scuola per l'europa di Parma	**January Exam** **5th year** **School year 2020/2021**

MATHEMATICS 6 PERIODS
PART B

NAME OF STUDENT:_____

DATE: 15th June 2021, morning

TIME: 9:20 – 10:50

DURATION OF THE EXAMINATION:
1.5 h (90 minutes)

AUTHORIZED MATERIAL:
Examination with technological tool.
Non-programmable, non-graphical scientific calculator.
Pencil for the graphs.

SPECIFIC INSTRUCTIONS:

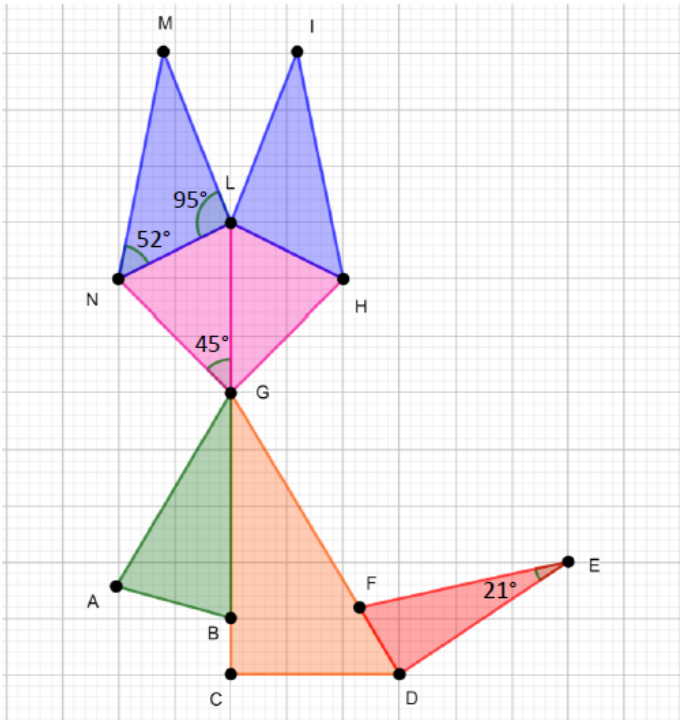
- Answers must be supported by explanations.
- They must show the reasoning behind the results or solutions provided.
- If graphs are used to find a solution, they must be sketched as part of the answer.
- Unless indicated otherwise, full marks will not be awarded if a correct answer is not accompanied by supporting evidence or explanations of how the results or the solutions have been achieved.
- When the answer provided is not the correct one, still some marks can be awarded if it is shown that an appropriate method and/or a correct approach has been used.

Teacher: Claudia Paris Number of students: 12

EXAM 2020-2021: MATHEMATICS 6 PERIODS

PART B		
QUESTION B1 TRIANGLES	**Page 1/1**	**Marks**

Martina wants to decorate her bedroom door with the outline of a cat, as shown in the figure below. **8 marks**



The cat's ears are two congruent triangles *MLN* and *ILH*, with $MN = 40$ cm, $MLN = 95°$ and $MNL = 52°$.
Martina wants to edge the two ears with blue ribbon.

a) Determine the length of the sides *ML* and *NL* and calculate how many centimetres of blue ribbon are needed to edge both ears. 4 marks

The cat's face *NGHL* is formed by two congruent triangles *NGL* and *HGL*, with $NG = 28$ cm, $GL = 30$ cm and $NGL = 45°$. Martina wants to paint the cat's face pink.

b) Determine the surface area of the cat's face (round to the nearest unit). 2 marks

The cat's tail consists of the triangle *FDE*, with $FE = 38$ cm, $DE = 36$ cm and $FED = 21°$. Martina cuts the tail from a piece of cardboard and then glues the base *FD* to the cat's body.

c) Determine the length of the base *FD* (round to 1 dp). 2 marks

PART B		
QUESTION B2 PERIODIC FUNCTIONS	**Page 1/2**	**Marks**

15 marks

Rimini's Ferris wheel has 42 transparent capsules that reach an altitude of 55 m from where you can see the Romagna coast, from Gabicce to Cesenatico.
The ticket costs 9 € and the trip lasts 30 minutes, during which the wheel completes 5 turns.
The motion of a capsule is described by the function

$$h(t) = 28 - 27\cos\left(\frac{\pi}{3}t\right)$$

where h is the altitude of the capsule in metres and t is time in minutes, with $t = 0$ when the trip starts.

a) Determine the time taken for a complete turn and explain the meaning of the coefficient $\frac{\pi}{3}$ in the equation of $h(t)$. — 2 marks

b) Check that the maximum altitude is 55 m and determine after how many minutes is attained. — 3 marks

c) Determine the altitude of the capsule when the trip starts, hence determine the radius of the wheel. — 2 marks

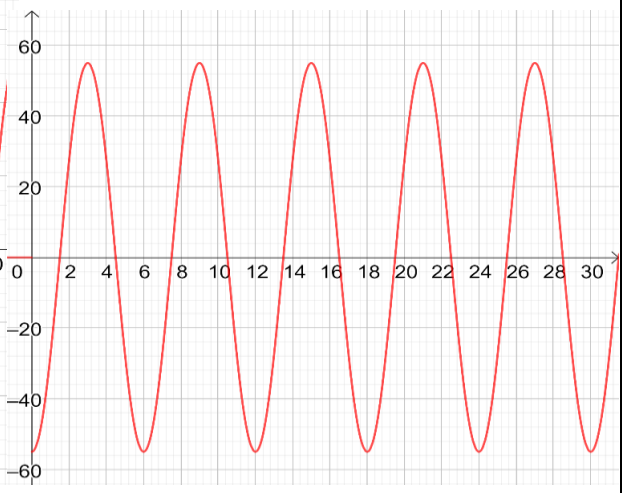
PART B

QUESTION B2 PERIODIC FUNCTIONS	Page 2/2	Marks

d) Among the following diagrams, find the one that represents the graph of the function $h(t)$. Justify your answer. — 2 marks

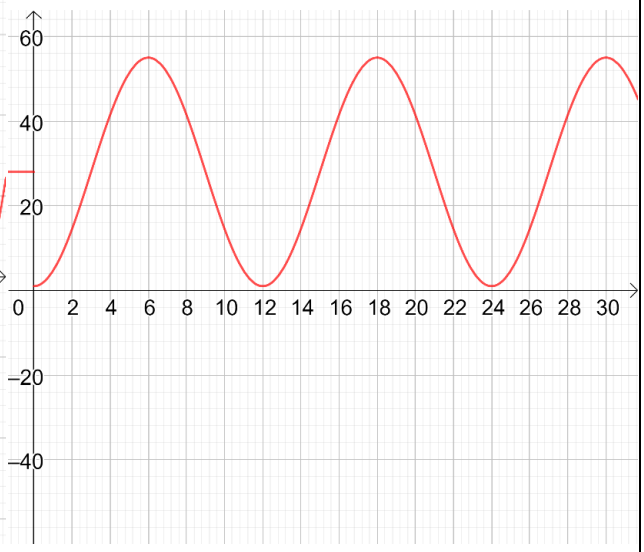
A

B



C

D



e) Determine the altitude of the capsule after 2 minutes. — 2 marks

f) Determine the time in minutes when the capsule reaches an altitude of 14.5 m from the ground. — 3 marks

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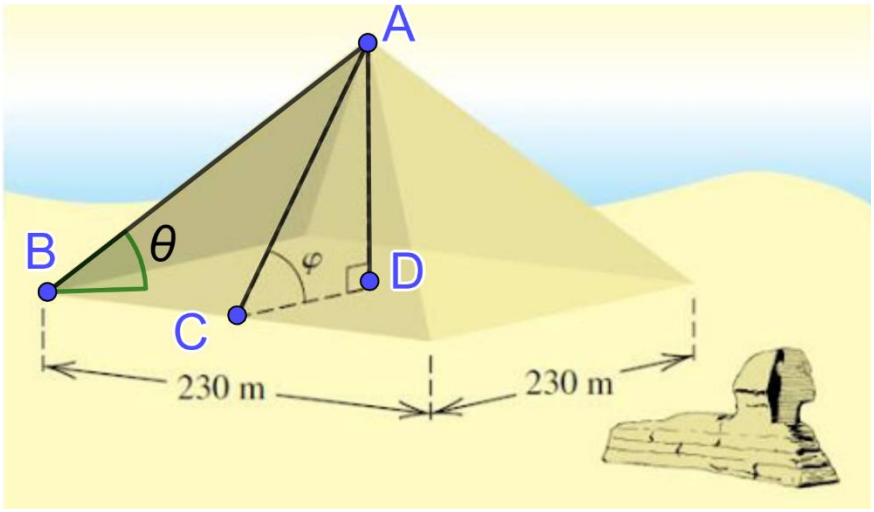
PART B		
QUESTION B3 3D GEOMETRY	**Page 1/1**	**Marks**
The Great Pyramid of Giza is a square-base pyramid, with base-length 230 m. The angle formed by the slant height AC with the plane of the base is $\varphi = 50.3°$  		**10 marks**
a) Determine the slant height AC of the pyramid (round to the nearest metre).		3 marks
b) Show that the height AD of the pyramid is 138.5 m.		2 marks
c) Determine the edge AB of the pyramid (round to the nearest metre).		3 marks
d) Determine the angle θ formed by the edge AB with the plane of the base.		2 marks

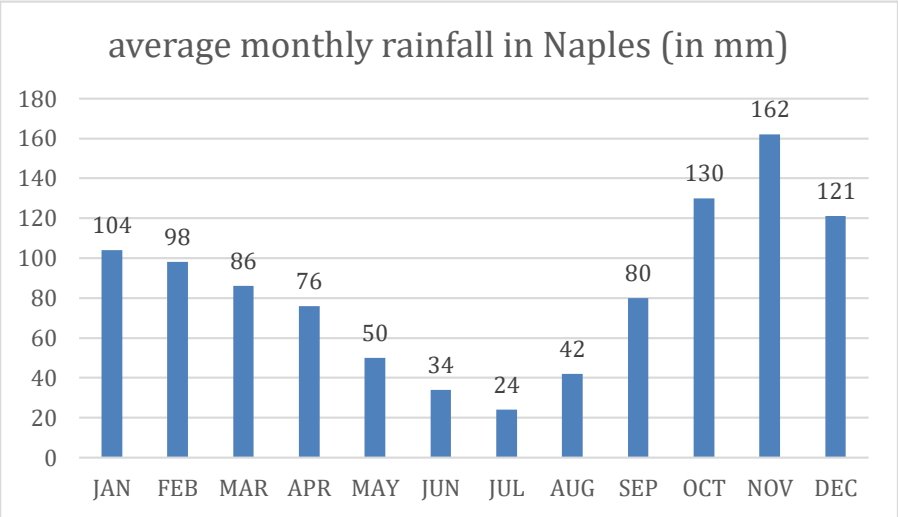
PART B

QUESTION B4 STATISTICS	Page 1/2	Marks

12 marks

If you think of Naples, you probably picture it on a sunny day. Milan, instead, it is often imagined in the rain.
But this is not an accurate description of the weather in the two cities.

The bar chart below shows the average monthly rainfall (in mm) in Naples, according to statistics of the last 30 years.



a) Determine min, Q1, median, Q3 and max of the data set shown in the bar chart. — 3 marks

b) Given the formulas — 3 marks

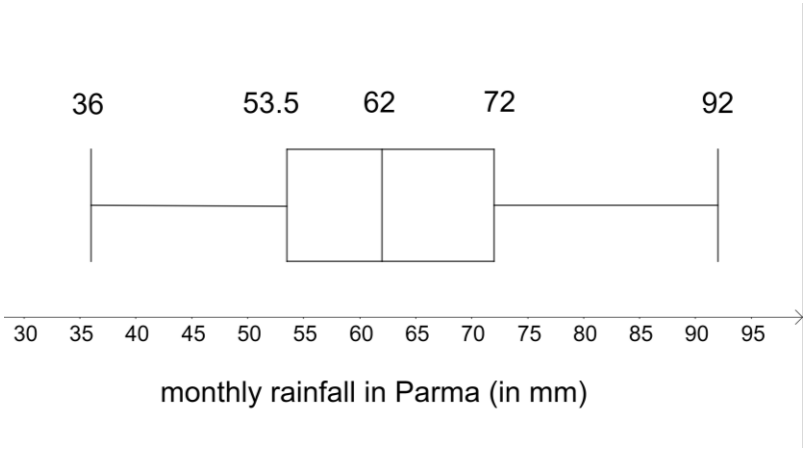
$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i \text{ and } \sigma = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2}\,.$$

Calculate the mean value $\bar{x}$ and the standard deviation σ for the monthly rainfall in Naples (round to 1 dp).

The table below presents data referring to the average monthly rainfall (in mm) in Milan, according to statistics acquired over the last 30 years.

min	Q1	median	Q3	max	$\bar{x}$	σ
60.0	64.5	75.5	95.0	101	78.7	15.7

c) On the same diagram, draw the box-plots representing the average monthly rainfall in Naples and in Milan. — 2 marks

PART B		
QUESTION B4 STATISTICS	**Page 2/2**	**Marks**
d) "Total rainfall in one year in Naples is 25% higher than in Milan". Use the information provided to explain whether this claim is correct or not. The following box-plot refers to average monthly rainfall in mm as recorded in Parma over the last thirty years.  		2 marks
e) In which one of these three cities data referring to rainfall show highest homogeneity? Explain your answer.		2 marks