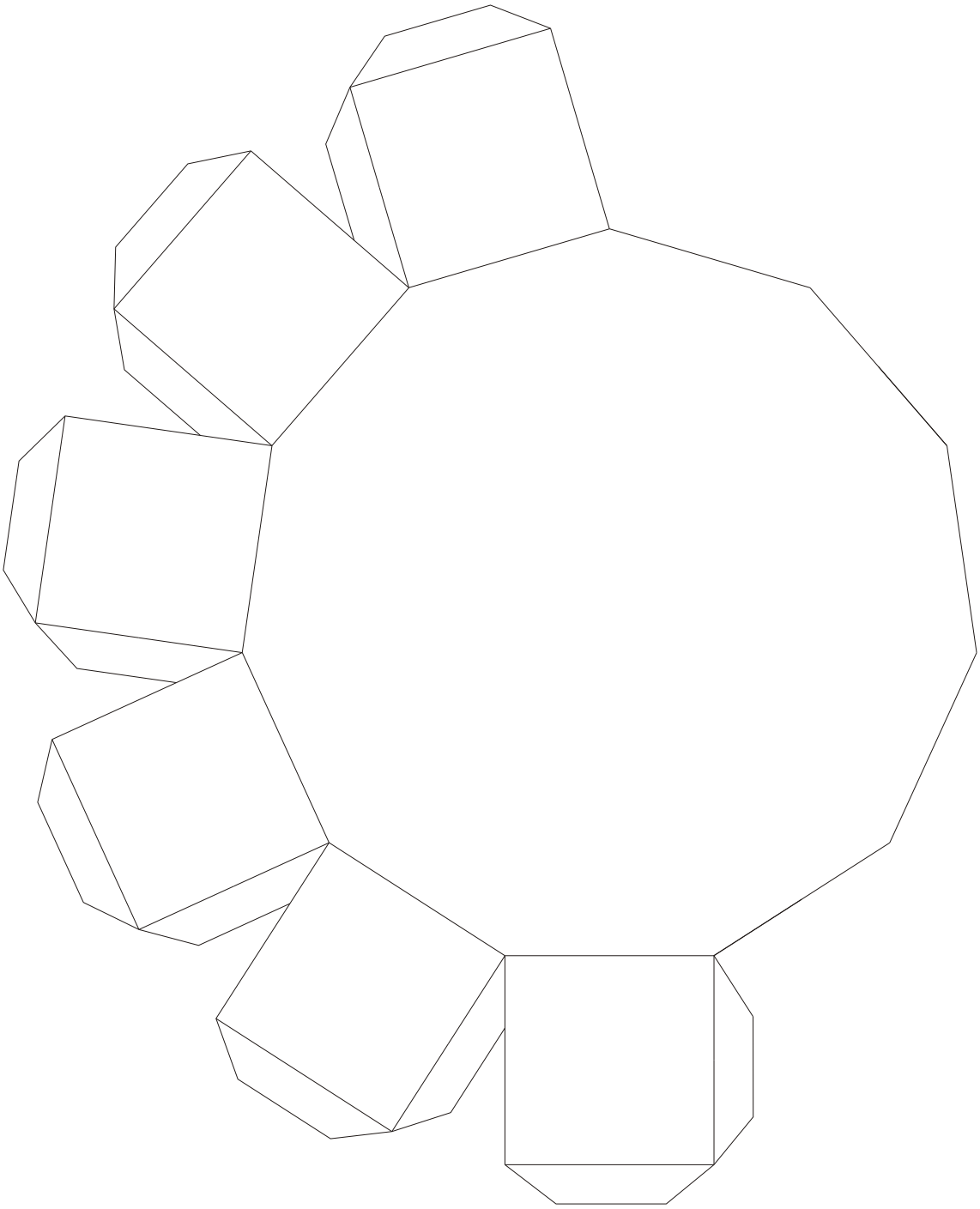


Hexagonal prism



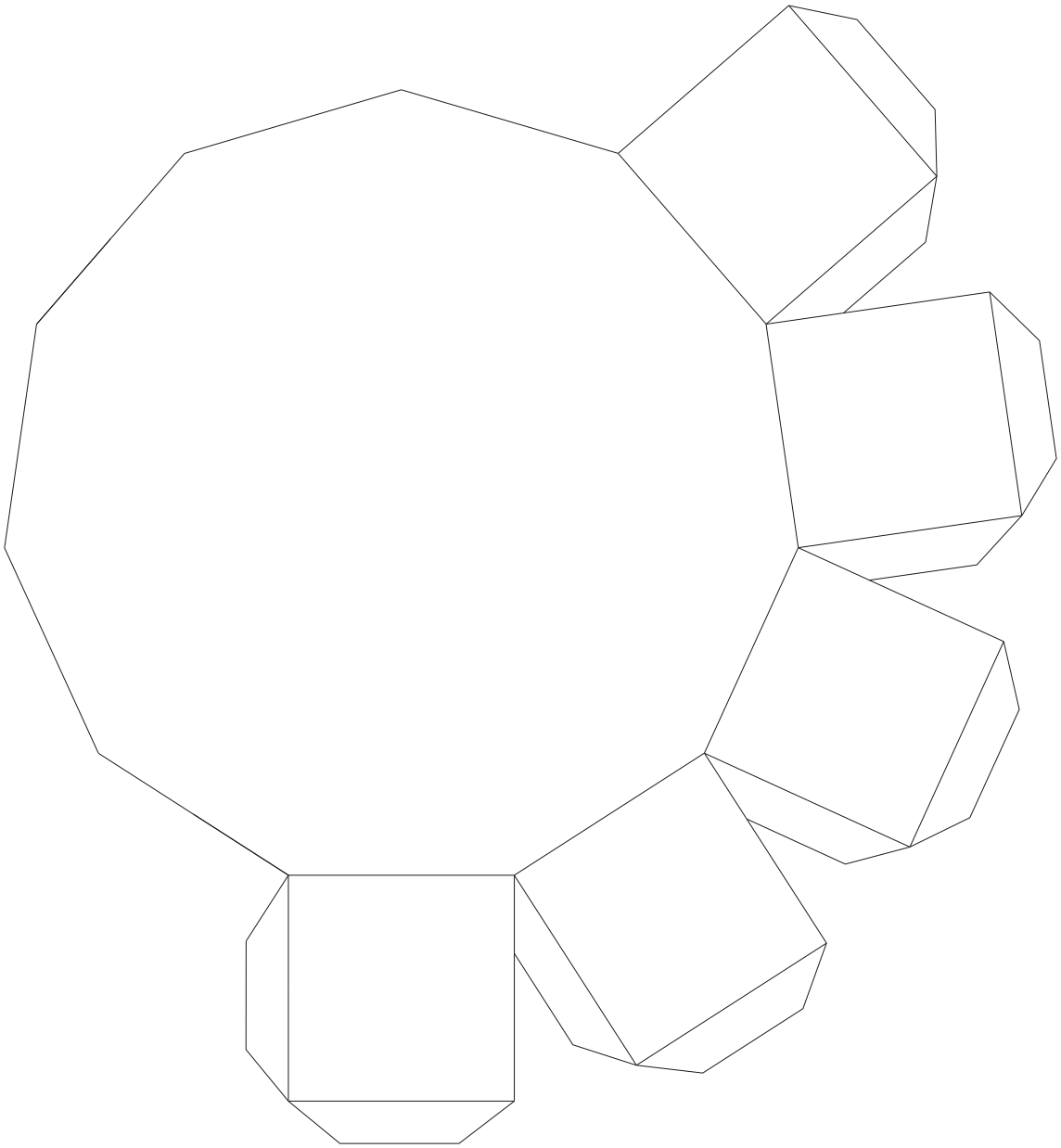
Hendecagonal prism

(Part 1)



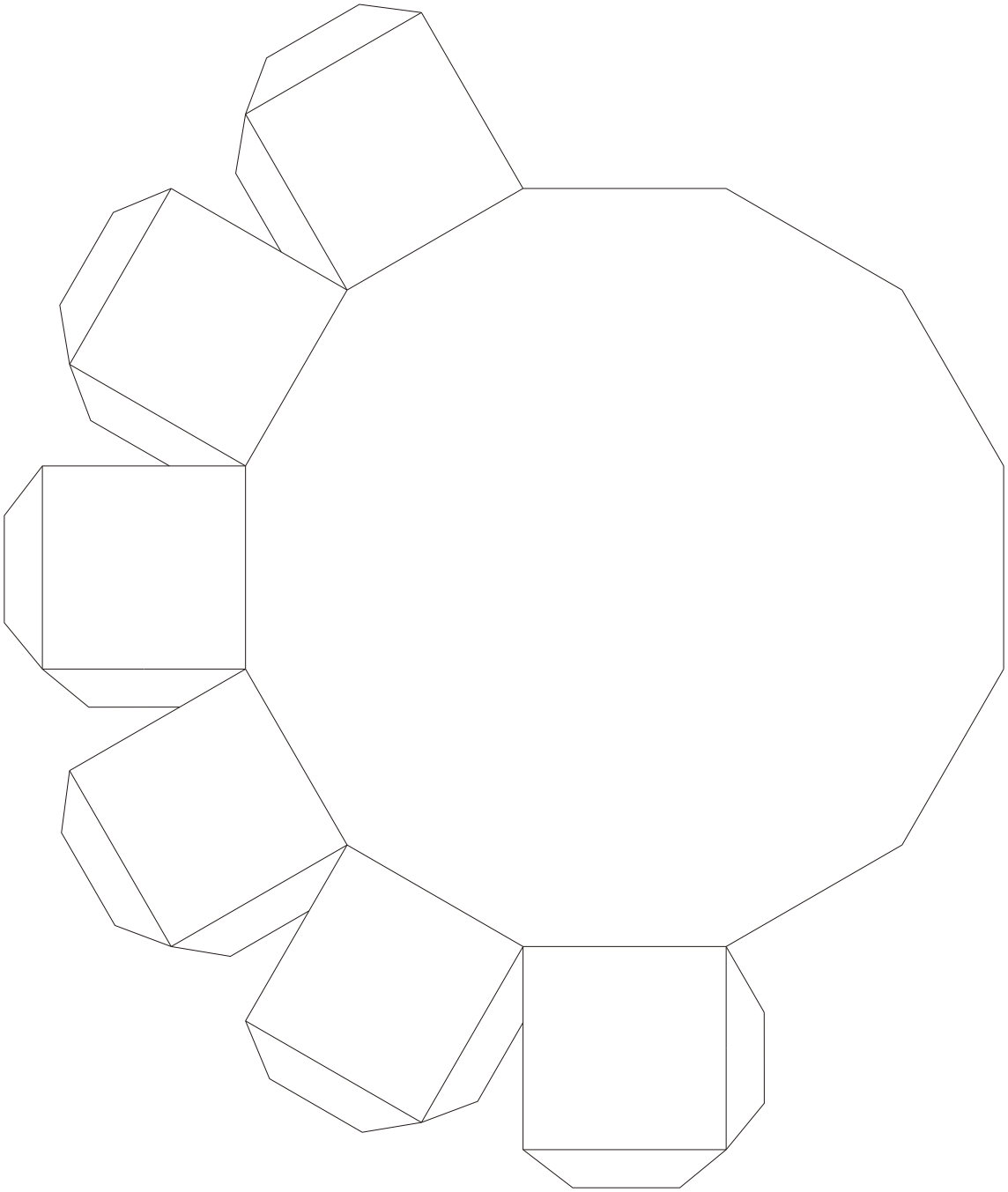
Hendecagonal prism

(Part 2)



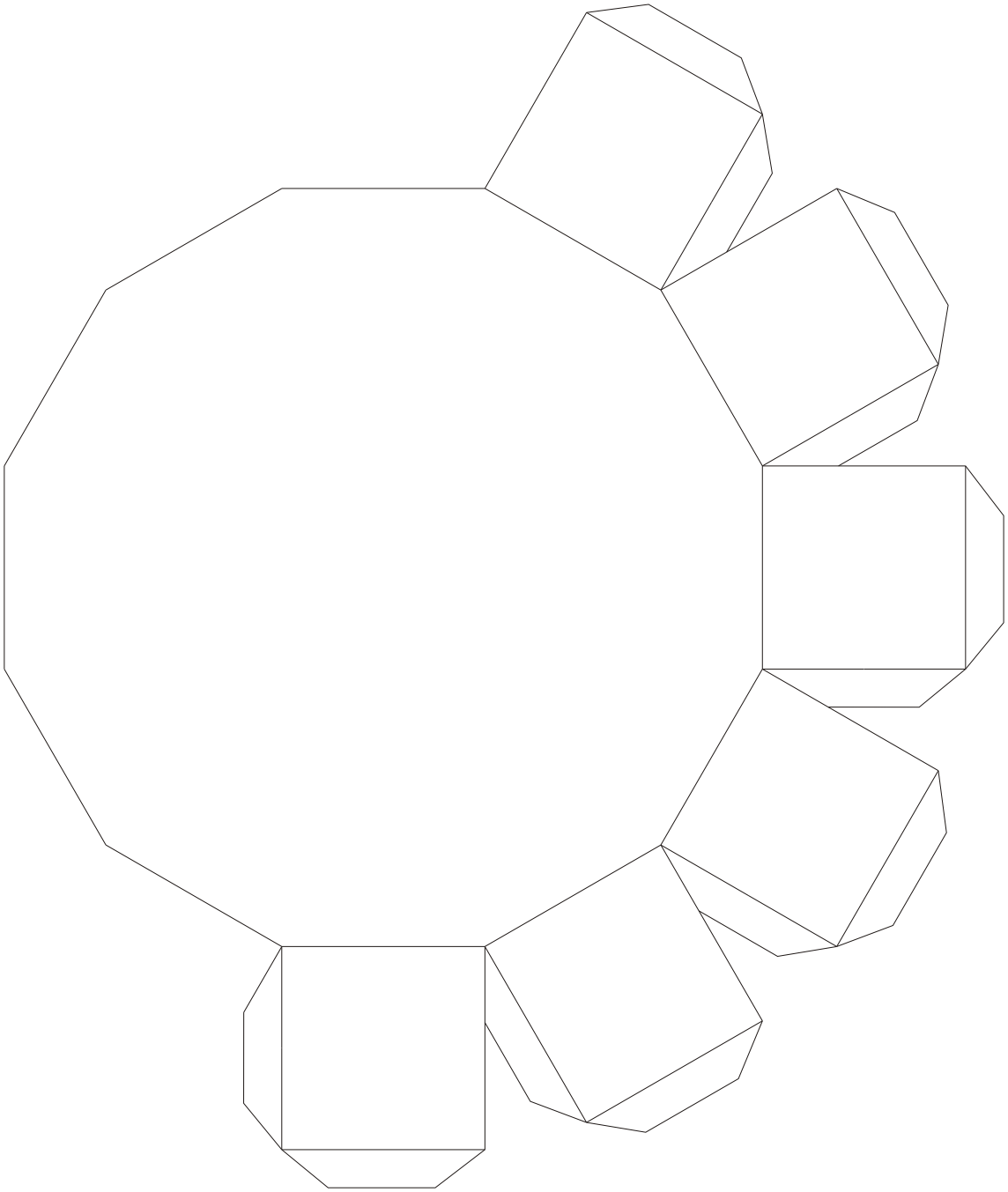
Dodecagonal prism

Part 1



Dodecagonal prism

Part 2



Materials for activity 2.2

Flashcard 1

Area of a rectangle = base x height

Area of a polygon = $\frac{perimeter\ of\ the\ polygon\ x\ apotheme\ of\ the\ polygon}{2}$

Flashcard 2

Area of a right prism:

Lateral area=sum of the areas of **n** identical rectangles which is the side of the polygon multiplied by the height of the prism.

Base area= area of the polygon which is $\frac{perimeter\ of\ the\ base\ \ x\ apoteme\ of\ the\ base}{2}$

Total area= lateral area+ base area

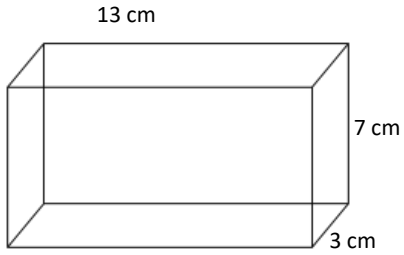
Flashcard 3

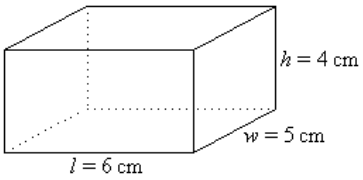
Volume of a prism = area of the base x height of the prism

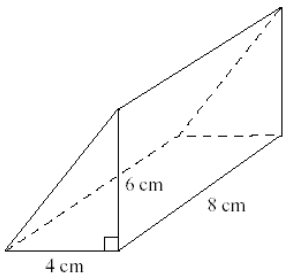
Calculate the area and volume of your model:

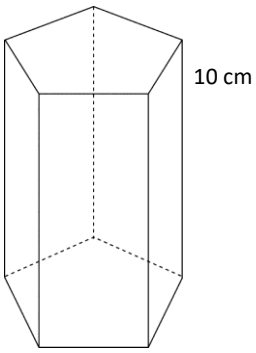
Let's work a little more

Calculate the area and the volume of the following examples.









Materials for activity 2.3

My High School prism:

Drawing:

Calculations

Materials for activity 2.3 4.4 5.5

Activity 2.3 GENERAL FEATURES OF PRISMS

	Triangular right prim	Square regular prism	Rectangular right prism	Pentagonal regular prism	Hexagonal regular prism	Heptagonal regular prism	Octagonal regular prism	Dodecagonal regular prism
base								
lateral faces								
vertices								
edges								
faces								

Activity 4.4 GENERAL FEATURES OF PYRAMIDS

	Triangular right pyramid	Square regular pyramid	Rectangular right pyramid	Pentagonal regular pyramid	Hexagonal regular pyramid	Heptagonal regular pyramid	Octagonal regular pyramid	Dodecagonal regular pyramid
base								
lateral faces								
vertices								
edges								
faces								

Activity 5.5 GENERAL FEATURES OF PLATONIC SOLIDS

	Tetrahedron	Hexahedron (cube)	Octahedron	Dodecahedron	Icosahedron
Type of faces					
vertices					
edges					
faces					
Euler's formula					

Materials for activity 2.4

Prepare a text for your exposition that explains the main features of the prisms, and also how to calculate its area and volume.

Step 1: List the important words for you from the padlet

Step 2: Define a prism. If necessary, use your models.

Greetings.....

To begin with.....

A prism is.....

A prism can be.....

A way of representing a prism is .....

A prism has .....

My prism has .....

My prism has .....

To conclude.....

.....

Step 3: Wrapping up the calculations of the model and the High School prism

Area

Model:

High School prism

Volume:

Model

High School prism

Introduce the vocabulary and language structures in the padlet.

https://padlet.com/ctrulls2/qqckzj8iqsl2

Materials for activity 3.3

Flashcard 1

A pyramid is a polyhedron that has any polygon for a base and a common vertex called the vertex of the pyramid. Its lateral faces are triangles.

The pyramids are classified according to the polygon of the base. Consequently, they can triangular, square, pentagonal, hexagonal, heptagonal…pyramids.

Flashcard 2

Height of the pyramid is the distance from the vertex to the base.

When the base of the pyramid is a regular polygon and the vertex is projected onto the centre of the polygon, the pyramid is called **regular**. If a pyramid is **regular** all the lateral faces are equal isosceles triangles. Their height is called the **apothem of the pyramid**.

Materials for activity 3.4

The teacher will hand out some cards with a word. Working in pairs, and using mimicry, each student will have to describe them to the other student so that the other student discovers the word. You can use your model.

perimeter	vertex	base
edge	apothem of the base	face
pyramid	quadrangular pyramid	pentagonal pyramid
hexagonal pyramid	octagonal pyramid	decagonal pyramid
prism	height	volume
area		

MAIN CHARACTERISTICS

Once you have got your own pyramid, write down its main features:

Vertices: _____

Faces: _____

Edges: _____

Regular or irregular: _____

Type: _____

Number of lateral triangles: _____

Height: _____

Apothem of the lateral triangles: _____

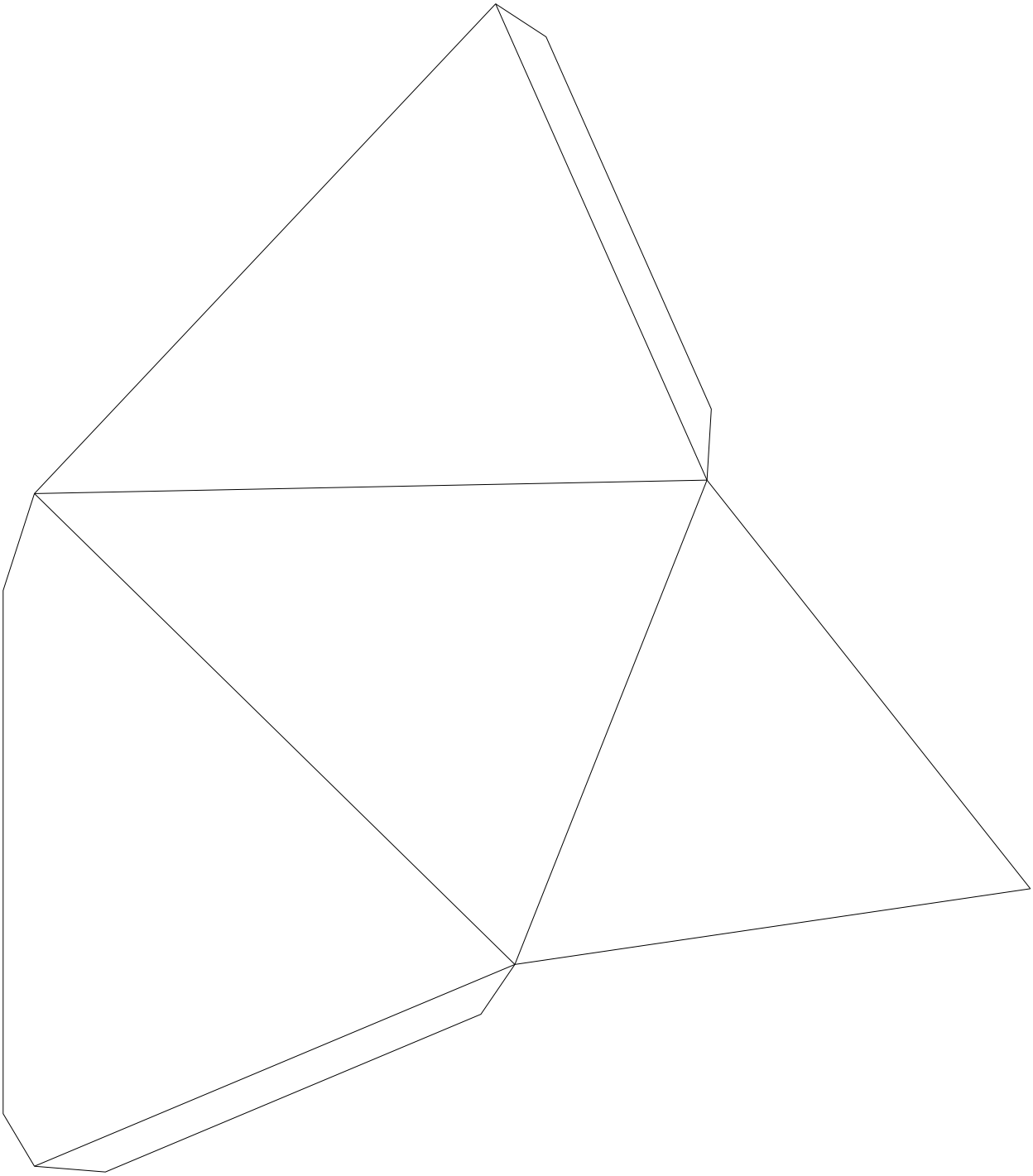
Polygon of the base: _____

Side of the base: _____

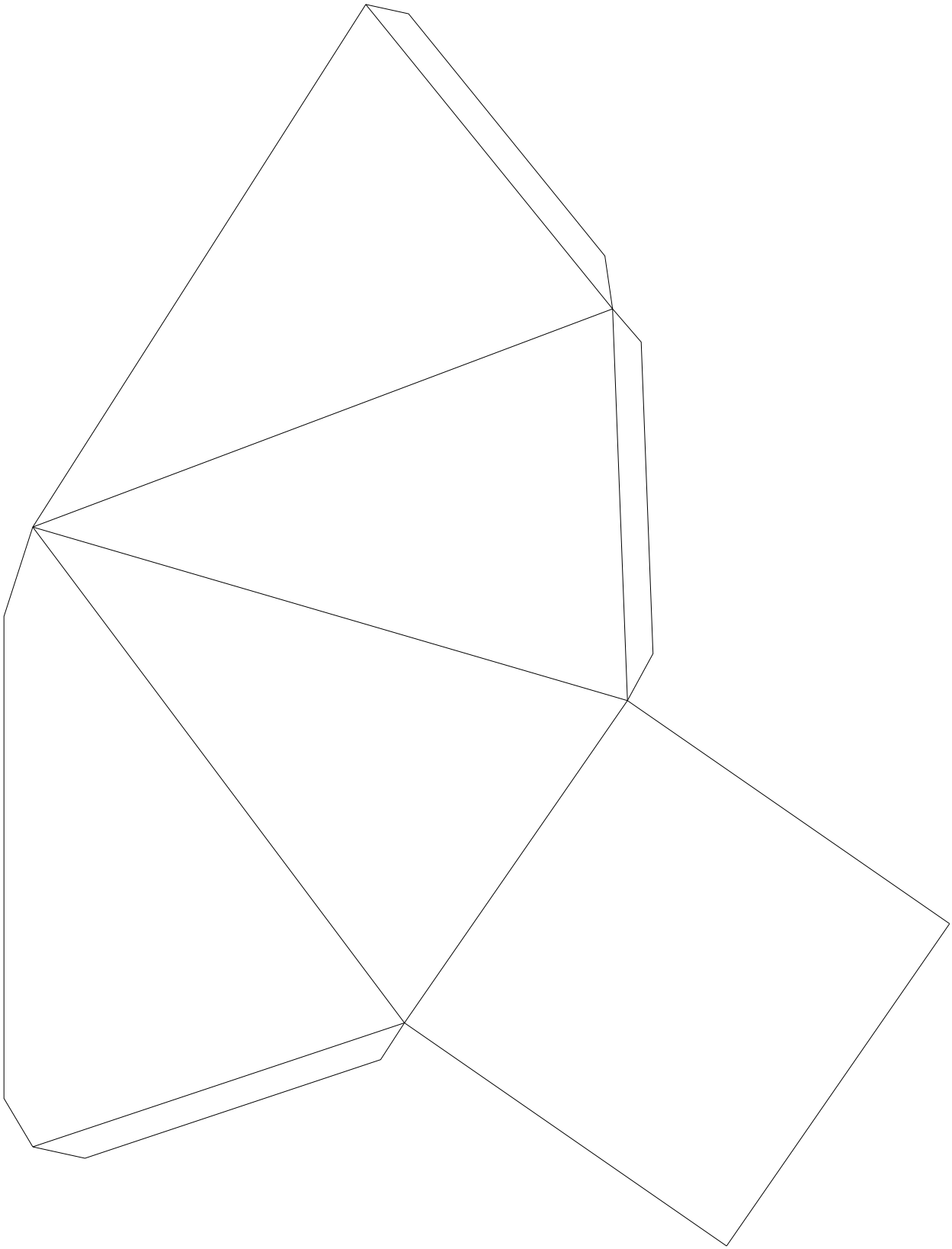
Perimeter of the base: _____

FLAT DEVELOPMENTS OF THE PYRAMIDS

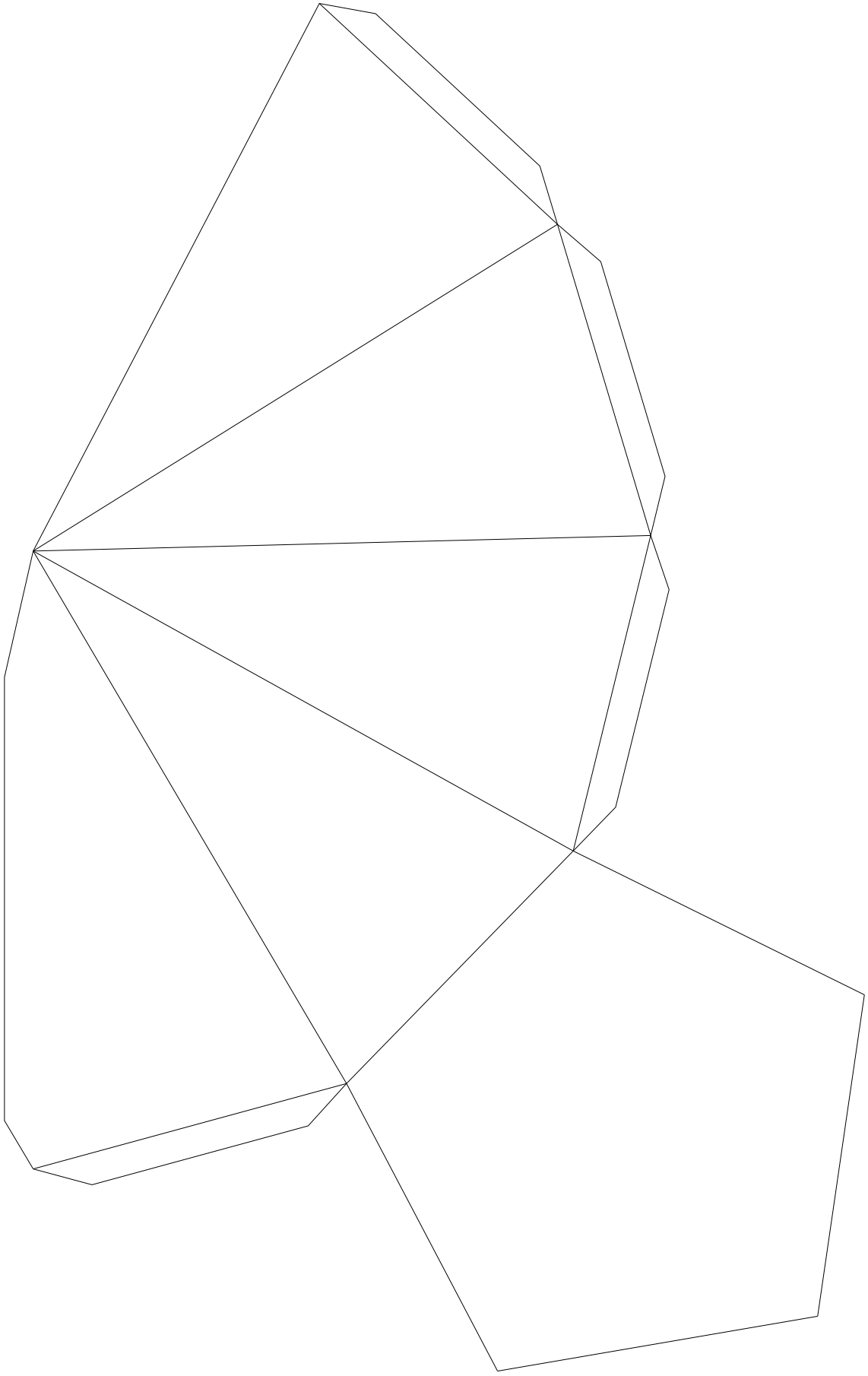
Triangular pyramid



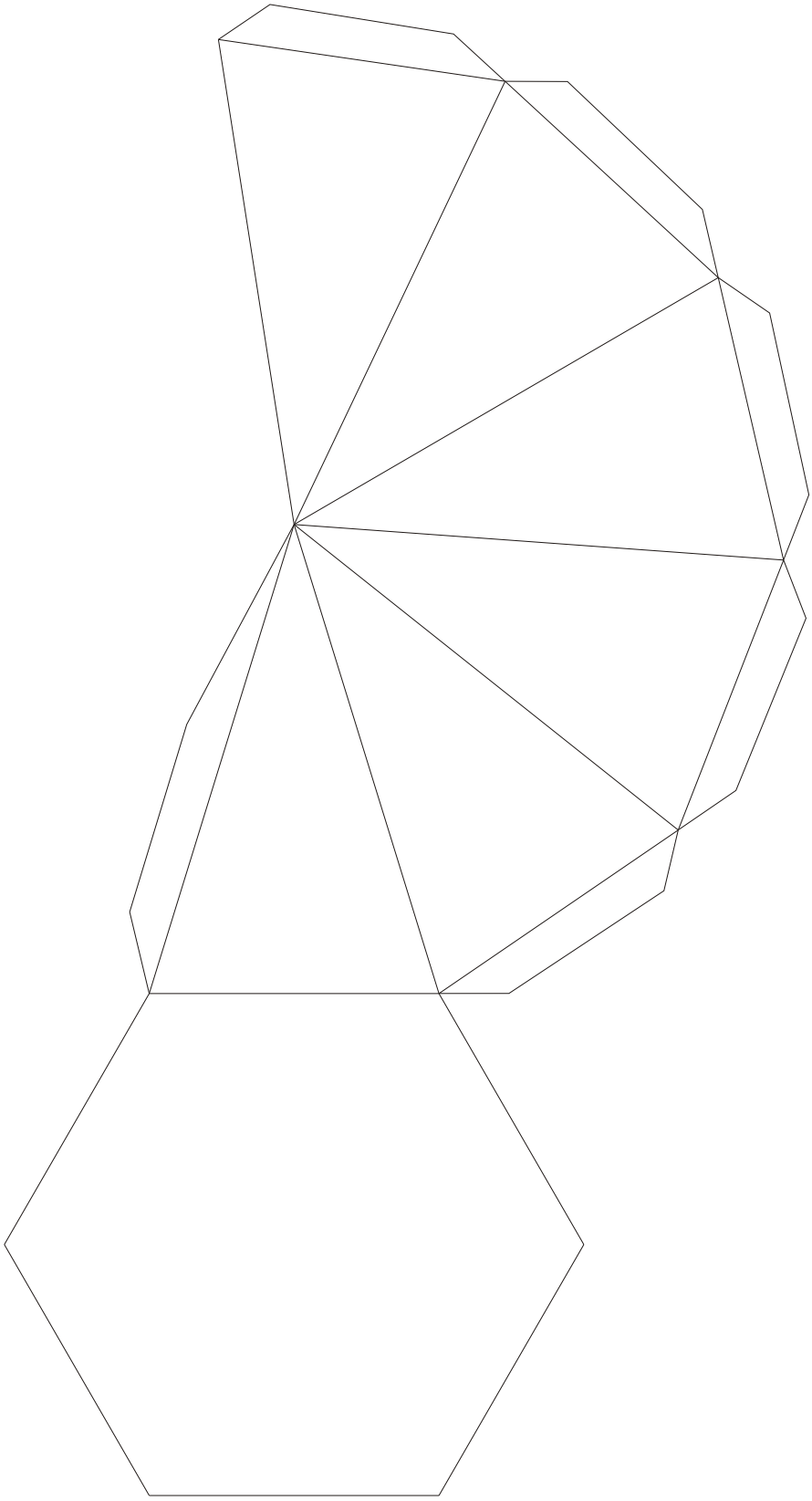
Square pyramid



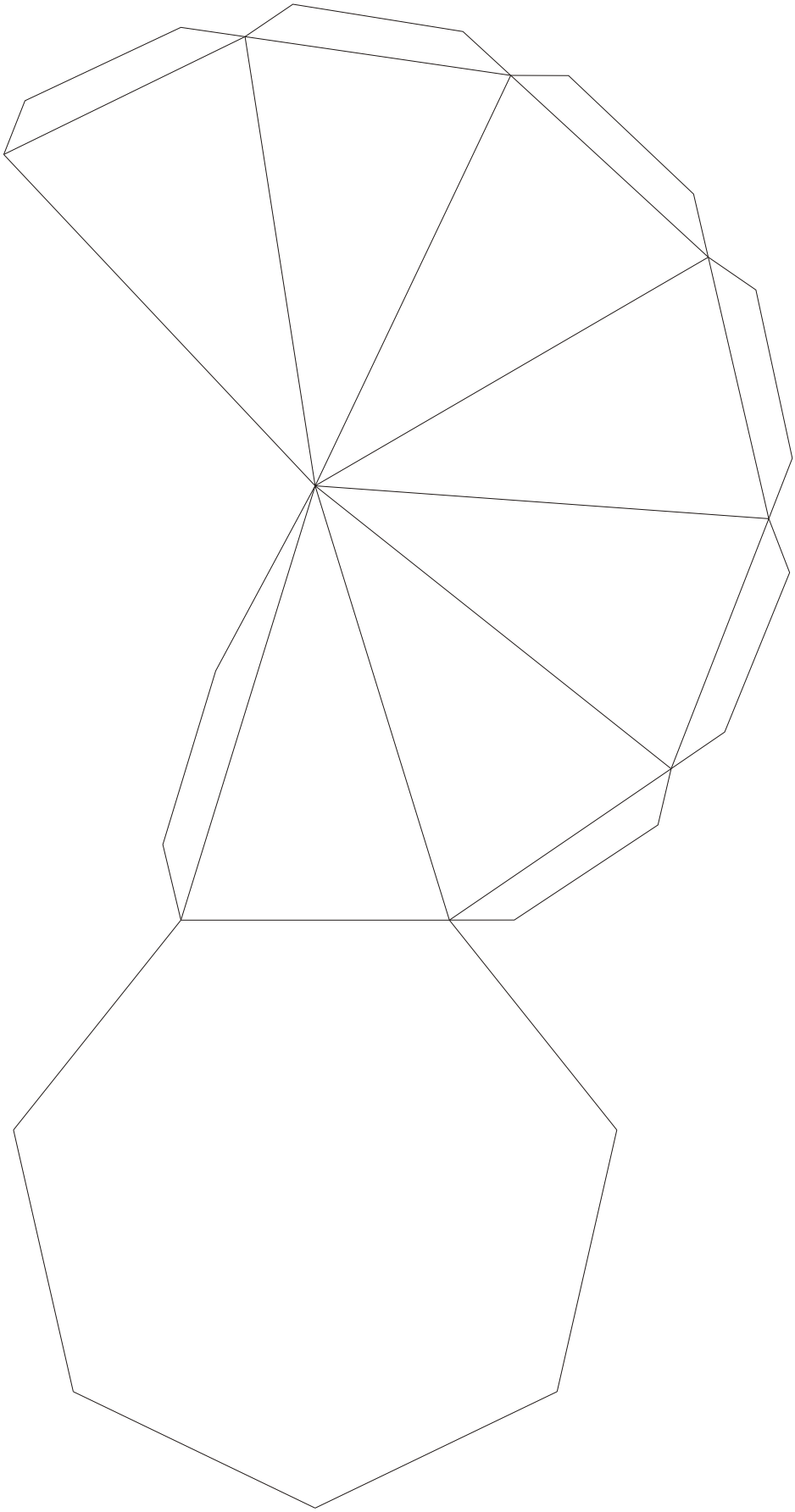
Pentagonal pyramid



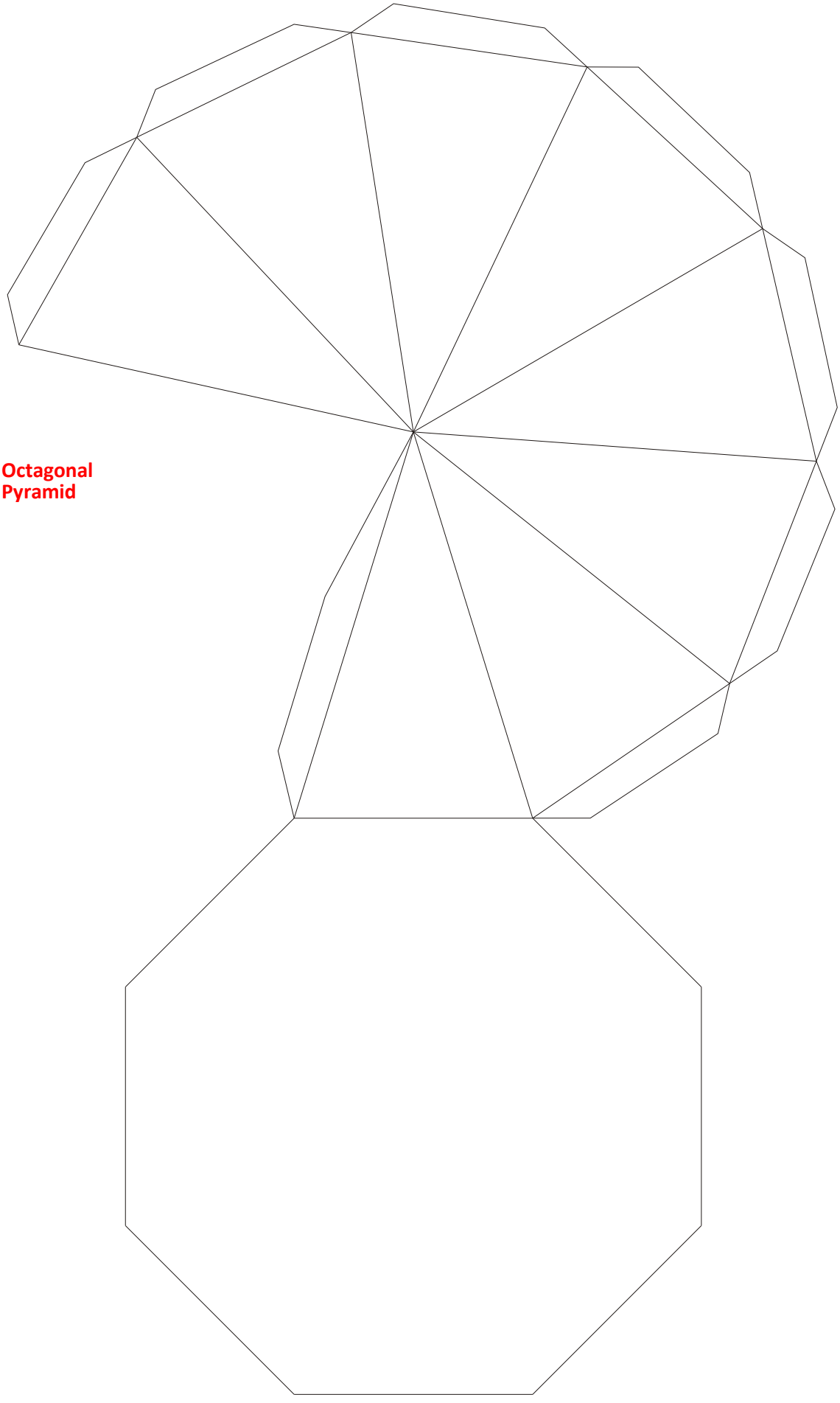
Hexagonal Pyramid



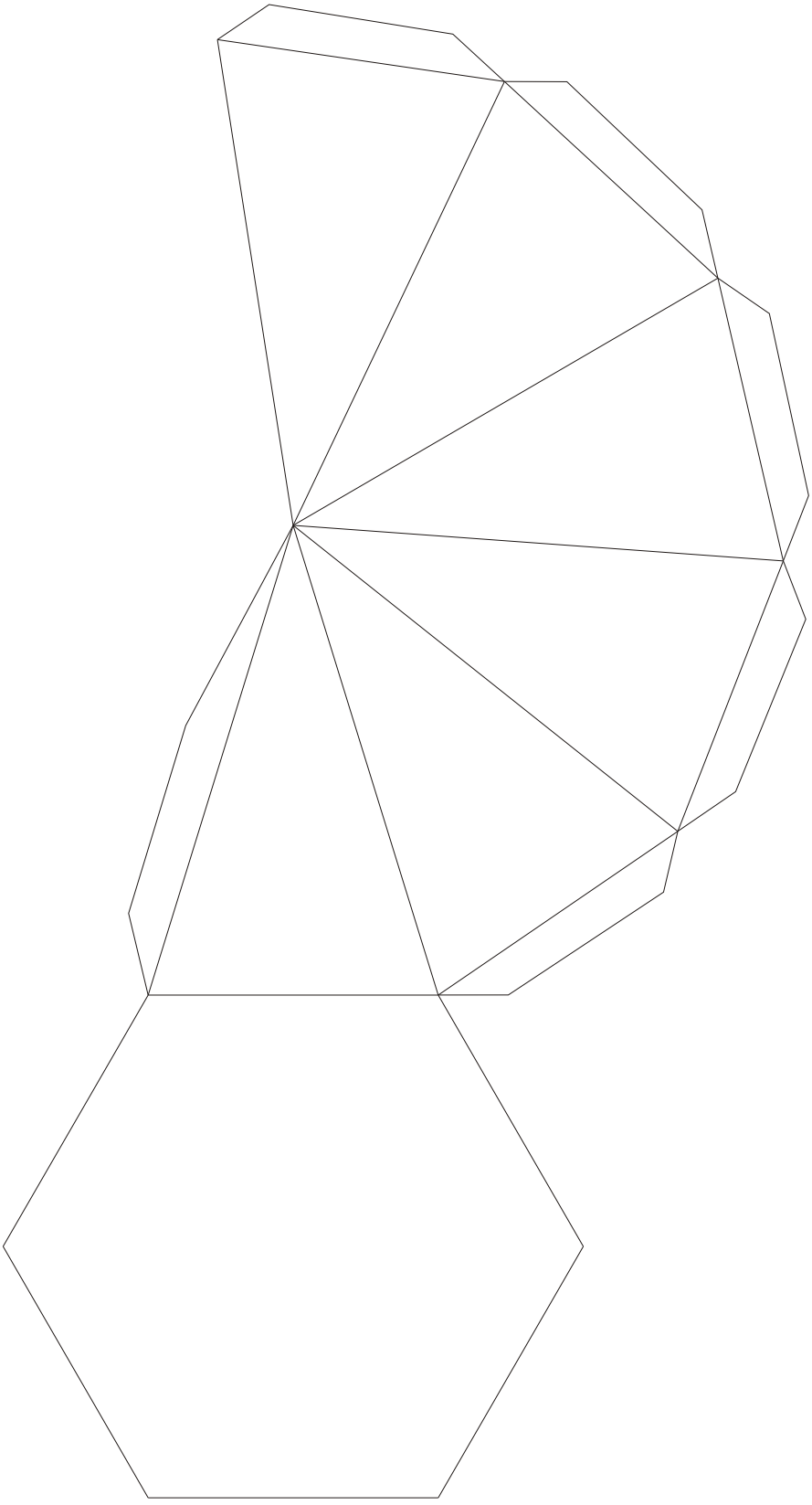
Heptagonal Pyramid



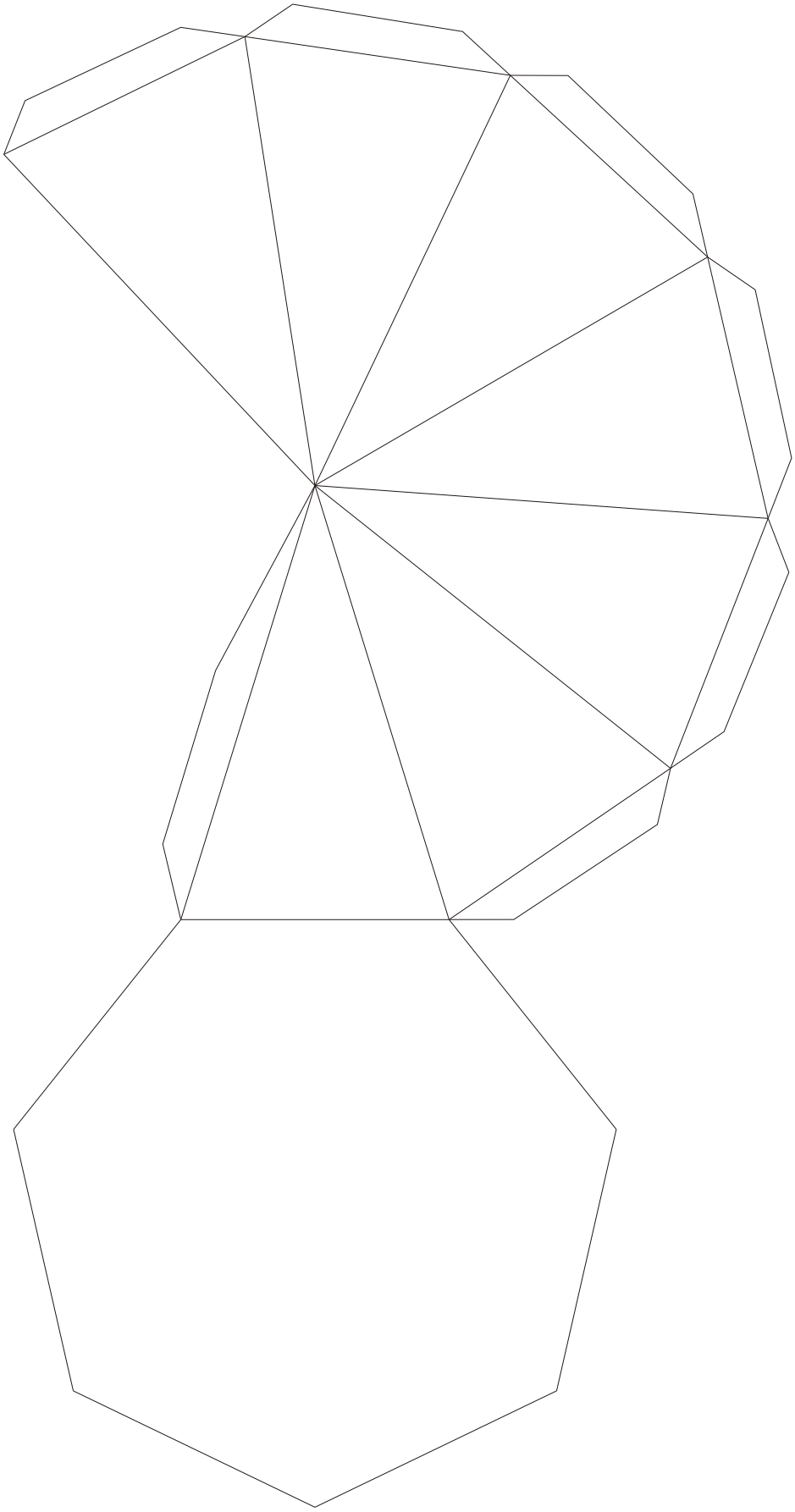
Octagonal Pyramid

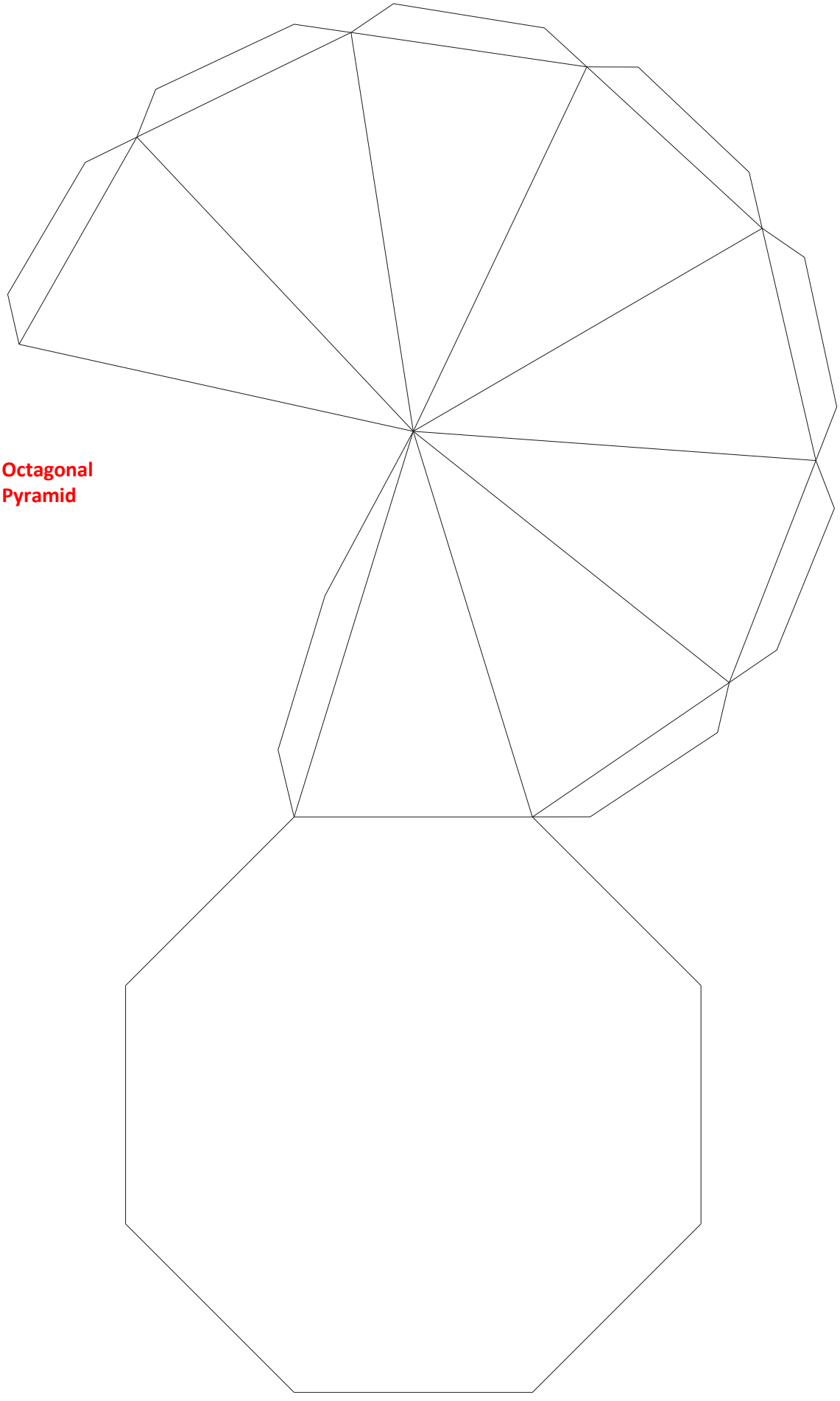


Hexagonal Pyramid

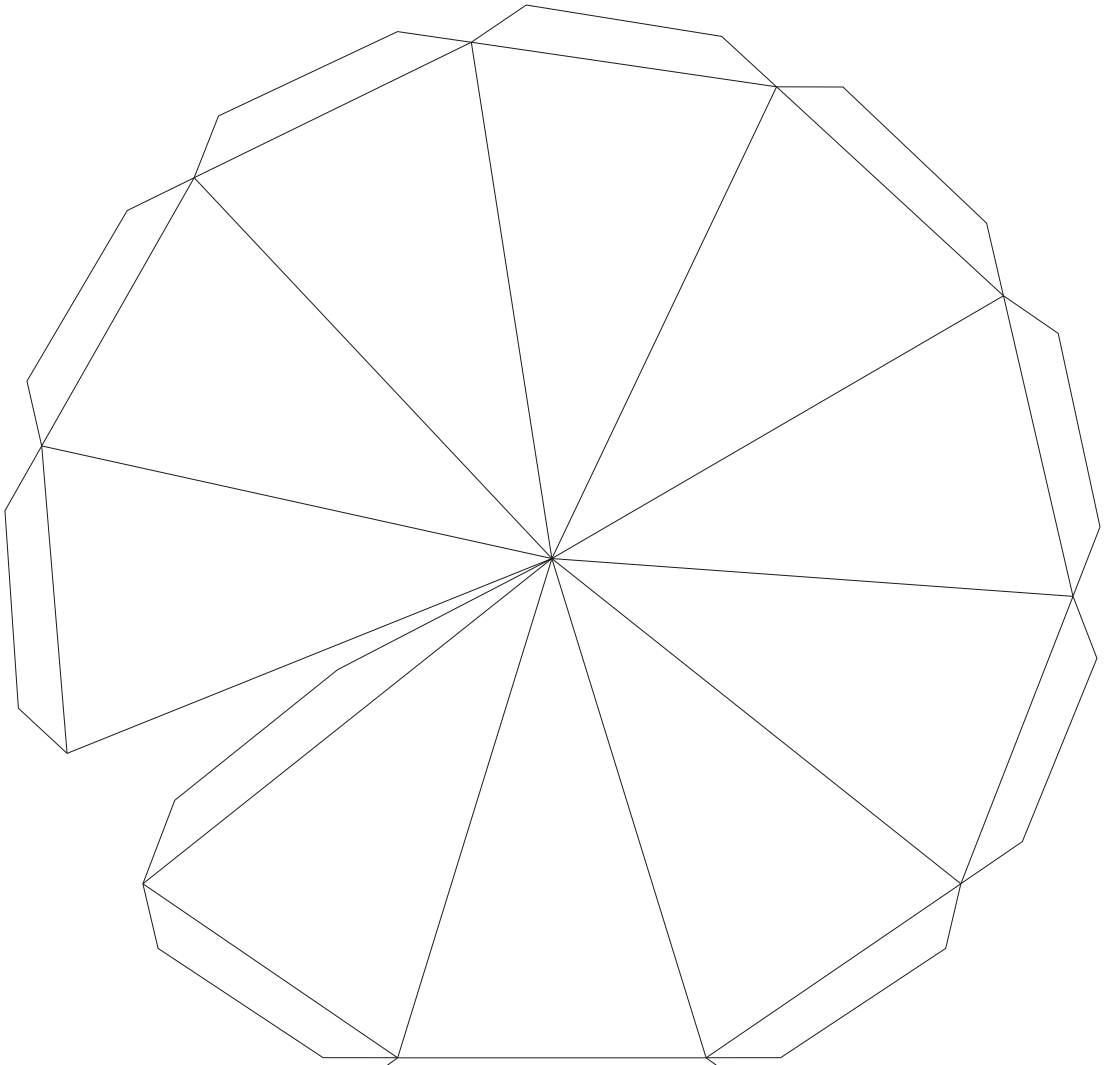


Heptagonal Pyramid



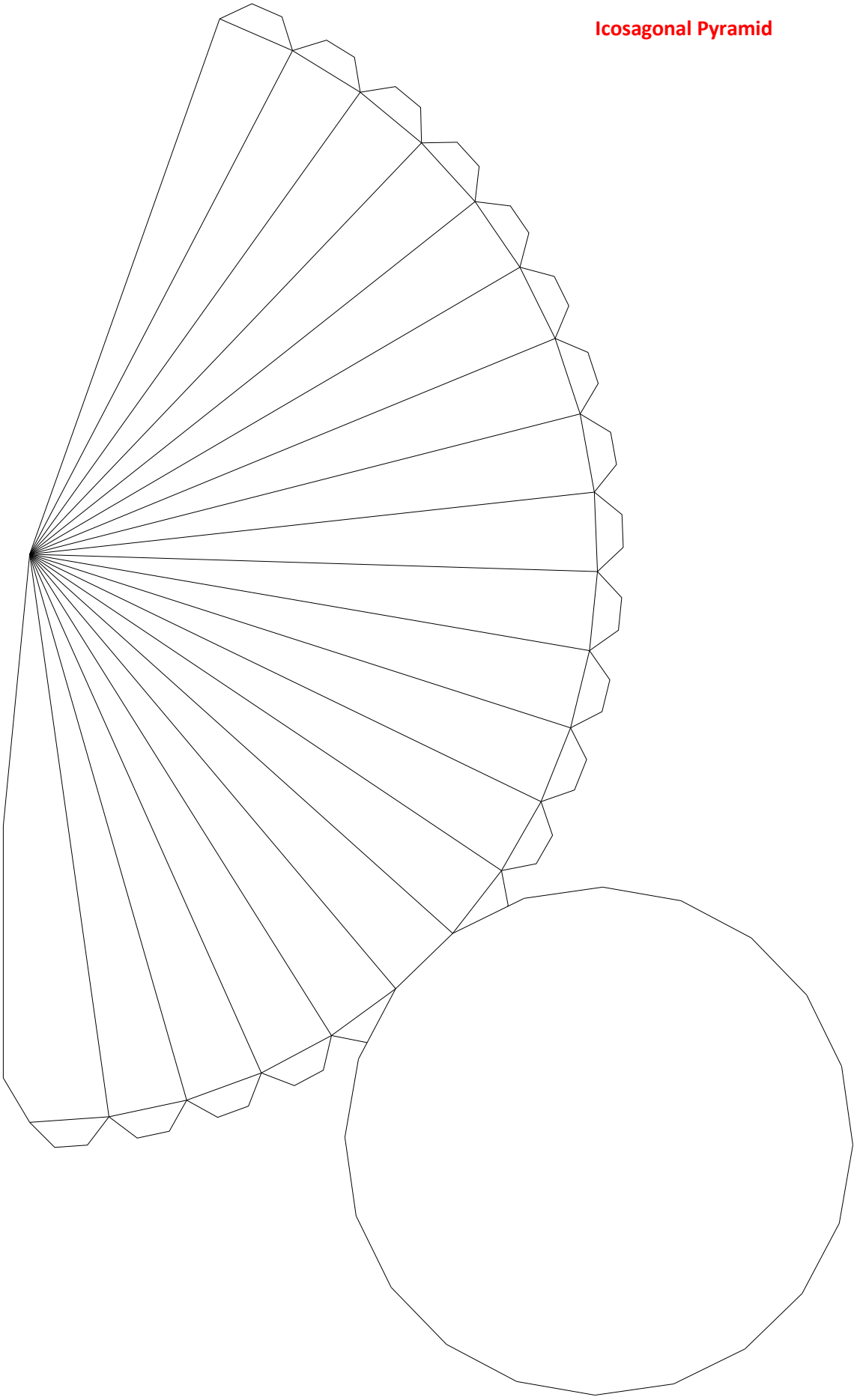


Octagonal Pyramid



Decagonal Pyramid

Icosagonal Pyramid



Materials for activity 4.2

Flashcard 1

Area of a triangle = $\frac{base\ x\ height}{2}$

Area of a rectangle = base x height

Area of a polygon = $\frac{perimeter\ of\ the\ polygon\ x\ apotheme\ of\ the\ polygon}{2}$

Flashcard 2

Area of a pyramid:

Lateral area=sum of the areas of the number **n** of identical triangles which is $\frac{perimeter\ of\ the\ base\ \ x\ apoteme\ of\ the\ pyramid}{2}$

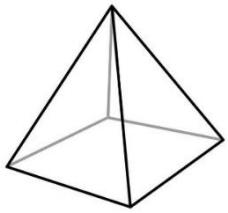
Base area= area of the polygon which is $\frac{perimeter\ of\ the\ base\ \ x\ apoteme\ of\ the\ base}{2}$

Total area= lateral area+ base area

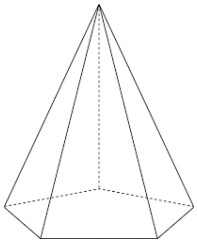
Calculate the area your model:

Let's work a little more

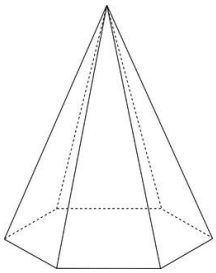
Calculate the area of the following examples.



A regular pyramid with a squared base with sides of 10 cm, and a height of 12 cm. Find the total area.



The base of a regular pyramid is a pentagon with sides of 16 dm and an apothem of 11 dm. the height of the pyramid is 26.4 dm. Find the total area.



The base of a regular hexagonal pyramid has a radius of 6 cm. Its apothem is 5,4 cm. The height of the pyramid is 14 cm. Find the total area.

Volume

After watching the video, write down the formula of the volume of a pyramid:

And now calculate the volume of your prism

Materials for activity 4.4

My High School prism:

Drawing:

Calculations

Materials for activity 4.5

Prepare a text for your exposition that explains the main features of the pyramids, and also how to calculate its area and volume.

Step 1: List the important words for you. You can use the padlet that was prepared for the prisms.

Step 2: Define a pyramid. If necessary, use your models.

I would like to start by saying:

A pyramid is.....

A pyramid can be.....

A way of representing a pyramid is .....

A pyramid has .....

My model pyramid has .....

My High School pyramid has .....

Some other things to consider.....

.....

.....

Step 3: Wrapping up with the calculations of the model and the High School pyramid

Area:

Model:

High School pyramid

Volume:

Model:

High School pyramid

Materials for activity 5.2

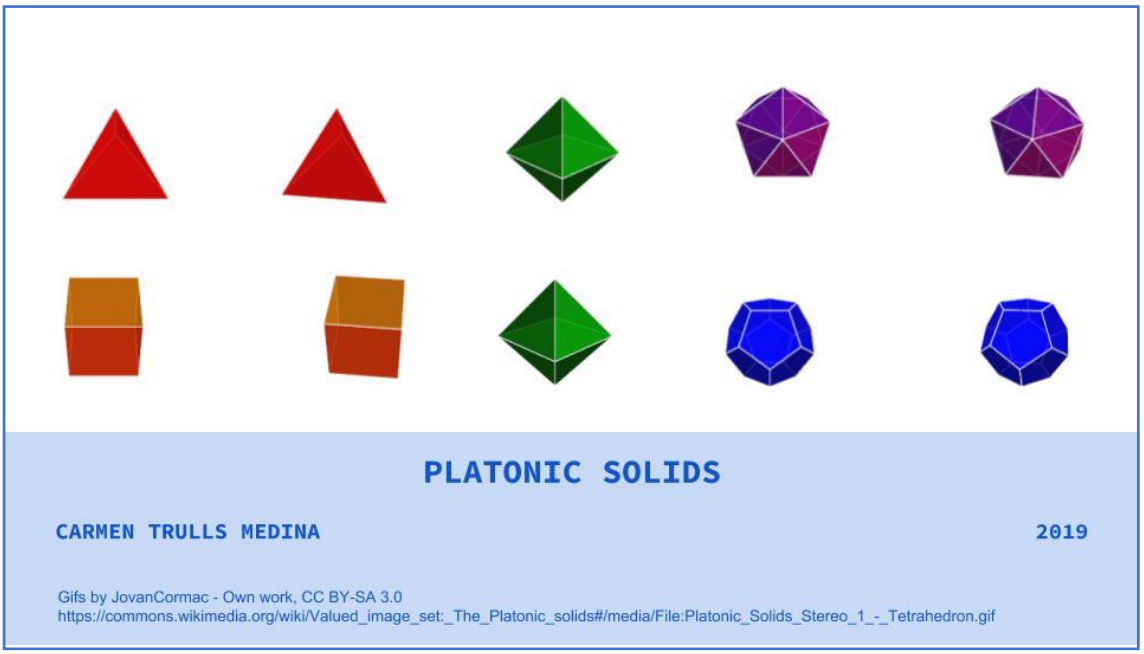
A polyhedron is called regular when has two features:

- Its faces are identical polygons (they are congruent, same shape and size)
- The same number of faces meet at each vertex

There are five types of polyhedra: tetrahedron, hexahedron (also called cube), octahedron, dodecahedron, icosahedron. The tetrahedron has three equilateral triangles that meet at each vertex; the cube has three squares; the octahedron has four equilateral triangles; the dodecahedron has three pentagons and the icosahedron has 5 equilateral triangles.

https://drive.google.com/open?id=1kOciXUJzmvJtuLMxLecHAL1aZfsZzj071oBJeamJCjM

First slide of the Google presentation (with a gift of developments) on the whiteboard



MAIN CHARACTERISTICS

Once you have got your own regular polyhedron, write down its main features:

Noun: _____

Faces: type _____number _____

Vertices: _____

Edges: _____

Euler's law V + F = E + 2_____

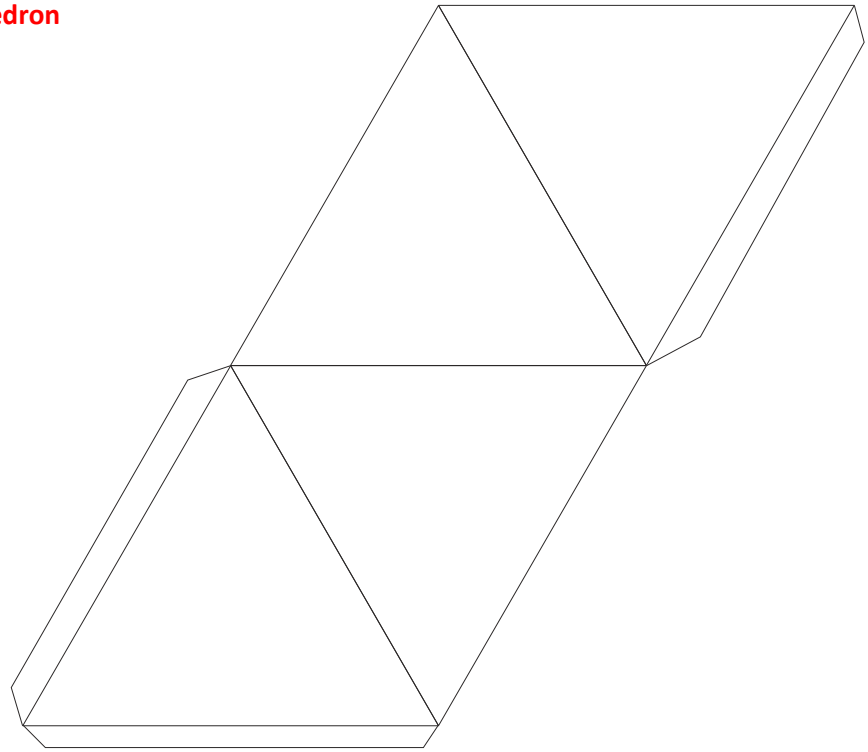
Edges of the face: _____

Edges of the vertex: _____

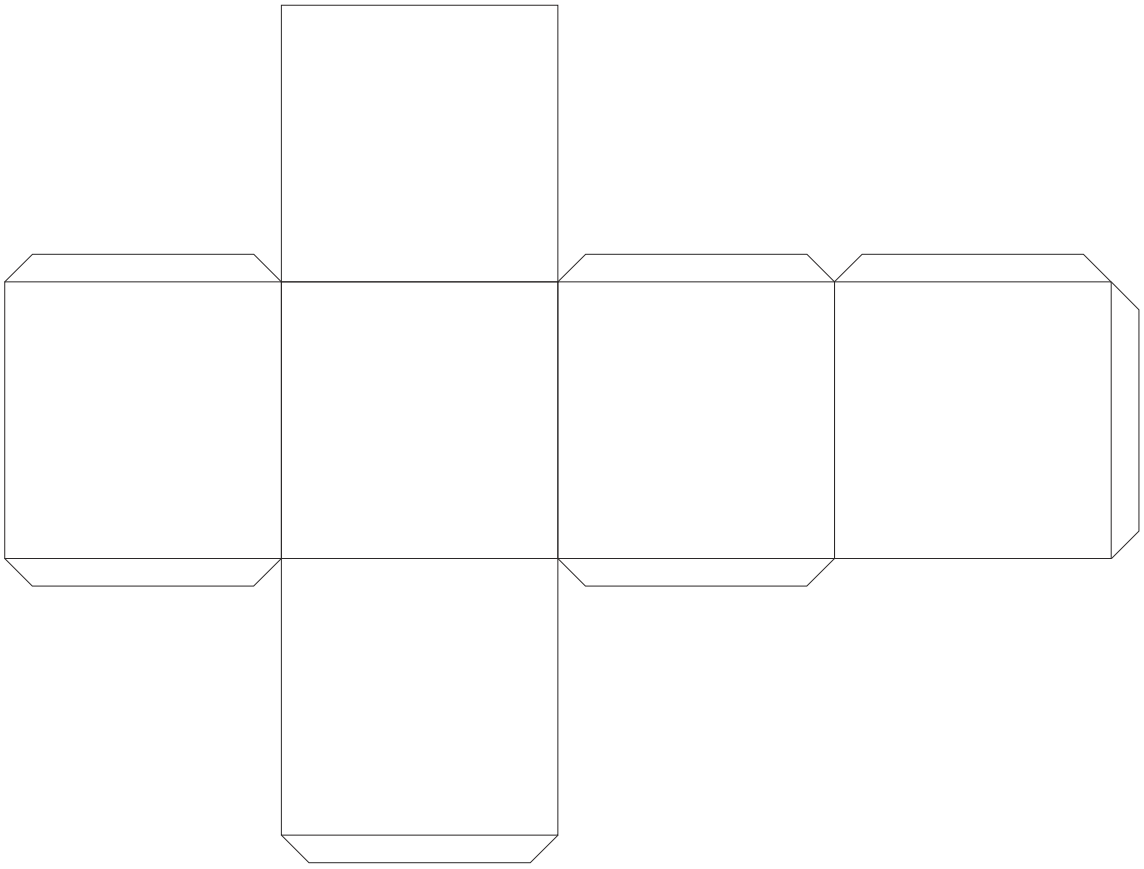
Dual polyhedron: _____

Side of the face: _____

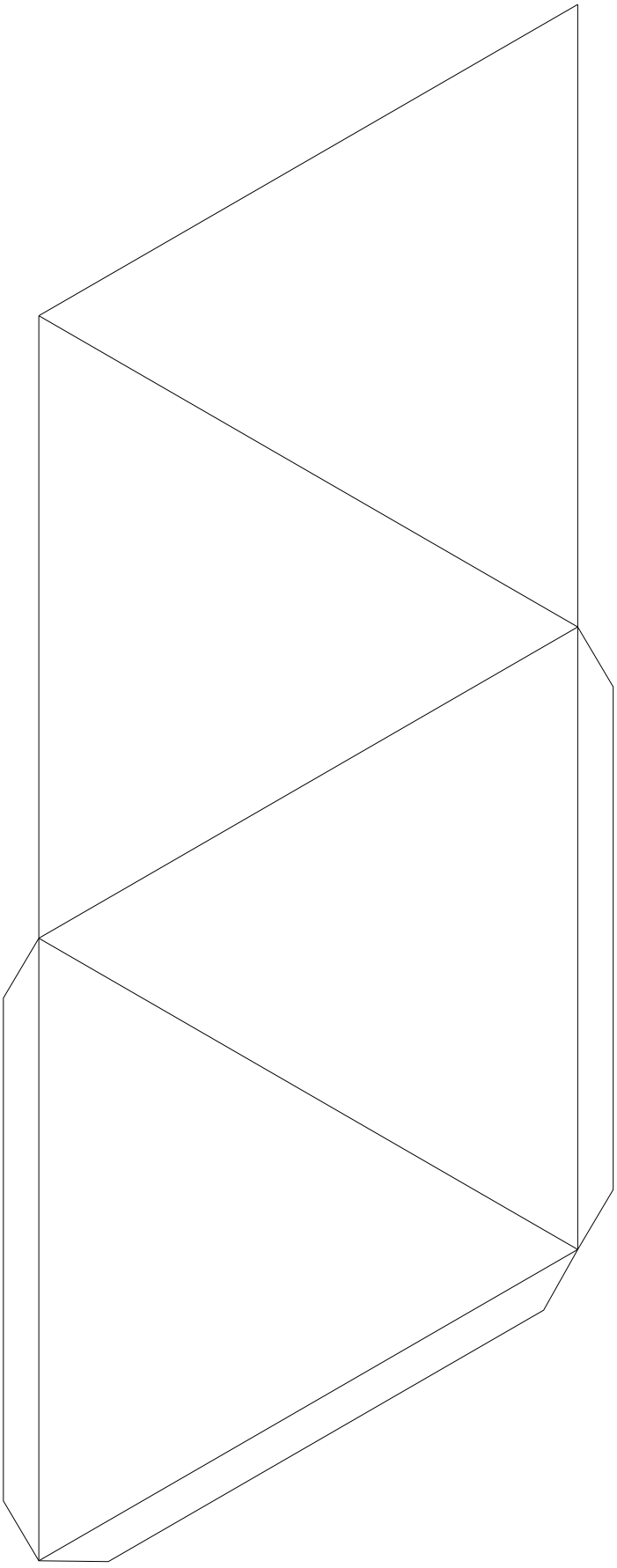
Tetrahedron



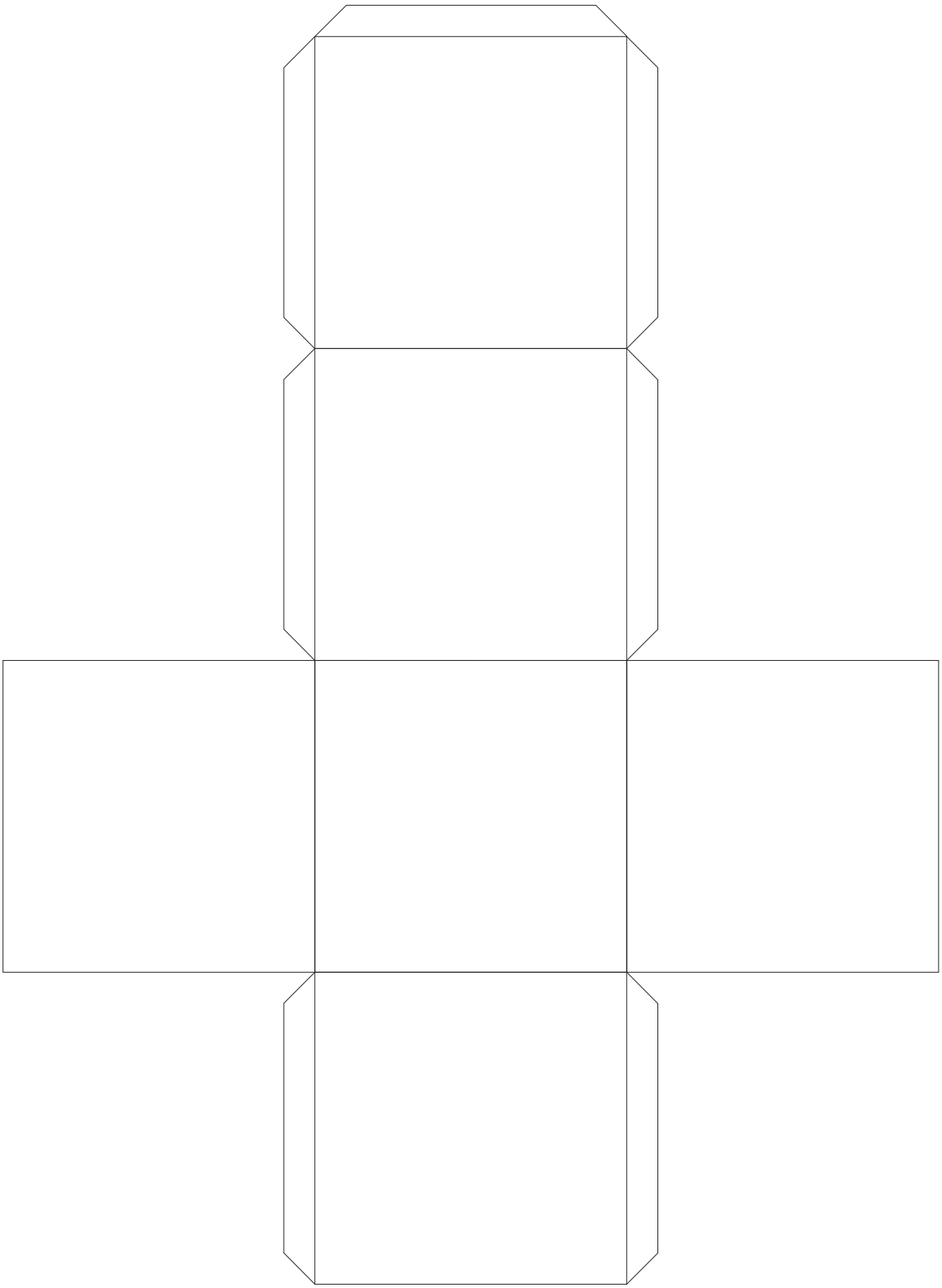
Cube



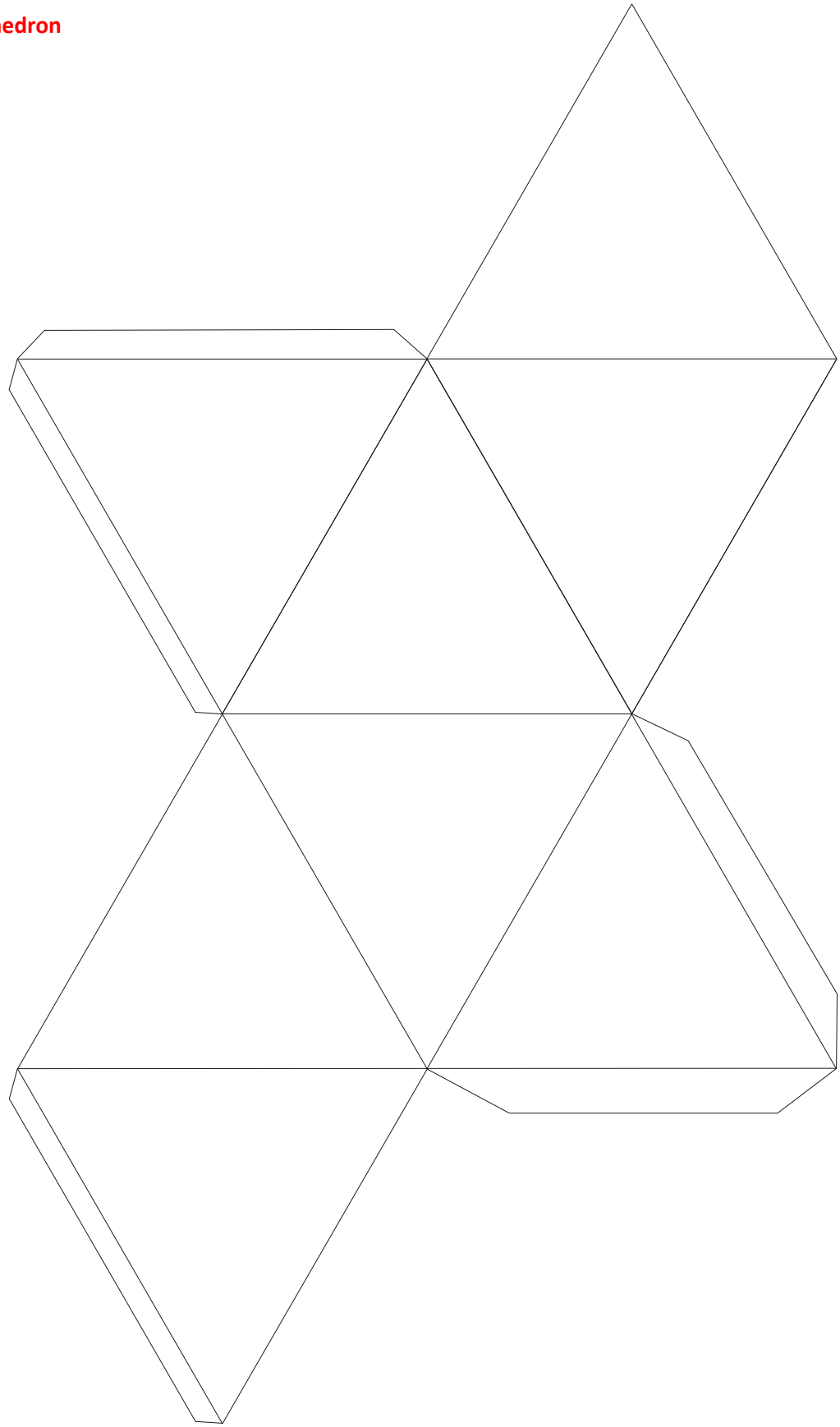
Tetrahedron



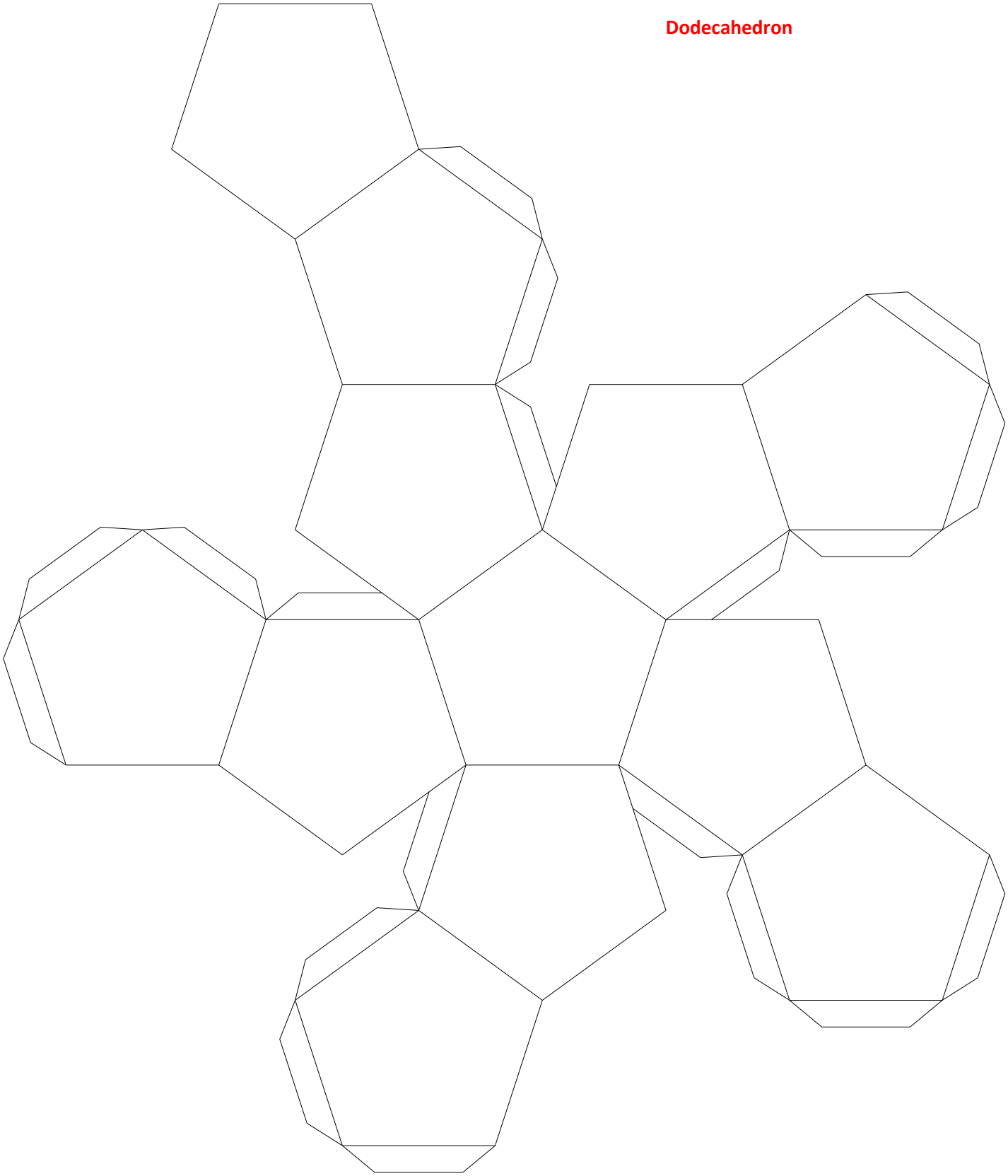
Cube



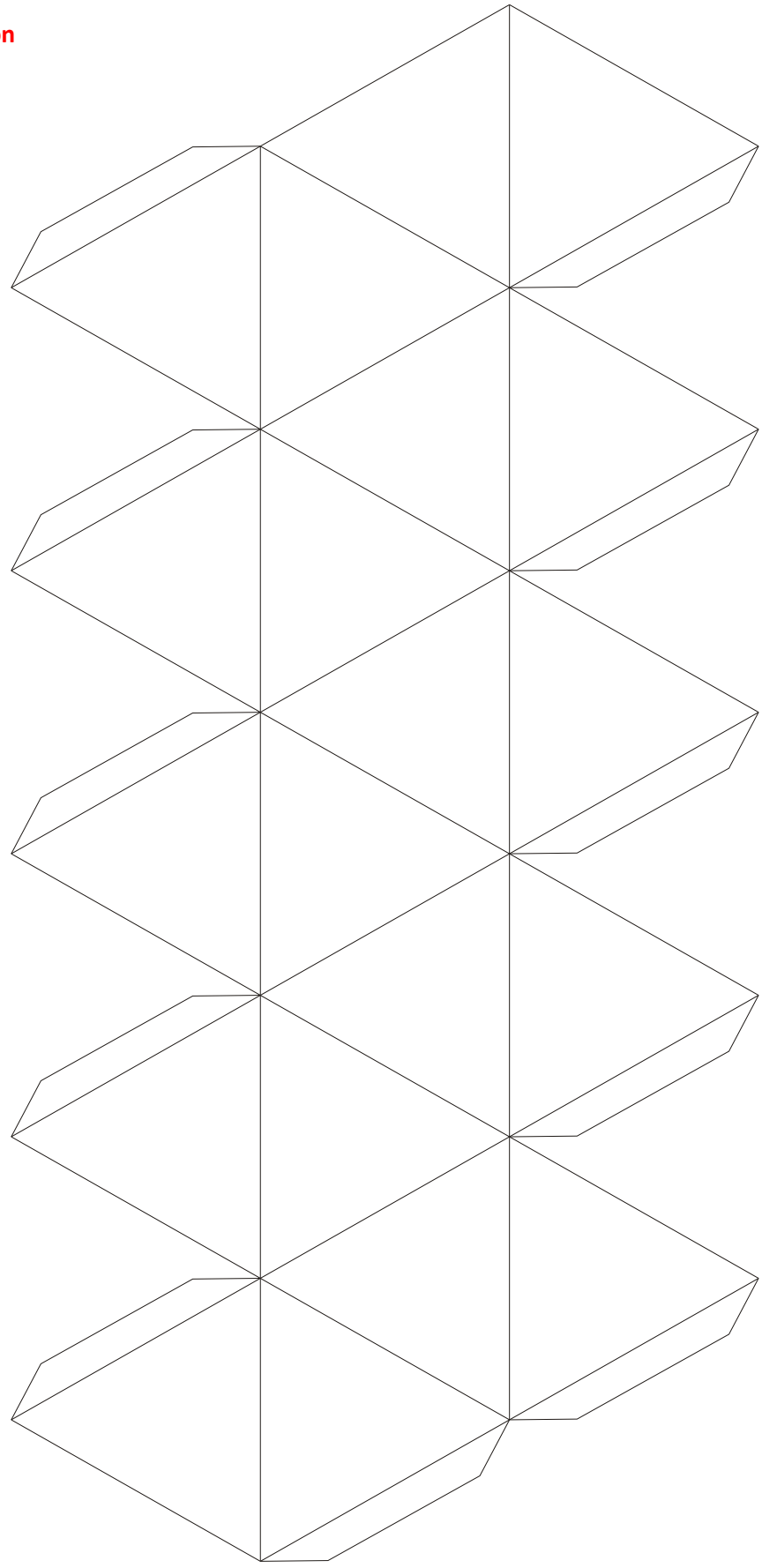
Octahedron



Dodecahedron



Icosahedron



Materials for activity 5.2

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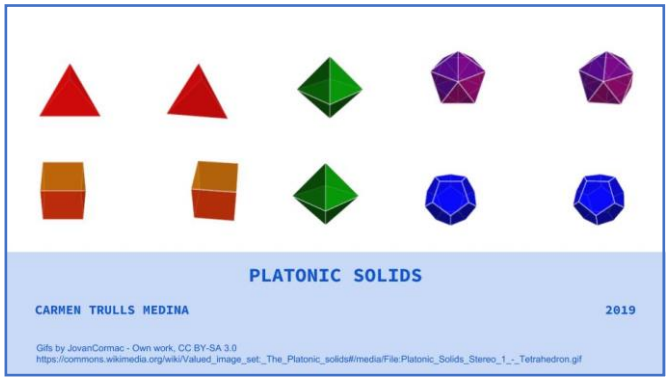
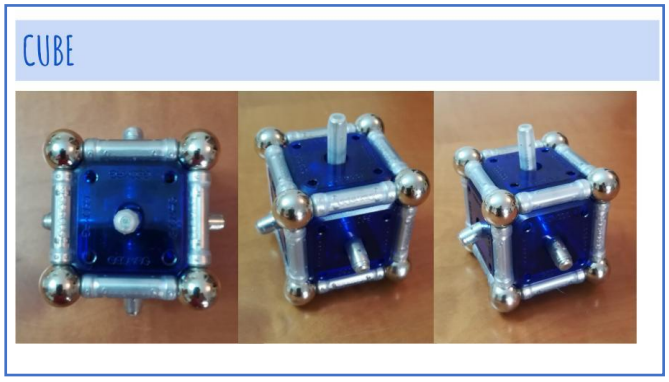
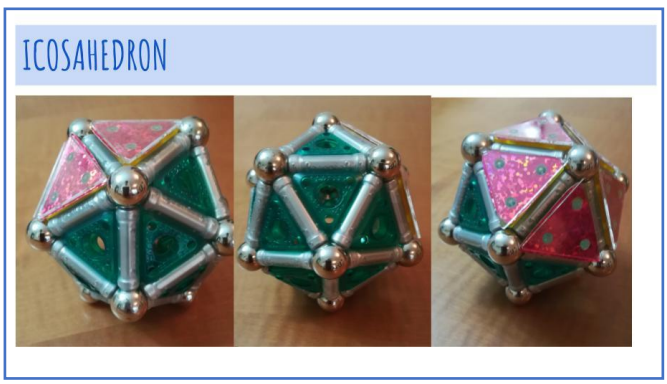
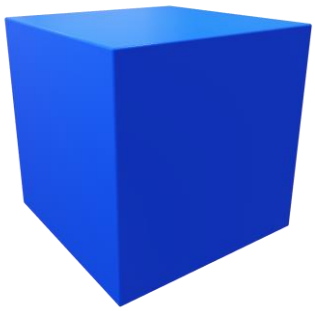
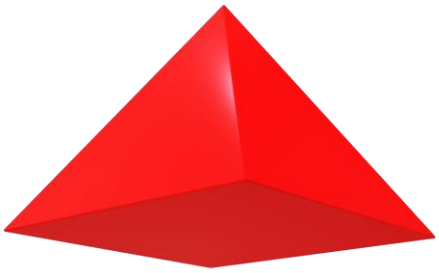
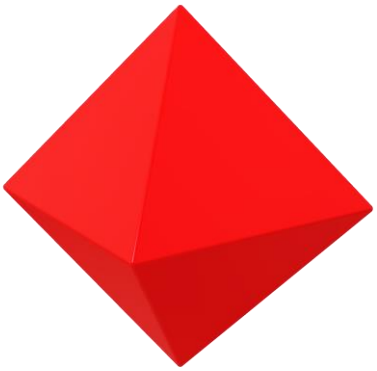




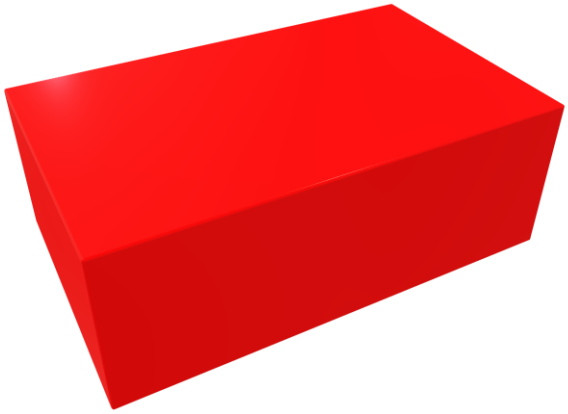


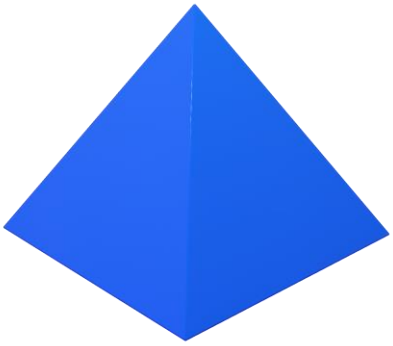






$$F + V = E + 2$$



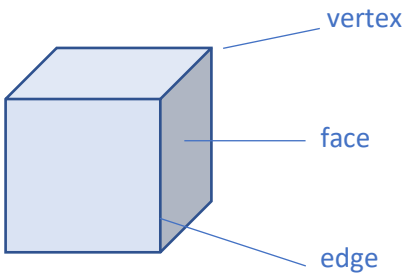


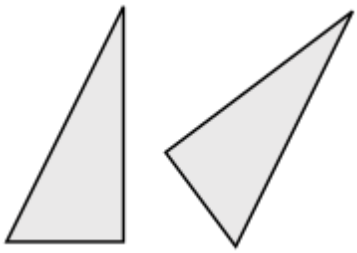
Materials for activity 6.4

Have you ever heard of the Platonic Solids? And of Plato? And Aristoteles?

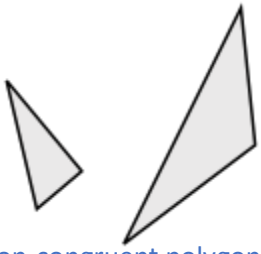
1. Vocabulary:

bounded = enclose

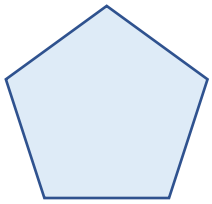




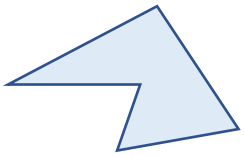
congruent polygon



non-congruent polygon



regular polygon



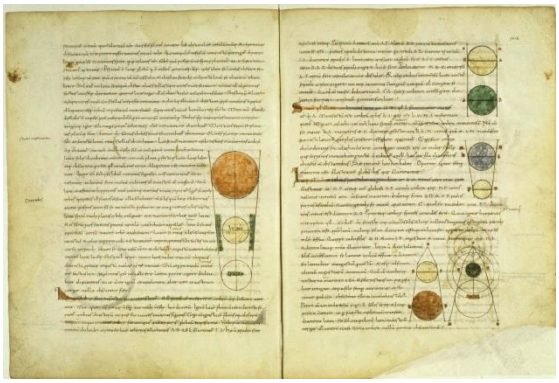
non-regular polygon

pair

a bit

amongst

Book XII of Euclid's Elements



work called Timaeus

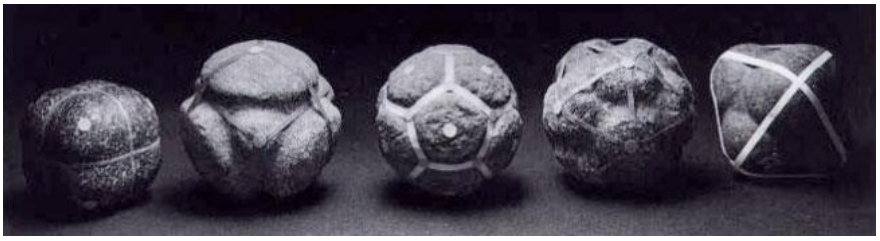
2. Read this text, it is an excerpt arranged from Wikipedia

A **polyhedron** is a solid bounded by plane polygons. The polygons are called **faces**; they intersect in **edges**, the points where three or more edges intersect are called **vertices**.

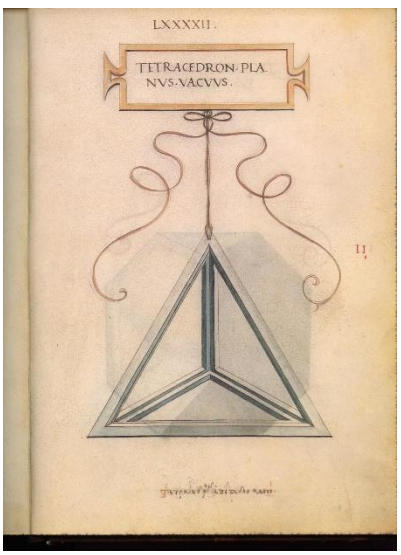
In three-dimensional space, a **Platonic solid** is a regular, convex polyhedron. It is constructed by **congruent** (identical in shape and size) **regular** (all angles equal and all sides equal) polygonal faces with the same number of faces meeting at each vertex. Five solids meet these criteria: Tetrahedron, Hexahedron (cube), Octahedron, Dodecahedron, and Icosahedron. The dual of every Platonic solid is another Platonic solid so that we can arrange the five solids into dual pairs. The Tetrahedron is self-dual (its dual is another tetrahedron). The cube and the octahedron form a dual pair. The dodecahedron and the icosahedron form a dual pair.

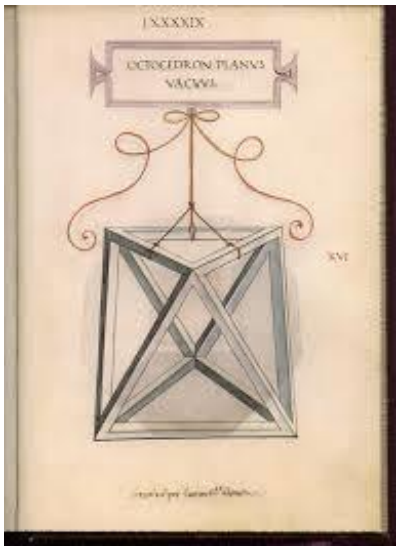
A bit of history:

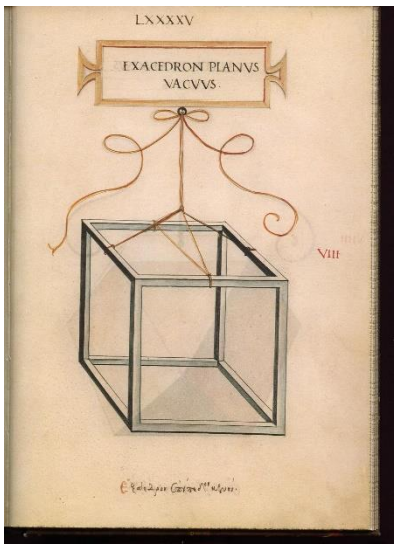
Stones carved in shapes resembling spheres have been found in Scotland and may be 4,000 years old. Some of these stones show the symmetries of the five Platonic solids and some of the relations of duality amongst them.



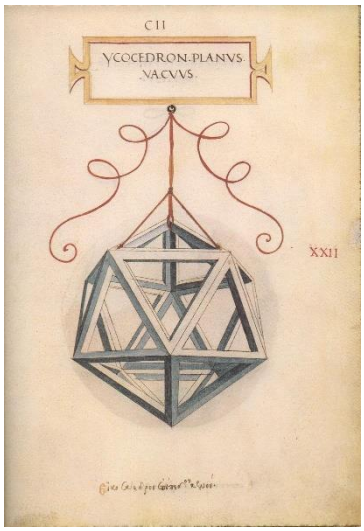
The earliest known written records of the regular solids originated from Classical Greece. Plato described a theory of matter in which the five elements (earth, air, fire, water and spirit) each comprised tiny copies of one of the five regular solids. It's uncertain who first described all five of these shapes - it may have been the early Pythagoreans - but some sources (including Euclid) indicate that Theaetetus (another friend of Plato's) wrote the first complete account of the five regular solids. Presumably, this formed the basis of the constructions of the Platonic solids that constitute the concluding Book XIII of Euclid's Elements. In any case, Plato was impressed by these five definite shapes that constitute the only perfectly symmetrical arrangements of a set of points in space, and late in life he expounded a complete "theory of everything", in the work called Timaeus, (350 BC) based explicitly on these five solids.

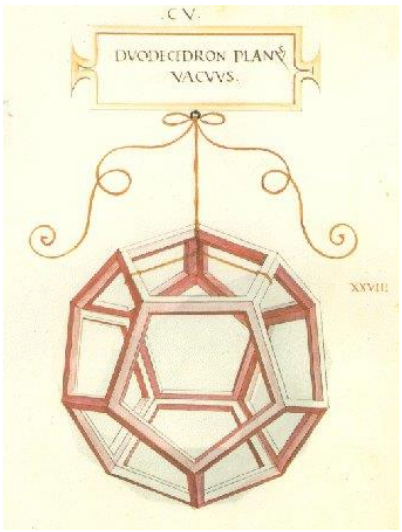




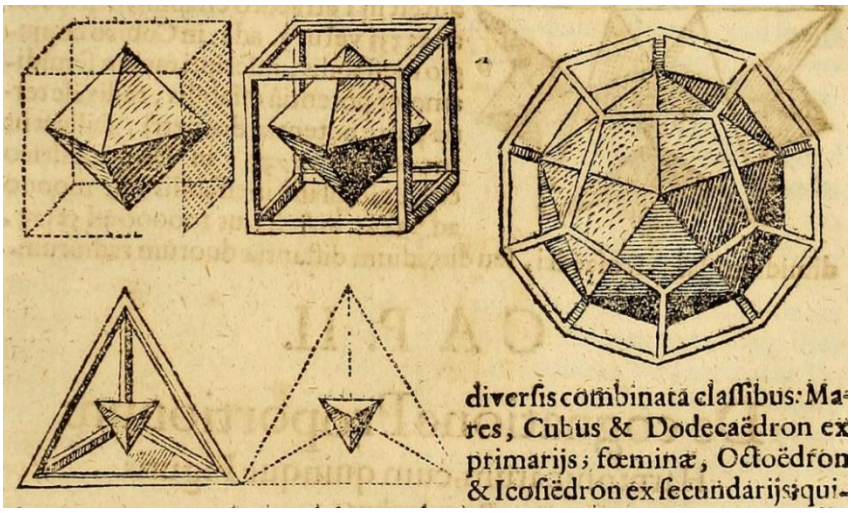


The Pennsylvania State University Libraries allowed Convergence *to publish the image of Da Vinci's illustration from their copy of the beautiful facsimile of Pacioli's* De Divina Proportione *published by Silvana Editoriale, Milan, Italy, 1982.*





Dual Polyhedron from Wikipedia



3. Working in pairs, answer the next questions:

a) What a polyhedron is?

b) What a platonic solid is?

c) Fill in the gaps: The polygons of the polyhedron are called_____; they intersect in_____, the points where three or more edges intersect are called_____.

d) Where were found five stones carved in shapes resembling spheres 4.000 years ago?

e) Who exposed the "theory of everything"?

f) Who first described the five polyhedra?

g) Why was Plato so impressed by the platonic solids?

h) Fill in the blanks:

- **Conclusions from the text**:

-There _____ only_____ regular solids. They are also called_____ due to Plato

-The names of the 5 regular solids are: _____, _____, _____, _____ and _____.

Materials for activity 6.5

Prepare a text for your exposition that explains the main features of the regular polyhedra o platonic solids.

Step 1: List the important words for you. You can use the padlet that was prepared previously

Step 2: Define a platonic solid. If necessary, use your models.

To begin with:

A polygon is a.....

A polyhedron is a.....

A regular polyhedron is also called.....

A platonic solid is.....

There are……platonic solids. They are:.....

The main features of the platonic solids are: .....

When two shapes have de same size and form, they are called.....

A tetrahedron has.....faces, that are, all of them.....

An octahedron has.....faces, that are, all of them.....

An icosahedron has.....faces, that are, all of them.....

A cube(hexahedron) has.....faces, that are, all of them.....

A dodecahedron has.....faces, that are, all of them.....

My regular polyhedron model is..... and, as you can see, has..... .....and.....and.....

My High School regular polyhedron is..... and, as you can see, has..... ..... and.....and.....

A dual polyhedron is a polyhedron whose vertices are in the centre of the faces.

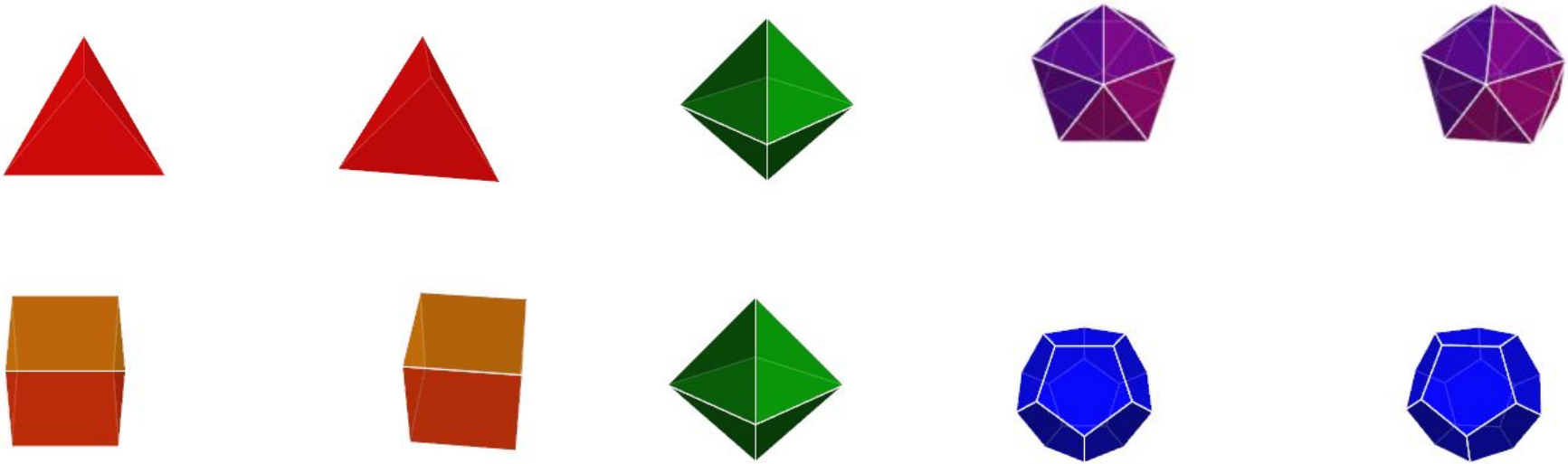
The dual polyhedron of my model is.....

The dual polyhedron of my High School polyhedron is.....

A bit of history: the polyhedra are also called platonic solids, and they were named after.....

.....However, Euclid had already talked about them in his book.....

Thanks for your attention



PLATONIC SOLIDS

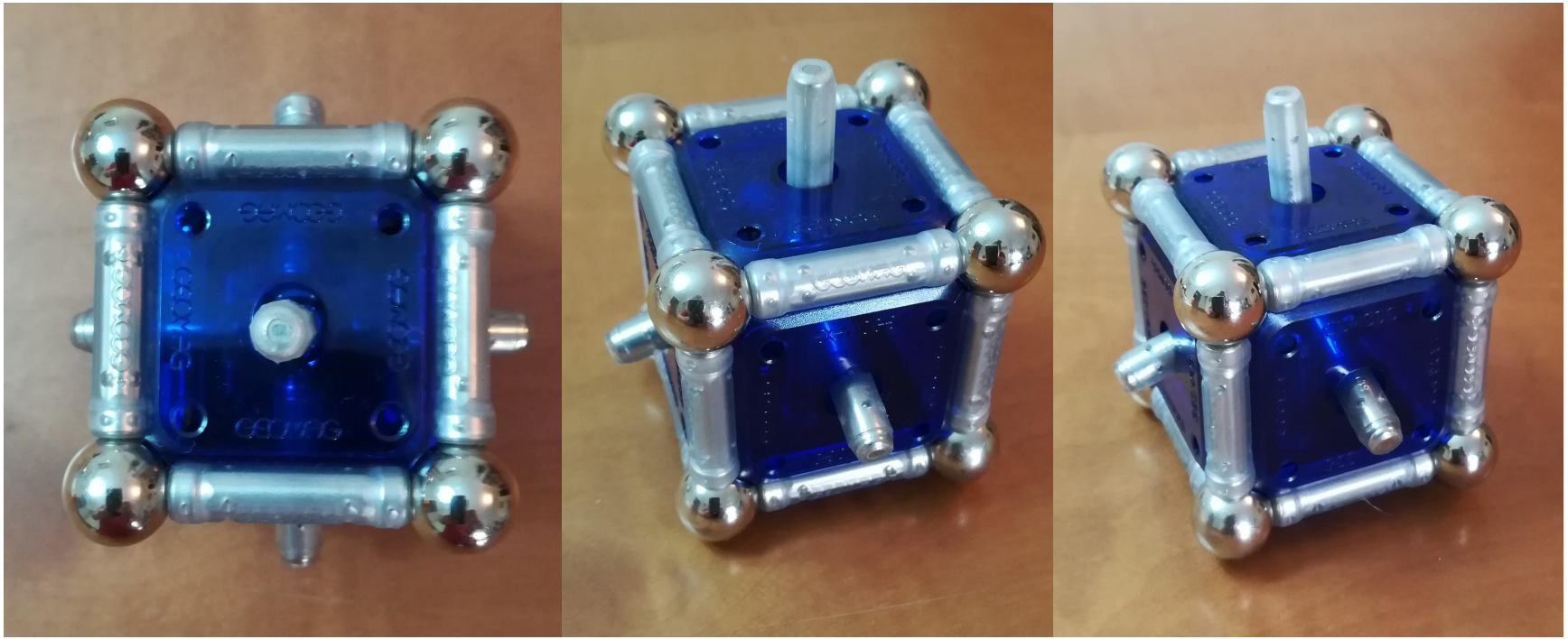
CARMEN TRULLS MEDINA

2019

TETRAHEDRON



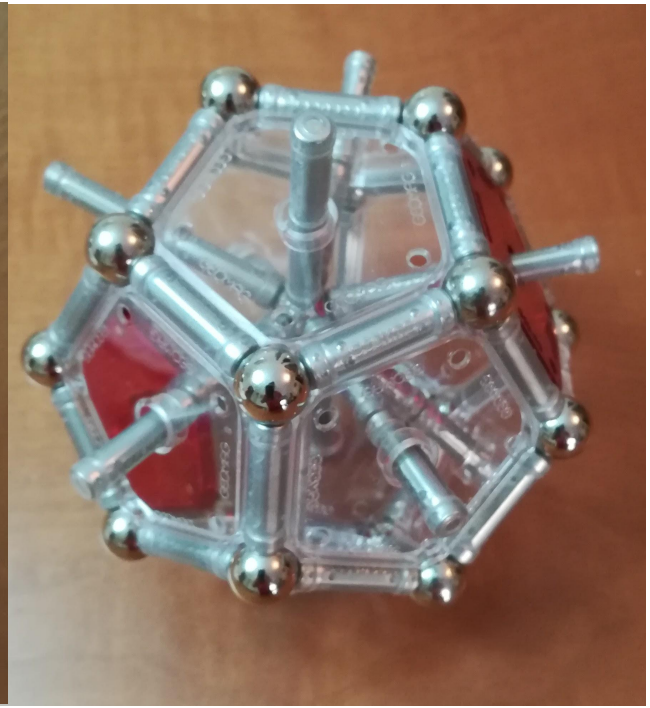
CUBE



OCTAHEDRON

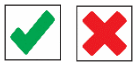


DODECAHEDRON

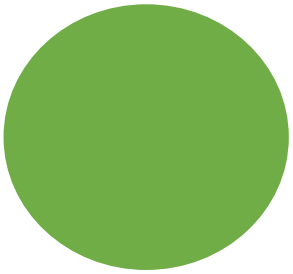


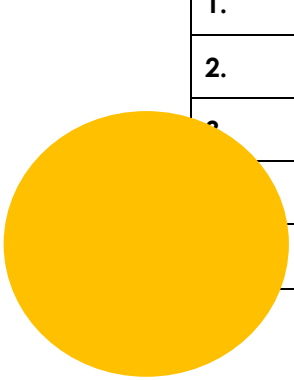
ICOSAHEDRON

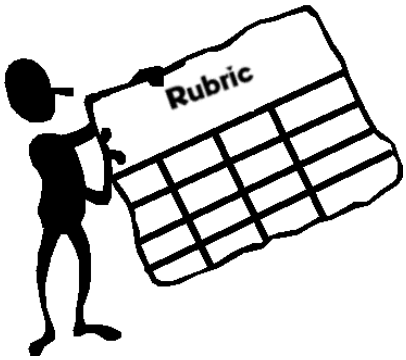
ASSESSMENT



Group	Quantity of ideas		Variety of ideas	
	✓	✗	✓	✗
1.				
2.				







Verusky 99 designs

TEACHER'S CHECK

Brainstorming about polyhedra.

Group	Quantity of ideas		Variety of ideas	
	✔	✘	✔	✘
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				

TEACHER'S CHECK

1.4 Building a prism with cardboard.

Group	Exercise done		Attitude	
	✔	✘	✔	✘
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				

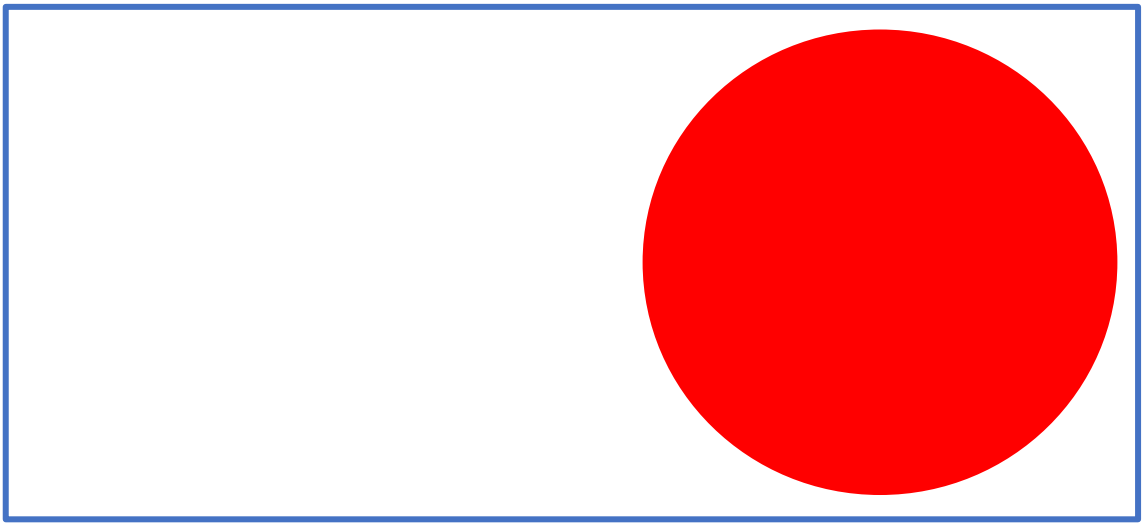
DIARY ASSESSMENT-SESSION 1

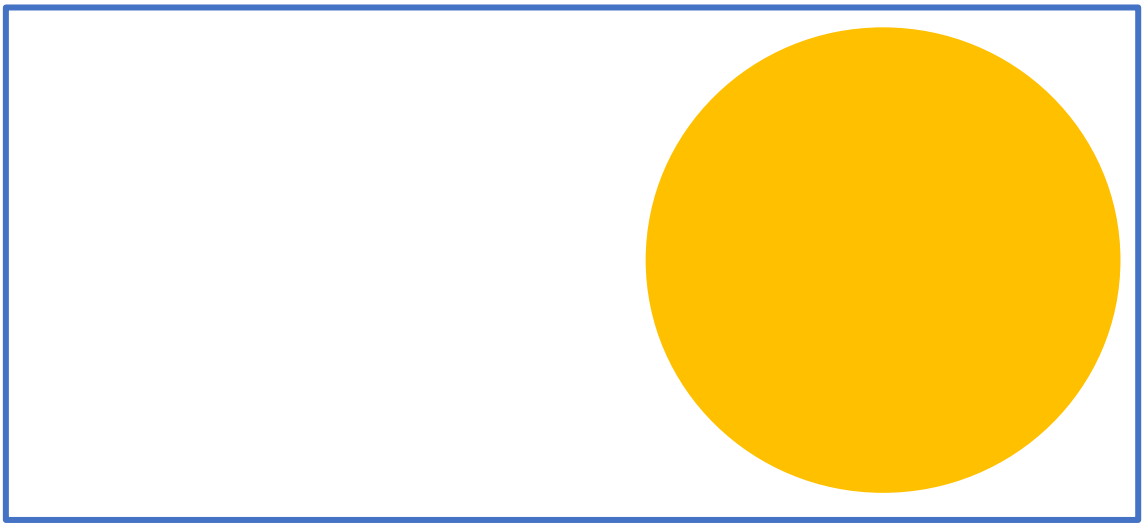
1.4 Building a prism with cardboard.

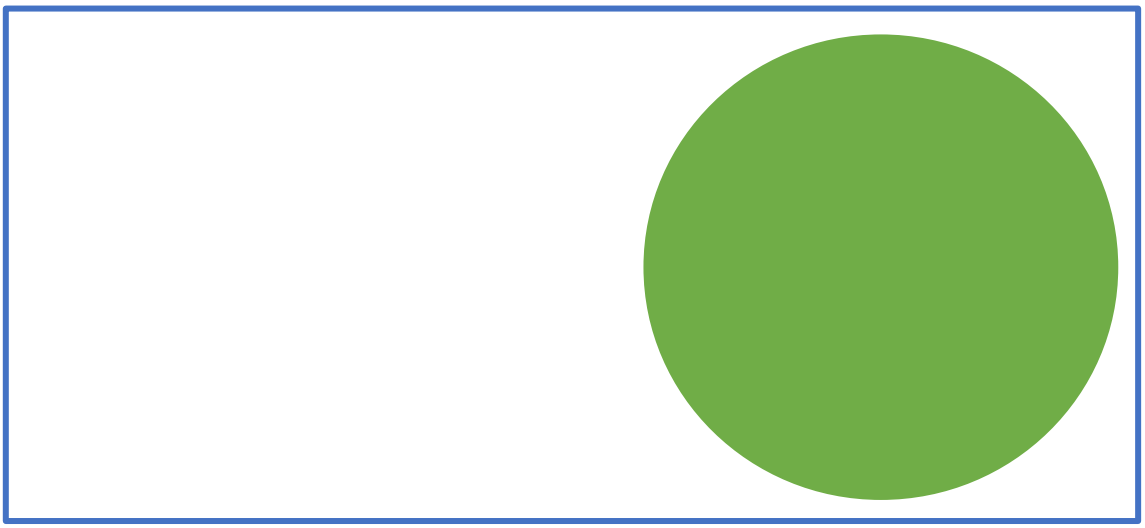
Group Student	Exercise done	
		
1. I have finished my prism correctly.		
2. I have understood what a prism is.		
3. I have understood the difference between a right prism and an oblique prism.		
4. My prism is a _____prism		

Assessment for activities **1.6** **2.3** **3.1** **4.3** **4.4** **5.2** **5.5** **6.2**

TRAFFIC LIGHTS







Assessment for activity 2.1

DIARY ASSESSMENT-SESSION 2

2.1 Building a prism with a flat development. Afterwards, writing down its main features.

Group **Student**	**Exercise done**	
	✔	✘
1. I have finished my prism model correctly.		
2. I see the faces, vertices and edges of my prism.		
3. I know which the lateral faces and the base of my prism are		
4. I understand what a regular prism is.		
5. I have filled the chart with the main features of my model		
6. I have put away my model in the polyhedra box		
7. I have put my name on my polyhedra box		
8. The prism of my classmate is a_____ prism. It is different to my prism because _____		

TEACHER'S CHECK

2.2 Calculating the area and the volume of a prism.

Group	Exercise done		Exercise understood		Attitude	
	✔	✘	✔	✘	✔	✘
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Assessment for activity 2.4

TEACHER'S CHECK

2.4 Preparing a text for the exposition

Group	Work collaboratively		Exercise done		Attitude	
	✔	✘	✔	✘	✔	✘
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TEACHER'S CHECK

3.2 Building a pyramid with cardboard.

Group	Exercise done		Attitude	
	✔	✘	✔	✘
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DIARY ASSESSMENT-SESSION 3

3.2 Building a pyramid with cardboard.

Group Student	Exercise done	
	✔	✘
1. I have finished my pyramid correctly.		
2. I understand clearly the difference between prism and pyramid.		
3. I have understood the difference between a right pyramid and an oblique pyramid.		
4. I have understood the difference between a square pyramid and a pentagonal pyramid.		
5. My pyramid is a _____pyramid		
6. My classmate's pyramid is a _____pyramid		

3.5 Building a pyramid with a flat development. Afterwards, writing down its main features.

Group Student	Exercise done	
	✔	✘
1. I have finished my pyramid model correctly.		
2. I see the faces, vertices and edges of my pyramid		
3. I know which the lateral faces and the base of my pyramid are		
4. I understand what a regular pyramid is.		
5. I have filled the chart with the main features of my model		
6. I have put away my model in the polyhedra box		
7. I can distinguish my model from others easily		
6. I can explain how my pyramid is to my mate		
7. If my classmate needs my collaboration, I help him/her		

TEACHER'S CHECK

4.2 Jigsaw with the area of the pyramids and calculation of the area of the pyramid model.

Group	Exercise done		Exercise understood		Attitude	
	✔	✘	✔	✘	✔	✘
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Assessment for activity 4.5

TEACHER'S CHECK

4.5 Preparing a text for the exposition

Group	Work collaboratively		Exercise done		Attitude	
	✔	✘	✔	✘	✔	✘
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DIARY ASSESSMENT-SESSION 5

5.4 Building a regular polyhedron with a plane development. Afterwards, writing down its main features.

Group Student	Exercise done	
	✔	✘
1. I have finished my platonic solid model correctly.		
2. I see the faces, vertices and edges of my _____		
3. I see clearly the type of polygon that the faces are		
4. I understand what a regular polyhedron is.		
5. I have filled the chart with the main features of my model		
6. I have put away my model in the polyhedra box		
7. I can distinguish my model from others easily		
6. I can explain how my regular polyhedron is to my mate		
7. If my classmate needs my collaboration, I help him/her		

TEACHER'S CHECK

6.3 Answering a challenging question: Is the Euler's rule true?

Group	Exercise done		Work collaboratively	
	✔	✘	✔	✘
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TEACHER'S CHECK

6.4 Reading about the platonic solids

Group	Reads in silence		Exercice done		Works collaboratively	
	✔	✘	✔	✘	✔	✘
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TEACHER'S CHECK

6.5 Preparing a text for the exposition

Group	Work collaboratively		Exercise done		Attitude	
	✔	✘	✔	✘	✔	✘
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PEER-ASSESSMENT

Assessment made by

STUDENT:		**a lot**	**quite**	**a little**	**none**
Work	He/she has made his tasks and shared information				
	He/she has actively participated in the team work				
Attitude	He/she listens to his/her mates				
	He/she respects other's opinions				
	He/she woks for the good functioning of the group				

STUDENT:		**a lot**	**quite**	**a little**	**none**
Work	He/she has made his tasks and shared information				
	He/she has actively participated in the team work				
Attitude	He/she listens to his/her mates				
	He/she respects other's opinions				
	He/she woks for the good functioning of the group				

STUDENT:		**a lot**	**quite**	**a little**	**none**
Work	He/she has made his tasks and shared information				
	He/she has actively participated in the team work				
Attitude	He/she listens to his/her mates				
	He/she respects other's opinions				
	He/she woks for the good functioning of the group				

ORAL PRESENTATION (18 points)

	3	2	1	0
Understanding of the concepts 2D shapes, 3D shapes, polyhedra and types of polyhedra	He/she understands clearly the difference among 2D shapes, 3D shapes and polyhedra. He/she distinguishes among the different types of polyhedra.	He/she understands pretty well the difference among 2D shapes, 3D shapes. Shows insecurity distinguishing the polyhedra.	He/she has some concepts unclear. Doesn't distinguish the main groups of polyhedra.	He/she doesn't understand the difference among 2D shapes, 3D shapes and polyhedra at all. Confuses the polyhedra.
Knowledge of polyhedra and his models	Shows control over his/her models. Knows exactly what he/she has. Explains clearly the characteristics of the models and the polyhedra of the High School	He /she shows control over his/her models. Knows what he/she has. Shows some indecision controlling the characteristics of the models and the polyhedra of the High School	He/ she doesn't have control over his/her models. Knows what he/she has but makes mistakes when explaining the characteristics of the models and the polyhedra of the High School	He/she doesn't have control over his/her models. Doesn't know what he/she has nor the models' main characteristics.
Knowledge of the processes to calculate areas and volumes.	Masters the calculations processes. Explains fluently the steps to consider finding the areas of prisms, pyramids and platonic solids. As well, he/she knows how to calculate the volume of prims and pyramids.	He/she seemingly knows how to calculate on the one hand the areas of prisms, pyramids and platonic solids and on the other hand the volume of prisms and pyramids. He/she makes one/ two mistakes	He/she manifests a vague idea of calculating areas and volumes but makes lots of mistakes.	He/she has no idea how to calculate areas or volumes. Even he/she doesn't know how to begin with.
Vocabulary	He/she knows both the words and expressions that have been introduced during the sessions. He/she doesn't make mistakes or need help to remember those expressions.	He/she knows more or less the words and expressions that have been introduced during the sessions. He/she makes a few mistakes or need some help to remember those expressions.	He/she knows some the words and expressions that have been introduced during the sessions. He/she makes a few mistakes or need some help to remember those expressions.	He/she doesn't know the words nor the expressions that have been used during the six sessions.
Speaking, posture, and contact eye	He/she stands up straight, looks relaxed and confident. He/she speaks clearly and fluently. He/she establishes contact eyes with the audience. He/she doesn't use the paper at all.	He/she stands up straight but seems a bit nervous. She says what she has to say. Sometimes he/she establishes contact eyes with the audience. He/she looks at the paper sometimes	He/she doesn't stand up straight. He/she forgets to say some parts. He/she doesn't establish contact eyes. He/she needs the paper too often.	He/she doesn't stand up straight. He/she doesn't know what to say and simply reads his/her paper.
Body language and time control	His/her body language grabs the interest of the audience. Control over the length of the presentation.	His/her body language is pretty good. His/her presentation doesn't fit the expected duration.	He/she needs to improve his/body language. His/her presentation doesn't fit the expected duration.	He/she shows a total lack of enthusiasm. The audience is bored and doesn't listen to him/her. The length of the presentation is inacceptable.

POLYHEDRA BOX AND STUDENT'S DOSSIER (9 points)

	3	2	1	0
Models	The model box contains all the models: two with strings and three that have been built with flat development.	Missing a model in the box	Missing two models in the box	Missing three or more models in the box
Execution of the models	The models are perfectly done. They have been put away in the box with care. The owner can identify clearly his/her models from others. The box is labelled.	The models are generally correct but with some small errors. The owner can identify clearly his/her models from others. The box is labelled.	The process of building must improve. Not exact or not clean. He/she makes errors in the process of differentiating his models from others.	Many things must change: The construction of the models, the acknowledge of the owner's models, the order of the box, the labelling of the box.
Student's dossier	He/she presents all the previous preparations for the presentation: sheets to fill, texts for the exposition, peer assessment, diary assessment. The dossier is well ordered, with an index and numbered sheets.	He/she presents all the previous preparations for the presentation: sheets to fill, texts for the exposition, peer assessment, diary assessment. There isn't index or the sheets aren't numbered. Maybe it is not well ordered.	Something is missing: sheets to fill or texts or the peer assessment or the diary assessment. (one or two or three sheets) Furthermore, there isn't index, or the sheets aren't numbered. Maybe it is not well ordered.	Missing more than four sheets. Or there is no student's dossier.

ATTIDUDE (3 points)

	3	2	1	0
Attitude	Very good behaviour throughout the sessions. Enthusiastic with the topic, eager to learn, participating in the activities. He/she works collaboratively and has good peer and teacher assessments.	In general terms, his/her attitude is good. He/she has worked with interest and participated in many activities. In some activities, though he/she hasn't showed a good attitude, either in collaborative work or on his/her own.	His/her general attitude needs to improve. Despite having done some exercises and having built some prisms, he/she hasn't manifested a genuine interest or participation. The peer assessments aren't good.	The peer assessments aren't good. Neither the teacher assessments. He/she hasn't worked or participated in the activities. He/she hasn't shown any interest in the topic nor in helping nor collaborating with his/her mates

GEneració Plurilingüe 2

SELF-ASSESSMENT CHECKLIST

CLIL-PBL Project - Teaching materials	✔ ✘
The teaching materials are **visually attractive** and **well-organized**.	✔
The teaching materials are **self-explanatory** and **ready-to-use.**	✔
All activities and teaching materials are **original** and **created** by the course participant.	✔
Any resource in any format (including videos, images, texts from the Internet), that is not original, is respectful of copyright and its **sources** are **cited**.	✔
Students are presented with **multimodal** and **varied** input (spoken, written, visual, hands-on…).	✔
Input is presented at the right **cognitive level**.	✔
Input is presented at the right **language level.**	✔
Students are **helped** in some way to **understand and process the input presented.**	✔
Visuals are used to support comprehension.	✔
Students are presented with **good questions** (explicit, implicit and referential) that help them process input and that challenge them not only to understand, but to think, create...	✔
There are **opportunities for significant linguistic output** (the students produce communicative "products", speak, write, interact…).	✔
Support is provided to help students read, write, speak and interact.	✔
A variety of **collaborative and cooperative learning strategies** are used throughout the sessions.	✔
Activities facilitate **inquiry and reflection** and promote the role of the teacher as a facilitator/coach.	✔
Task instructions are short, concise, **clear** and **comprehensible** to the students. Activities are written using an **appropriate level of language**.	✔
The teaching materials are written in **accurate English**. There are **no mistakes at all**.	✔

For more PBL resources, visit bie.org

PROJECT DESIGN RUBRIC

Essential Element of PBL	Incorporates Best PBL Practices *The project has the following strengths:*	Needs Further Development *The project has essential PBL features but has some of the following weaknesses:*	Lacks Essential Features of Effective PBL *The project has one or more of the following problems in each area:*
Significant Content	☒ The project is focused on teaching students important knowledge and skills derived from standards and key concepts at the heart of academic subject areas.	☐ The project is aligned with standards and concepts from academic subject areas, but it may focus on too few, too many, or less important ones.	☐ The project is not aligned with standards and what students learn is not important in terms of concepts from academic subject areas.
21st Century Competencies	☒ A limited number of important 21st century competencies are targeted to be taught & assessed. ☒ There are adequate opportunities to build 21st century competencies and they are rigorously assessed (with a rubric and feedback). ☒ Students work in collaborative teams that employ the skills of all group members; students may collaborate with people beyond their classmates. ☒ Students are asked to analyse & solve problems and think critically, in an in-depth and sustained way. ☒ Students are given opportunities to use creativity and follow a process for innovation.	☐ Too few or relatively unimportant competencies are targeted, OR too many to be adequately taught & assessed. ☐ The project scaffolds the development of 21st century competencies to some extent, but there may not be adequate opportunities to build competencies or rigorously assess them. ☐ Students work in teams, but it may be more cooperative than collaborative (the work of individuals is pieced together). ☐ Students are asked to analyse & solve problems and think critically, but not in depth or in a sustained way. ☐ Students may find ways to be creative and innovative, but without using a process.	☐ The development of 21st century competencies is not included. ☐ It is assumed that some 21st century competencies will be gained by students, but the project does not explicitly scaffold the development of these competencies. ☐ Students do all project tasks as individuals. Students are not asked to think critically or solve problems. ☐ Students are not given opportunities to use creativity or follow a process for innovation.
In-Depth Inquiry	☒ Inquiry is sustained and academically rigorous: students pose questions, gather & interpret data, ask further	☐ Inquiry is superficial (information-gathering is the main task).	☐ The “project” is more like an activity or applied learning task, rather than an extended

	questions, and develop & evaluate solutions or build evidence for answers.	☐ Inquiry focuses on only one too-narrow topic, OR it tries to include too many issues, side topics, or tasks.	inquiry. ☐ The "project" is unfocused, more like a unit with several tasks than one project.
Driving Question	☒ DQ captures the project 's main focus. ☒ DQ is open-ended; it allows for students to develop more than one reasonable, complex answer. ☒ DQ is understandable & inspiring to students. ☒ To answer the DQ, students will need to gain the intended knowledge, skills, & understanding	☐ DQ relates to the project but does not capture its main focus; it may be more like a theme. ☐ DQ meets some criteria for an effective DQ but lacks others (it may lead students toward one particular answer, or it may be hard to answer thoroughly with the resources & time available and/or by students in this class).	☐ There is no DQ. ☐ DQ is seriously flawed; for example: ☐ It has a single or simple answer. ☐ It is not engaging to students (it sounds too "academic," like it came from a textbook or appeals only to a teacher).
Need to Know	☒ The project motivates students to learn new content knowledge or gain skills because they genuinely find the project's topic, Driving Question, and tasks to be relevant and meaningful. ☒ The Entry Event will powerfully engage students, both emotionally & intellectually (make them feel invested in the project & provoke inquiry)	☐ The project motivates students to learn new content knowledge or gain skills because they see the need for them in order to complete project products and not be embarrassed to present their work. ☐ The Entry Event will gain student attention, but it will not begin the inquiry process by creating a "need to know" or generate questions about the topic of the project.	☐ The project does not motivate students to learn new content knowledge or gain skills. ☐ No Entry Event is planned. Day one of the project will feel like any other day (or worse, because it seems like more work than usual).
Voice & Choice	☒ Students have opportunities to express "voice & choice" on important matters (the topics to study, questions asked, texts & resources used, products created, use of time, and organization of tasks). ☒ Students have opportunities to take significant responsibility and work independently from the teacher.	☐ Students are given limited opportunities to express "voice & choice," generally with less important matters (deciding how to divide tasks within a team or which website to use for research). ☐ Students are expected to work independently from the teacher to some extent, although they have the skills and desire to do even more on their own.	☐ Students are not given opportunities, if appropriate, to express "voice & choice" (to make decisions affecting the content or conduct of the project). ☐ Students are expected to work too much on their own, without adequate guidance from the teacher and/or before they are capable.
Critique & Revision	☒ Students are provided with regular,	☐ Students are provided with	☐ Students do not give and receive

	structured opportunities to give and receive feedback about the quality of their work-in- progress. ☒ Students are taught how to constructively critique each other's work-in-progress. ☒ Students use feedback about the quality of their work to revise and improve it.	opportunities to give and receive feedback about the quality of their work-in-progress, but they may be unstructured or only occur once. ☐ Students are given brief, general guidelines for critiquing each other's work-in-progress. Students look at and/or listen to feedback about the quality of their work, but do not substantially revise and improve it.	feedback about their work-in-progress. ☐ Students are not taught how to give constructive critique of each other's work-in- progress (it is brief, superficial, vague). ☐ Students do not use feedback about the quality of their work to revise and improve it.
Public Audience	☒ Students share their work with other people from both within and outside the school, which may include online audiences. ☒ Students present culminating products and defend them in detail & in depth (by explaining their reasoning behind choices they made, their inquiry process, etc).	☐ Students share their work only with classmates & the teacher. ☐ Students present culminating products, but their explanation of how & why they did things is limited to a short, superficial question/answer session.	☐ Students do not share, present or exhibit their work.

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