

# A MATHS WALK

*Dear students!*

*You are kindly invited to take a walk in the surroundings of your home and exercises not only your body, but also your brain because you will try to think;*

- *resourcefully* (finding the right and/or creative solution fast),
- *flexibly* (adjusting your work to your and others' needs),
- *independently* (managing your time and workload)

*and accomplish the MAIN GOAL of the task;*

*use maths outdoors to learn something new and discover how useful maths is in real life.*



1. **Choose a BIGGER tree near your home.**
2. **Follow the steps in the instructions on the pages below to:**
  - a) **determine THE AGE of the tree,**
  - b) **calculate how many CUBIC METERS OF USEFUL TIMBER you can get from it**
  - c) **maximise your EARNINGS**
3. **Upload your FINDINGS to "A Maths Walk" PADLET (link in Twinspace)**
4. **Join the TEAMS video meeting on TUESDAY, 11<sup>TH</sup> May at 13:30 (14:30 EST) (link in Twinspace)**



Follow the instructions CAREFULLY. If possible, print them out to TAKE them with you for a walk. Otherwise, read them from your phone and write all the answers on a separate piece of paper.



Make use of the EXAMPLE PHOTOS and the EXAMPLE measurements and calculations.



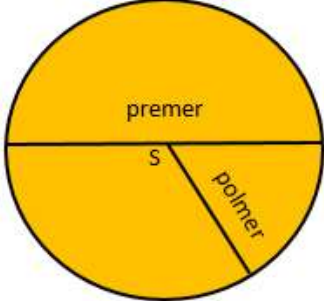
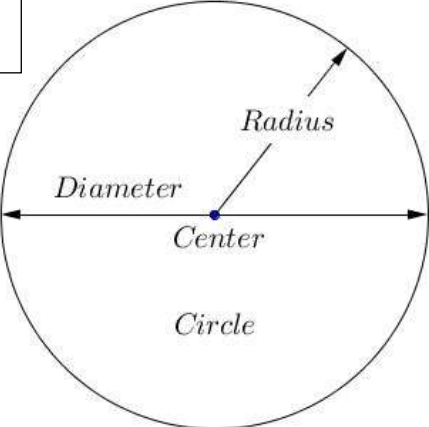
**WRITE all your calculations into the CHART on the next page.**

USE a calculator 😊.

<b>MEASURED, ESTIMATED AND CALCULATED DATA</b> (complete this chart as you do the tasks)		
Tree name	in English	
	in your mother tongue	
The AGE of the tree (in years)	estimated	
	calculated	
Measured circumference <b>c</b> (cm) (in Slovene circumference is called "obseg" and the symbol is letter <b>o</b> )		
Calculated diameter $2r$ (cm)		
Calculated tree height		
Calculated volume of the wood $V$ (m <sup>3</sup> )		
Earnings	earnings per 1 m <sup>3</sup>	
	total earnings	

☺☺☺ **3, 2, 1 – ACTION!** ☺☺☺

<p>1. Before going out, make sure you <u>take</u> the following:</p> <ul style="list-style-type: none"> <li>• a measuring tape</li> <li>• a pencil / pen</li> <li>• a string</li> <li>• instructions &amp; fill-in chart</li> <li>• calculator</li> <li>• camera</li> </ul> <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-left: 20px;"> <p>OR: your mobile phone</p> </div> <p><i>Now check <u>the weather</u> and dress accordingly. It's important to feel comfortable on your walk.</i></p>											
<p>2. Finally, go out and choose a BIG OLD tree so you can get as much useful timber as possible (and higher earnings, of course)</p> <p>☺ DON'T FORGET ☺ Take a photo of the tree to upload it to Padlet later.</p>	<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>Example photo of a tree</p>  </div>										
<p>3. Write the name of the tree into the chart on page 2 - in English &amp; your mother tongue.</p> <p>4. Take a good look of the tree and <u>estimate</u> its age. Write it into the chart on page 2.</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td rowspan="2" style="width: 50%; text-align: center; vertical-align: middle;">Tree name</td> <td style="width: 20%; text-align: center;">in English</td> <td style="width: 30%;"></td> </tr> <tr> <td style="text-align: center;">in your mother tongue</td> <td></td> </tr> <tr> <td rowspan="2" style="text-align: center; vertical-align: middle;">The AGE of the tree (in years)</td> <td style="text-align: center;">estimated</td> <td></td> </tr> <tr> <td style="text-align: center;">calculated</td> <td></td> </tr> </table>	Tree name	in English		in your mother tongue		The AGE of the tree (in years)	estimated		calculated	
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<p>5. Take the string and measure the circumference of the tree trunk at the height of 1.4 m above the ground.</p> <p>(Check the photo on the right.)</p>			
<p>6. Place the string along the measuring tape and read the circumference (in cm).</p> <p>7. Write the data into the chart on page 2.</p>	 <table border="1" data-bbox="826 860 1453 1016"> <tr> <td> <p>Measured circumference <b>c</b> (cm)</p> <p>(in Slovene circumference is called "obseg" and the symbol is letter <b>o</b>)</p> </td> <td></td> </tr> </table>	<p>Measured circumference <b>c</b> (cm)</p> <p>(in Slovene circumference is called "obseg" and the symbol is letter <b>o</b>)</p>	
<p>Measured circumference <b>c</b> (cm)</p> <p>(in Slovene circumference is called "obseg" and the symbol is letter <b>o</b>)</p>			
<p><i>And now - some maths theory – probably a revision for most of you, the others simply read the explanation carefully.</i></p> <p>8. To get the age of the tree you need to have the diameter of the tree – it's calculated using the measured tree circumference. Use the formula below:</p> <p><b><math>o = 2\pi r</math></b></p> <div data-bbox="172 1473 507 1684" style="border: 1px solid black; padding: 5px;"> <p><b>o</b> - circumference (<b>o</b> = <b>obseg</b> (in SLO) (<b>c</b> = <b>circumference</b> in English)</p> </div> <div data-bbox="555 1451 949 1579" style="border: 1px solid black; padding: 5px;"> <p><b>r</b> – radius of the tree <b>2r</b> – diameter of the tree</p> </div> <div data-bbox="279 1702 798 1841" style="border: 1px solid black; padding: 5px;"> <p>Number <b><math>\pi</math> (pi) = 3,14</b> is Archimedes' constant</p> </div>	<p>In SLOVENE:</p> <p>obseg</p>  <p>premer s polmer</p> <hr/> <p>IN ENGLISH:</p> <p>Circumference</p>  <p>Radius Diameter Center Circle</p>		

9. After re-arranging the formula, you can calculate the circumference of the tree:

$$2r = \frac{O}{\pi}$$

It's really simple: divide the measured circumference by number  $\pi$  (pi).

☺ **SOME ADVICE** ☺  
Use a calculator.

10. Write the calculation into the chart on page 2.

Example:

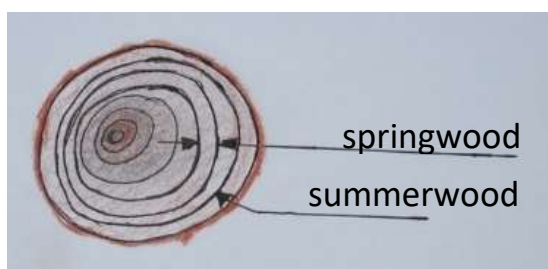
$$(2r) = \frac{O}{\pi} = \frac{141}{3,14} = 44,9 \text{ cm}$$

Your calculation:

Calculated diameter  
2r (cm)

11. Now you can use a special formula to get the approximate age of the tree. You already know that the most accurate way to find the age of the tree is to count the number of rings visible when the tree is cut horizontally.

The growth factor is calculated on yearly measurements of a tree and it stands for the width of springwood growth.

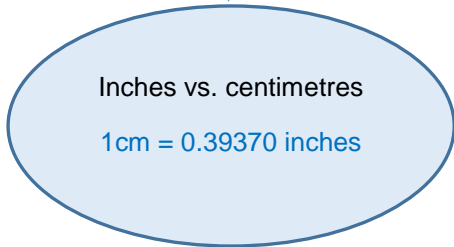


**SOME ADVICE:**  
If the chart on the right does not have the info for your tree, simply use the info for the most similar tree. Think – Does your tree grow faster or slower than ex. a spruce tree?

Related growth factors	
aspen	2
maple, linden	3
alder	3,5
red oak, elm tree, ash tree, beech tree, larch	4
birch, cherry tree, white oak, spruce tree, chestnut	5
cornel tree	7
horse chestnut	8

12. Calculate the age of your tree using the formula below:

$$\text{approximate age} = \frac{\text{diameter}}{2,5} \cdot \text{tree growth factor}$$



13. Write the calculated age into the chart on page 2.

Example:

Your calculation:

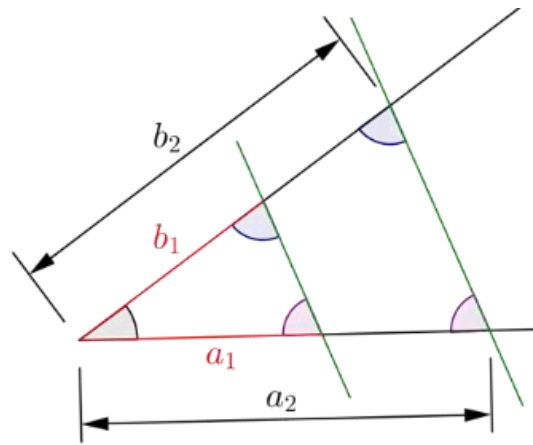
The AGE of the tree (in years)	estimated	
	calculated	

14. Now you will calculate the height of the tree – you will later need this to calculate the volume of the tree and finally your earnings, too.

You will use the discovery by an important Greek mathematician, astronomer, engineer and philosopher **Thales of Miletus** (born 624/623 BC; died 548/545 BC.)

Take a good look at the outline on the right – you will see TWO similar triangles. They have the same angles, and the parallel sides are in equal proportions. This rule is the **Thales formula**.

Parallel sides are:  $a_1$  in  $a_2$   
 $b_1$  in  $b_2$

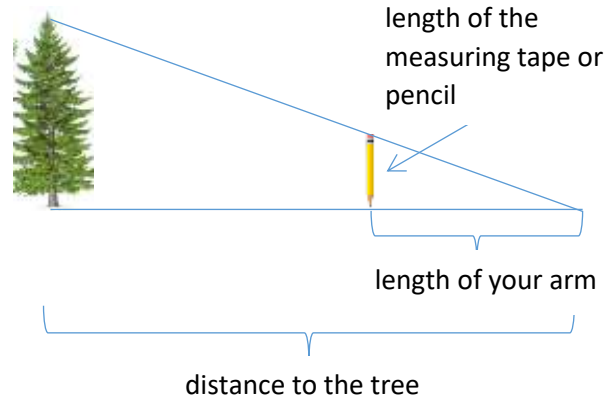




Thales formula

The proportion of parallel sides:  
 $a_1 : a_2 = b_1 : b_2$

15. Now use the Thales formula in your task. Use the picture on the right:

- One side of the smaller triangle is the length of your arm, the other is the length of the measuring tape or the pencil.
- One side of the larger triangle is the distance to the tree, the other side is the height of the tree – that's the info you need.



<p>16. You will calculate the tree height using Thales formula:</p>	
<p><b>tree height : measuring tape or pencil length = distance to the tree : arm length</b></p>	
<p>But you need some more data that you get with the measurements below.</p>	
<p>17. Measure the length of your outstretched arm – from the shoulder to the pencil (cm).</p> <p>Write the measurement: .</p> <p>Example: 64 cm = 0,64 m</p> <p>Arm length: _____ cm = _____ m</p>	
<p><i>Next step is to pretend to be Thales or a forester calculating tree height using Thales formula.</i></p> <p>18. Face the tree, stretch out your arm and hold the outstretched measuring tape or your pencil. Focus your eyes on the tape or pencil and at the same time look at the tree. Move away from the tree to the point where the measuring tape (or the pencil) covers the tree from bottom to top.</p> <p>19. If you're using a pencil, measure its length (cm). If you're using a measuring tape, read the length of the tape that covers the complete tree.</p> <p>And DON'T MOVE FROM THE SPOT YOU'RE STANDING AT!</p> <p>Example: 50 cm = 0,5 m</p> <p>Pencil / measuring tape length: _____ cm = _____ m</p>	
<p>20. Now measure the distance from the spot where you're standing to the tree. If your step is 1 m long, you can simply walk to the tree, otherwise use the measuring tape.</p> <p>Write down the distance.</p> <p>Example: 21 m</p> <p>Distance to the tree: _____ m</p>	

21. After precise measuring, you can use the rearranged Thales formula to calculate the height of your tree.

Example

$$= \frac{0,50 \cdot 21}{0,64}$$

$$= \underline{16,4 \text{ m}}$$

$$\text{tree height} = \frac{\text{length of measuring tape OR pencil} \cdot \text{distance to tree}}{\text{length of the arm}}$$

Your calculation:

22. You now have the height of the tree; write it into the chart on page 2.

Calculated tree height

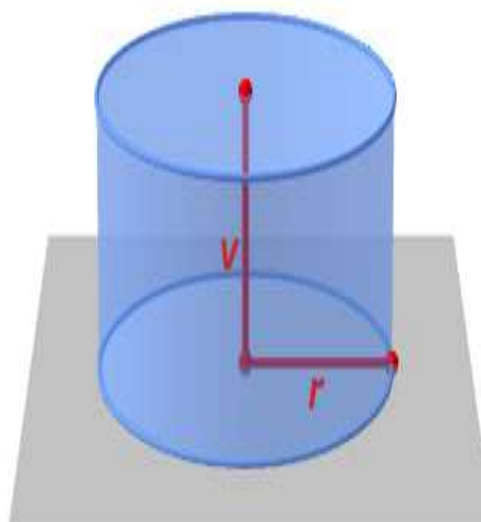
*You need to do the last, but the most important part of the task. So, just go for it!*

23. Now you have enough information to calculate the amount of useful  $\text{m}^3$  of wood of your chosen tree. And this is of course connected to your earnings. You're going to calculate the volume of the tree trunk.



*But – consider the following:*

- *The tree trunk gets narrower towards the top and the wood is useless so it needs to be removed.*
- *The foresters cut the tree trunk in smaller parts to transport them easier. Such tree trunks are called logs and have the form of a cylinder – with round sides.*





24. Use the formula below to calculate the cylinder volume.

**Volume = area of the bottom base (circle) · tree trunk height (tree trunk length)**

Volume = **circle area** · tree trunk height

$$V = \pi r^2 \cdot v$$

Example:

Tree trunk height = 12 m; (4 m are USELESS)

$V = 3,14 \cdot 22,5^2 \cdot 1200$   
 $V = 1\,907\,550 \text{ cm}^3 = 1,9 \text{ m}^3$   
 $\approx 2 \text{ m}^3$

*r = 44,9 : 2  
r = 22,5 cm*

Your calculation:

25. Write the date into the chart on page 2.

Calculated volume of the wood  
V (m<sup>3</sup>)

26. After you've done all the tasks above:
1. it's time to return home, switch on the computer and find out how successful your math walk has been. **OR**
  2. you can do the task below using your mobile phone and continue enjoying the nature.



27. And, finally – you probably want to find out how much you have earned today, right☺?

*Be resourceful and calculating – it's only up to you to decide the following:*

28. **HOW** you want to use the wood – as TIMBER; WOODEN BOARDS, FUEL WOOD; VENEER, .... – the price of the wood depends on the way it is used.

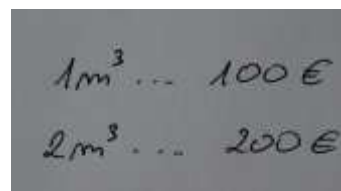


29. Search the web to find the price for one  $m^3$  of the specific use of the wood of your tree. Write it into the chart.

30. Calculate the earnings. (Check the example calculation.)

31. Write the data into the chart on page 2.

Example earnings calculation:



You earnings calculation:

Earnings	earnings per $1 m^3$	
	total earnings	

32. 😊 Don't forget 😊

Upload the photo of your tree and all the data to Padlet. Scan the QR code to access Padlet or click on the link, which you can also find in Twinspace.

And join the Teams video meeting on Tuesday at 13.30 (14.30 EST).

Scan:



or

[CLICK HERE](#)

***Congrats!***  
***Your work is done!***



## Appendix 1: An example of a filled-in chart.

<b>THE FILL IN CHART: MEASURED, ESTIMATED AND CALCULATED DATA</b>		
Tree name	in English	spruce
	in your mother tongue	smreka
The AGE of the tree (in years)	estimated	75 years
	calculated	approximately 89 years
Measured circumference <b>c</b> (cm) (in Slovene circumference is called "obseg" and the symbol is letter <b>cmo</b> )	141 cm	
Calculated diameter <b>2r</b> (cm)	44.9 cm	
Calculated tree height	16.4 m	
Calculated volume of the wood <b>V</b> (m <sup>3</sup> )	approximately 2 m <sup>3</sup>	
Earnings	earnings per 1 m <sup>3</sup>	approximately €100
	total earnings	approximately €200