

YEAR 10 CAS PROJECT - ARTIFICIAL TREES

A page from a Christmas catalogue advertising artificial trees that come with lights is shown below. The accompanying table shows the different trees available for purchase.



Tree name	Height	As shown Diameter	Lights	Tips	Price
Pinehurst	2'	16"	50	65	\$9.95
Colorado Conifer	5.5'	50"	480	850	\$89
Shenandoah Pine	7'	60"	750	1246	\$129
Fraser Fir	12'	96"	2250	3752	\$299

1. One of the elements of thinking critically is interpreting information. Look at the pamphlet above. Are there any errors in the information provided? Briefly explain your answer.
2. Convert all dimensions to centimetres. You will need to find how to convert from feet and inches to centimetres. See calculator hints below.

3. Make a new table (you will need to adjust the “diameter” column to be a true diameter measurement), which will show all dimensions in centimetres.
4. The formula for the curved surface area of any cone in terms of its radius and slant height is $SA = \pi \times r \times s$. What assumptions have to be made in order to use this formula?
5. What feature of the tree is designated ‘s’? Add this to your diagram.
6. Define surface area as ‘sa’ on your calculator. See calculator hints below.
7. Use the formula to compute the curved surface area of each of the four trees, excluding tree stems. Given that the shortest tree has a stem height of 6 inches and the three taller trees have stem heights of 12 inches. All calculations and results need to be in cm and cm^2 . Why? You will need to first calculate slant height for each tree. Use your defined ‘sa’ function and lists to calculate three surface areas in one computation on a calculator. See calculator hints below. Write down your results in a table.
8. Convert each surface area to m^2 using the conversion $1m^2 = 10000cm^2$.
9. For each tree, calculate the following:
 - a) Concentration of lights per square cm of surface area.
 - b) Concentration of tips per square cm of surface area.
 - c) Percent of tips that are lighted, assuming that all lights are at the tips of the branches.

Write your results in a table like the one below.

Tree	Lights per m^2	Tips per m^2	Percentage of tips that are lighted
Pinehurst			
Colorado Conifer			
Shenandoah Pine			
Fraser Fir			

10. Make a reasoned judgment about which is the ‘best lit’ tree using the evidence of your calculations.
11. What other relevant information could help you make a decision?

HOW TO WRITE UP AND PRESENT YOUR REPORT

Communication is an important part of the assessment of this report. You cannot expect to achieve a high grade if you simply type up the answers and insert them next to the question numbers.

Your report should be written in such a way that it can be read without the need to refer to the question sheet. This doesn't mean you should simply copy the questions into your report! It means that you should write full linking sentences which explain what it is you are going to present next, and, where relevant, why you had to do this.

DO NOT submit your work as a set of answers labelled 1-11. Your report must be text which incorporates all the answers to the questions. You can create a scenario if you wish. Check the assessment criteria before submission. Have you completed everything.....???

Your writing should link each set of calculations with appropriate explanations. This means you should show what you did to achieve the answers you get. Explain what you did by showing calculations. (Or a sample calculation if there are repeats of the same calculation.) You may wish to present multiple results in a table.

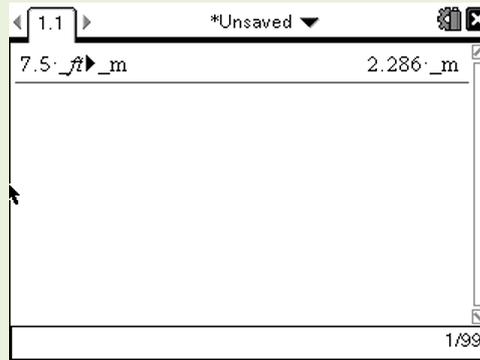
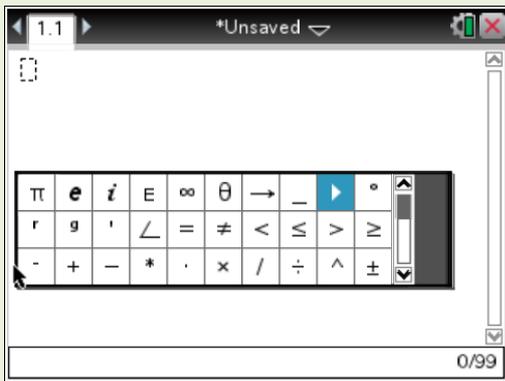
You should write down how you used the CAS calculator, although it is not necessary to write entry lines. It would be ideal to have **Student Software** installed on your laptop. It allows you to take **screen shots** of your calculations and copy and paste the screen shots into your written report. Remember to use the correct mathematical terms and notation.

CALCULATOR HINTS

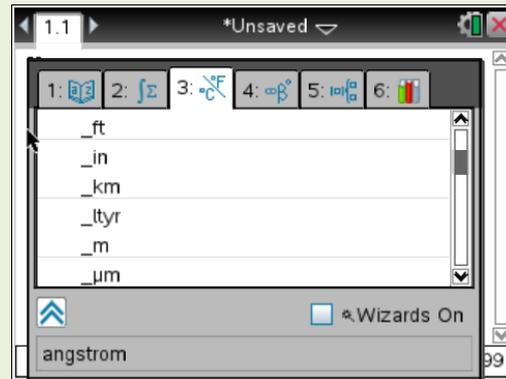
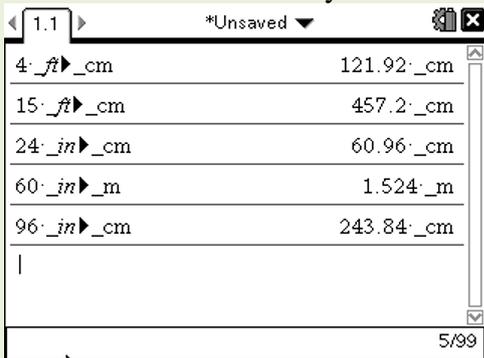
(Note that different values are used in these examples)

1. Converting Units

Open a new document with a **Calculator** page. To convert units on TI-Nspire use the conversion operator which can be found in a $\alpha\beta^\circ$ (ctrl book) **Conversion Operator** (►). The _ underscore character designates units. To type the underscore use the shortcut menu from ctrl catalogue (to the left of the arrow) or ctrl enter. To convert 7.5 feet to metres type: 7.5_ft►_m.



Here are some more to try:



If you wish to convert other units check the abbreviations used by going to Catalogue (book), select 3 and select Length. Scroll down to see `_ft` (feet) and `_in` (inches).

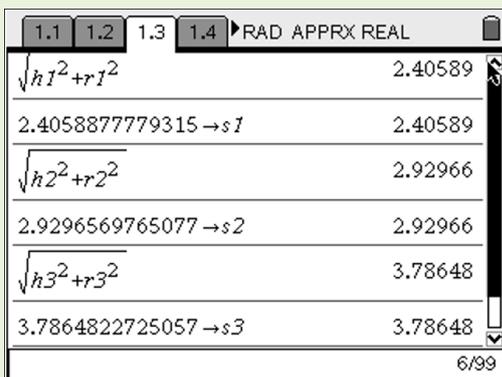
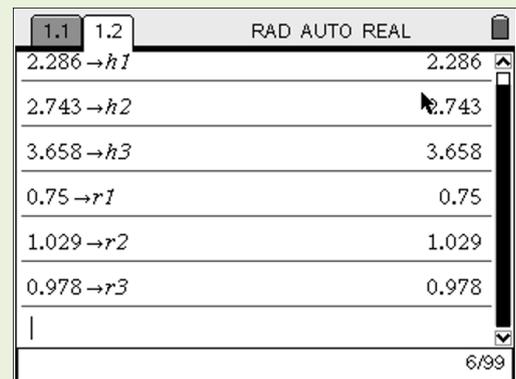
2. Using the Define function and storing results

(note: this example is for 3 calculations only)

It is a good idea to store the numerical values for heights and radii of each tree on a calculator. To store a variable, type the numerical value followed by $\text{ctrl} + \text{var}$ followed by the name e.g. $2.286 \rightarrow h1$.

You can use Pythagoras theorem to calculate a slant height of each tree and store the values as s_1, s_2, s_3, s_4 .

Type $\sqrt{h_1^2 + r_1^2} \rightarrow s_1$.



Calculate surface area for each tree and store the values as sa_1, sa_2, sa_3, sa_4

In the surface area formula use the π button which is located close to the left bottom corner on your calculator. Remember to enter \times sign after each pronumeral when you define the formula. Press menu 1 Action 1 **Define**. Type $sa = \pi \times r \times s$. Then use the substitution button 1 to find each surface area for specific values of radii and slant heights. For the first tree type $sa|r = r_1$ and $s = s_1$. You need a space in front of 'and' and after it.

1.1 1.2 1.3 1.4 RAD APPRX REAL	
Define $sa = \pi \cdot r \cdot s$	Done
$sa r = r1$ and $s = s1$	5.66874
$5.6687395263834 \rightarrow sa1$	5.66874
$sa r = r2$ and $s = s2$	9.4707
$9.4706987111478 \rightarrow sa2$	9.4707
$sa r = r3$ and $s = s3$	11.6339
$11.633882022666 \rightarrow sa3$	11.6339
7/99	

MathEXams

Year 10 Mathematics Measurement Project	
Feedback to Student	
Name:	
Title of assignment: Artificial Trees	Due Date:
Date set:	Date submitted:
A Use of notation and terminology:	/2
B Communication:	/3
C Mathematical Process:	/5
D Results and conclusions:	/5
E Use of technology:	/3
F Quality of Work:	/2