B) Meeting in Greece


Matthew, Korina, Evangelia and Stavros are measuring the height of our school by two different trigonometric approaches

First way:

from the equation: $\tan \varphi=\frac{\text { height } h}{\text { distance } d} \rightarrow h=d \cdot \tan \varphi$
Second way:


Calculating height $h$ from two points of observation from unknown distance

## Solution

From the right triangles we have


$$
\begin{aligned}
& \left\{\begin{array} { c } 
{ \operatorname { t a n } \varphi = \frac { h } { x } } \\
{ \operatorname { t a n } \vartheta = \frac { h } { x + d } }
\end{array} \Rightarrow \left\{\begin{array} { c } 
{ \frac { 1 } { \operatorname { t a n } \varphi } = \frac { x } { h } } \\
{ \frac { 1 } { \operatorname { t a n } \vartheta } = \frac { x + d } { h } }
\end{array} \Rightarrow \left\{\begin{array}{c}
\frac{1}{\tan \varphi}=\frac{x}{h} \\
\frac{1}{\tan \vartheta}=\frac{1}{\tan \varphi}+\frac{d}{h}
\end{array} \Rightarrow\right.\right.\right. \\
& \frac{1}{\tan \vartheta}-\frac{1}{\tan \varphi}=\frac{d}{h} \Rightarrow \frac{\tan \varphi-\tan \vartheta}{\tan \vartheta \cdot \tan \varphi}=\frac{d}{h} \Rightarrow \boldsymbol{h}=d \frac{\tan \vartheta \cdot \tan \varphi}{\tan \varphi-\tan \vartheta}
\end{aligned}
$$

Of course, at the end we must not forget to add the height of the observer c. So

Height of the tower $=\boldsymbol{h}+\boldsymbol{c}$


Third way: Thales way
Using only a vertical stick and similarity

$\frac{\text { Height of pyramid }}{1 / 2 \text { lengrth of base }+ \text { shadow of pyramid }}$
$=\frac{\text { heiqht of sick }}{\text { shadow of sick }}$


Anastasia, Evangelia and Dorothea are measuring the height of our school, as Thales did

## RESULTS

## Country: Czech Republic

Names: Lukas Kobelar, Dave Beutel, Carol Schullova, Fabien Krischke


## Second way

mathematic formula to find the
height $=7,09 \mathrm{~m}$
angle $\varphi=50$
angle $\theta=45$
length d1=7,95
height of the building $=7,09 \mathrm{~m}$

## Country: Czech Republic

Names: Tereza Hubertová, Petr Sobol, Karolína Schullová, Zuzana Glacová
photo of way 1
SCHOOL


$$
\begin{array}{ll}
\phi=48^{\circ} & h=\tan \phi \cdot d \\
d=8 \mathrm{~m} & h=48 \tan .8 \\
h=x & h=8.88 \mathrm{~m}
\end{array}
$$

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First way
mathematic formula to find the
height
angle \varphi = 48 %
distance d = 8m
height of the building }=8,8\textrm{m
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Names: Gheorghieș-Alexandru, Bălăṣescu-Andrei, Crîṣmariu-Codrin, Dărăbăneanu-Liviu-Eugen
photo of way 1 or 2


First way
mathematic formula to find the height $=A B=A C * \sin \varphi$
angle $\varphi=42$
distance $d=6 \mathrm{~m}$
height of the building $=5.5 \mathrm{~m}$
Third way
Mathematical formula height=
height of the stick $=0.9 \mathrm{~m}$ shadow of the building $=11 \mathrm{~m}$
photo of way 3


Second way
mathematic formula to find the height $=\tan \theta=y / x$
angle $\varphi=40$ angle $\theta=50$ length $\mathrm{d}=5 \mathrm{~m} .6 \mathrm{~m}$
height of the building $=5.3 \mathrm{~m}$

## Country:Romania

Names: Afrasiloaie Octavian, Corduneanu Alin George ,Cluci Andrei Florentin, Mihalache Cristian,Pascal Dragos,Minia Bogdan
photo of way 1 photo of way 2


First way
mathematic formula to find the
height $=14.75 \mathrm{~m}$ (using tangent)
angle $\varphi=70$
distance $d=5 \mathrm{~m}$
height of the building $=14.75 \mathrm{~m}$


Second way
mathematic formula to find the height $=13.2 \mathrm{~m}$ ( 45 deg triangle)
angle $\varphi=45$
angle $\theta=32$
length $d=12.2 \mathrm{~m}$
height of the building $=13.23 \mathrm{~m}$

Third way
Mathematical formula height $=$ Thales(of Miletus)
height of the stick $=1.03 \mathrm{~m}$. shadow of the stick $=90 \mathrm{~cm}$ shadow of the building $=13.01 \mathrm{~m}$. finally the height is $=13 \mathrm{~m}$

Names: Korina, Iliana, Stauros, Despoina, Leyteris
photo of way 1 or 2


First way
mathematic formula to find the
height $=$
angle $\varphi=62^{\circ}$
distance $d=5 \mathrm{~m}$
height of the building $=9,4+0,7=10,1 \mathrm{~m}$

Third way
Mathematical formula height $=($ shadow of the building $) \cdot \frac{\text { height of thestick }}{\text { shadow of the stick }}$
height of the stick $=1,70 \mathrm{~m}$
shadow of the stick $=0,40 \mathrm{~m}$
shadow of the building $=2,38 \mathrm{~m}$. finally the height is $=10,12 \mathrm{~m}$

## Country :Greece

Names: Mathiew. Dorothea, Anastasin . Evagelia


First way
mathematic formula to find the
height $=c+d \cdot \tan \varphi$
angle $\varphi=57^{\circ}$
distance $\mathrm{d}=6 \mathrm{~m}$
height of the building $=9.98 \mathrm{~m}$
photo of way 3


Second way
mathematic formula to find the
height $=c+d \frac{\tan \theta \tan \varphi}{\tan \varphi-\tan \theta}$
angle $\varphi=57^{\circ}$
angle $\theta=45^{\circ}$
length $\mathrm{d}=3 \mathrm{~m}$
height of the building $=9,30 \mathrm{~m}$

Third way
Mathematical formula height $=($ shadow of the building $) \cdot \frac{\text { height of thestick }}{\text { shadow of the stick }}$
height of the stick $=2 \mathrm{~m}$. shadow of the stick $=0.47 \mathrm{~m}$
shadow of the building $=2,38 \mathrm{~m}$
finally the height is $=10,13 \mathrm{~m}$

Some of the works in padlet

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Czech - way 1
tree way 1


The Greek team is ready to calculate the earth's circumference.

## RESULTS

## Country: Greece - Romania

Names: Corina Iliana, Stavros, Despina, Lefteris, Mathew, Dorothea ,Anastasia, Evagelia

Place here the geometric figure


Place here two photos:


Solution:
central angle $\omega=25-11,9=13,1, \quad$ distance between the two cities $=1297$
result: The circumference of earth is $=35643 \mathrm{Km}$.

## Dourvtry-Eench Neprublle


 MCrlachive


Whate here tuwo phobes:



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