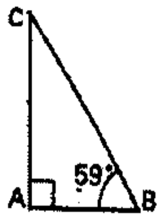
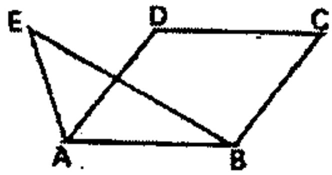
Unit 3 – Measurement (ratio, proportion, scalars, vectors) and Presentation Skills

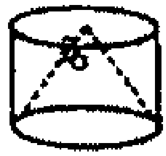
I Measurement

Ratio and Proportionality

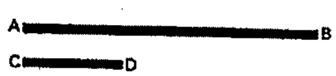
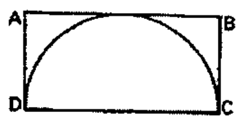
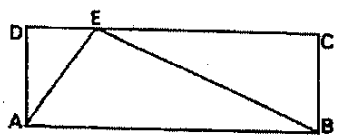
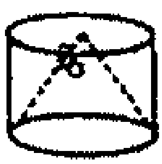
1. Revision. Describe the following pictures using as many mathematical expressions as possible.
(Ex. 1 and 2 based on Nucleus Mathematics, Longman 1982)



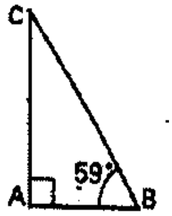
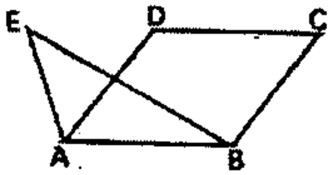
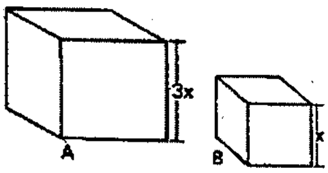




2. a) EXAM PRACTICE. Transform the sentences so that the meaning is the same.

	The lengths of *AB* and *CD* are in the ratio of approximately *3*:*1*. *AB* is approximately three times ……………………………… *CD*. (2 words)
	The diameter of the inscribed semi-circle is equal to the length of side *AB* of the rectangle *ABCD*. The diameter of the inscribed semi-circle is as ………………………………side *AB* of the rectangle *ABCD*. (2 words)
	The areas of rectangle *ABCD* and triangle *ABE* are in the ration of exactly *2*:*1*. The area of rectangle *ABCD* is exactly ………………………………as the area of triangle *ABE*. (3 words)
	The volume of the cylinder is three times as big as the volume of the cone with the same base and height. The volume of the cylinder and the volume of the cone with the same base and height are in the ……………………………… *3*:*1*. (2 words)

b) Now prepare similar tasks for your classmates.

 (< ABC … < ACB)
 (… rhombus *ABCD* … triangle *ABE*)
 (… cube *A* … cube *B*)

Grammar, e.g. https://dictionary.cambridge.org/grammar/british-grammar/as-and-as-expressions/as-as

3. PROPORTIONALITY/VARIATION.

a) Study the table below, translate the underlined expressions and link the examples to the correct type of variation.

Type of Variation	**Formula**	**Example Wording**
<u>Direct/Proportional Variation</u> y ∝ x	$y=kx$ or $y/x=k$	*y* <u>varies directly</u> with/as *x* *y* is directly proportional to *x* the ratio between *y* and *x* is a constant *y* varies inversely with/as *x*
<u>Inverse/Indirect Variation</u> y ∝ 1/x	$y=k/x$ or $xy=k$	*y* is <u>inversely proportional</u> to *x* the product of *x* and *y* is a constant *y* is <u>indirectly proportional</u> to *x*
Joint Variation	$y=kxz$	*y* is directly proportional to the <u>reciprocal</u> of *x* *y* is directly proportional to the product of *x* and *z* *y* is jointly proportional to *x* and *z* *y* varies inversely with/as *x* and *z*

b) Describe the relationship between the following quantities, where k is a proportionality constant.

- *a = k/b*
- *a = kbc*
- *a/b = k*
- *a = kb*
- *a: 1/b = k*

c) Examples – read the first example and make similar sentences for the following examples.

- The volume of a gas is inversely proportional to its pressure. → The smaller the volume, the higher the pressure.
- … the circumference of a circle and its diameter …
- **…** the area of a triangle and its height and base …
- … the speed of a car and the distance travelled …
- … the number of workers doing the job and the time needed to complete the job …

Scalars and Vectors

4. a) EXAM PRACTICE. Reading - Seven parts of sentences have been removed from the text below. Choose one of parts (A – G) for each gap.

A: which have very special definitions
B: humans to describe and understand
C: but they are not the same quantity
D: the direction in which they occur
E: comparing two vector quantities of the same type
F: an object does depend on direction
G: when the terms are used interchangeably

Math and science were invented by (1)___________________________ the world around us. We observe that there are some quantities and processes in our world that depend on (2)___________________________, and there are some quantities that do not depend on direction. For example, the volume of an object, the three-dimensional space that an object occupies, does not depend on direction. If we have a 5 cubic foot block of iron and we move it up and down and then left and right, we still have a 5 cubic foot block of iron. On the other hand, the location, of (3)___________________________. If we move the 5 cubic foot block 5 miles to the north, the resulting location is very different than if we moved it 5 miles to the east. Mathematicians and scientists call a quantity which depends on direction a vector quantity. A quantity which does not depend on direction is called a scalar quantity.

Vector quantities have two characteristics, a magnitude and a direction. Scalar quantities have only a magnitude. When (4)___________________________, you have to compare both the magnitude and the direction. For scalars, you only have to compare the magnitude. The fact that magnitude occurs for both scalars and vectors can lead to some confusion. There are some quantities, like speed, (5)___________________________ for scientists. By definition, speed is the scalar magnitude of a velocity vector. A car going down the road has a speed of 50 mph. Its velocity is 50 mph in the northeast direction. It can get very confusing (6)___________________________. Another example is mass and weight. Weight is a force which is a vector and has a magnitude and direction. Mass is a scalar. Weight and mass are related to one another, (7)___________________________.

The text based on https://www.grc.nasa.gov/www/k-12/airplane/vectors.html

b) Divide the following quantities into vector or scalar quantities:

speed, mass, weight, force, acceleration, velocity, distance, volume, temperature, momentum, power, pressure, displacement

5. a) Pre-listening. Answer the questions:

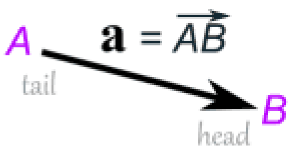
What is a vector, how is it different from a scalar?

Which mathematical operations can you perform with vectors?

***b)* Listening https://ocw.mit.edu/courses/mathematics/18-02-multivariable-calculus-fall-2007/video-lectures/lecture-1-dot-product/**

Listen to the beginning of a lecture on vectors and decide whether the statements are true or false. If a statement is false, please correct it. What is the nationality of the speaker?

1) Almost all students have heard about vectors before.
2) If the students have problems with vectors, they can go to the lecturer's office and ask him.
3) The lecturer draws the x-y coordinate system.
4) Vector quantity is indicated by an arrow above.
5) In the textbooks vectors are in bold because it is easier to read.
6) A vector <j> hat points along the z axis and has length one.
7) The notation a_1 and a_2 is in angular brackets.
8) The length of a vector is a scalar quantity.



It was the first lecture of a course, however, we did not see how the lecturer greets the audience. Could you think of appropriate phrases he might have said?

II Presentation Skills (tasks 1, 2 from Daniela Dlabolová):

1. PRESENTATION STRUCTURE

Complete the structure with your own suggestions.

1. Introduction

- open the presentation, introduce the group
- introduce the ……………………..…… of the presentation
- explain how the presentation is …………………….………

2. Main Body

- present each main point
- give …………………………… or supporting information
- evaluate solutions

3. Conclusion

- summarize what ………………………… you have made
- give overall evaluation
- invite the …………………………… to ask questions

2. PHRASES YOU CAN USE

Match the phrases and corresponding parts of a presentation.

Thank you for listening……

This presentation is about ……

And finally, I will talk about…..

Now I will be happy to answer your questions……….

Now let us turn to the next point…….

What I want to do is to show that…………………

Are there any questions or comments?

I would like to begin by…………

To sum up………..

Moving on, I will look at……………….

That is all I have to say…………

What I want to point out is ………………

3. "VIDEO HOMEWORK". Presenting information about a TED talk:

- Prepare and present a 3-minute speech (incl. an introduction and a conclusion):
  - a spoken summary of a talk of your choice from https://www.ted.com/
  - give the main point and your evaluation and opinion
  - on any topic about mathematics or related disciplines that you find relevant or interesting
  - support your mini-presentation by a visual (ppt, poster, …)
  - sign up for the date of your talk: **https://tinyurl.com/2018JAM2** (Week 5 - Week 9)