Name: _____
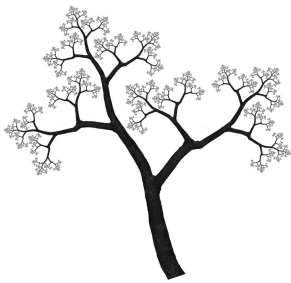
Fractal Trees

1. How is a tree a fractal?

2. What type of fractal pattern is a tree?

3. List three other naturally-occurring things that are the same type of fractal pattern as a tree.
a)   b)   c)

4. Use a ruler to measure the distance in millimeters between the bottom of the tree (marked A) and the first branching point (B). Record your measurement in the table under "Distance".
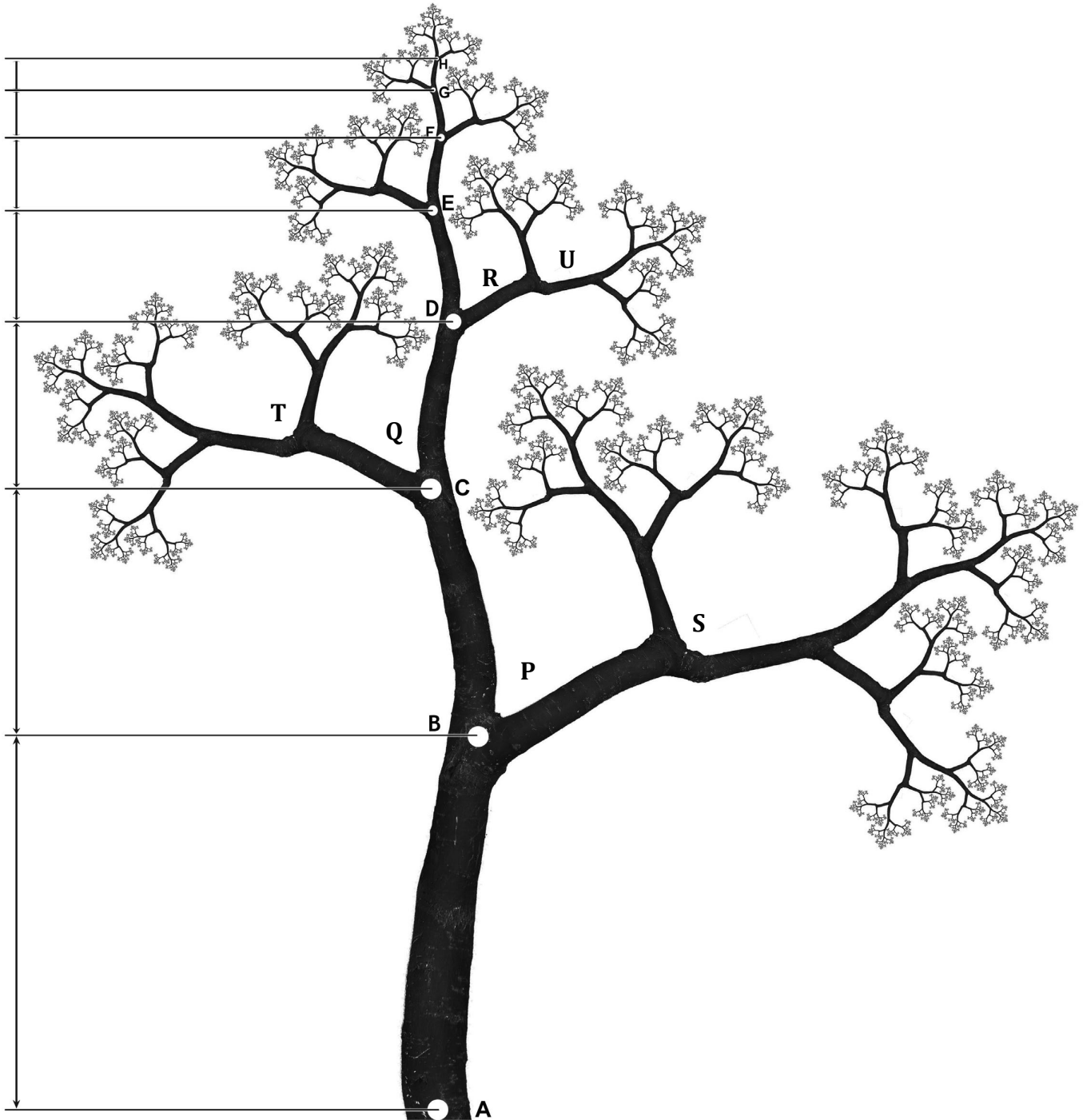
Do this for all sections of the tree.

Section	Name of Section	Distance (mm)	Quotient of Adjacent Sections	Ratio of Adjacent Sections
A to B	AB		Example: AB/BC = 64/45 = 1.4	Example: 1.4:1
B to C	BC			
C to D	CD			
D to E	DE			
E to F	EF			
F to G	FG			
G to H	GH			

Name: _____

Fractal Trees
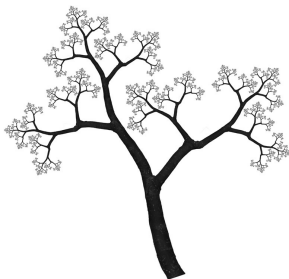
Name: _____

Fractal Trees

Next, we want to see how the size between branches compares from one branch to the next. To do so, we calculate the *quotient* between the lengths of the branches. This is easy to do but will require a calculator.

5. Under "Quotient of Adjacent Sections," write the length of one branch, for instance AB, divided by the length of the next branch, BC, and do the math. The quotient tells us how much bigger the branch is than the next smaller branch. So if AB were twice as long as BC, the quotient would be 2.

6. Finally, write the ratio of the distances. In the case above, with AB and BC, the ratio would be 2:1. If AB were only one and a half times bigger than BC, the quotient would be 1.5, and ratio would be 1.5:1, or 3:2.

Use your calculator to compute the rest of the quotients in the table.

7. What pattern do you see?

8. Is it easier to measure the branch distances in millimeters instead of inches? If so, why?

9. Use a protractor to measure the angles between the branches. Measure the angles (P, Q, R, S, T and U) and fill in the values in the table to the right.

a) What do you notice about the various angles in the tree?

b) How many kinds of angles can you find in the tree?

| Label	Angle
P	
Q	
R	
S	
T	
U	
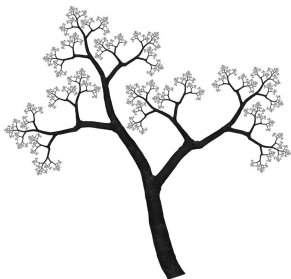
Name: _____

Fractal Trees

Go outside and measure the angles of the cracks around your school. Investigate six of them and draw them, noting the angles and anything else that may affect the cracks, such as the corner of a building or edge of the concrete.

a	b	c
d	e	f

10. Do you notice any patterns in the cracks? If so, what do you see?

Discuss this with your classmates.
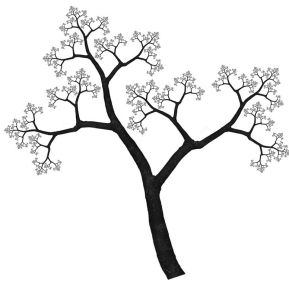
Fractal Trees

Now let's switch gears and look at tree growth. You can tell the age of a tree by counting its rings.
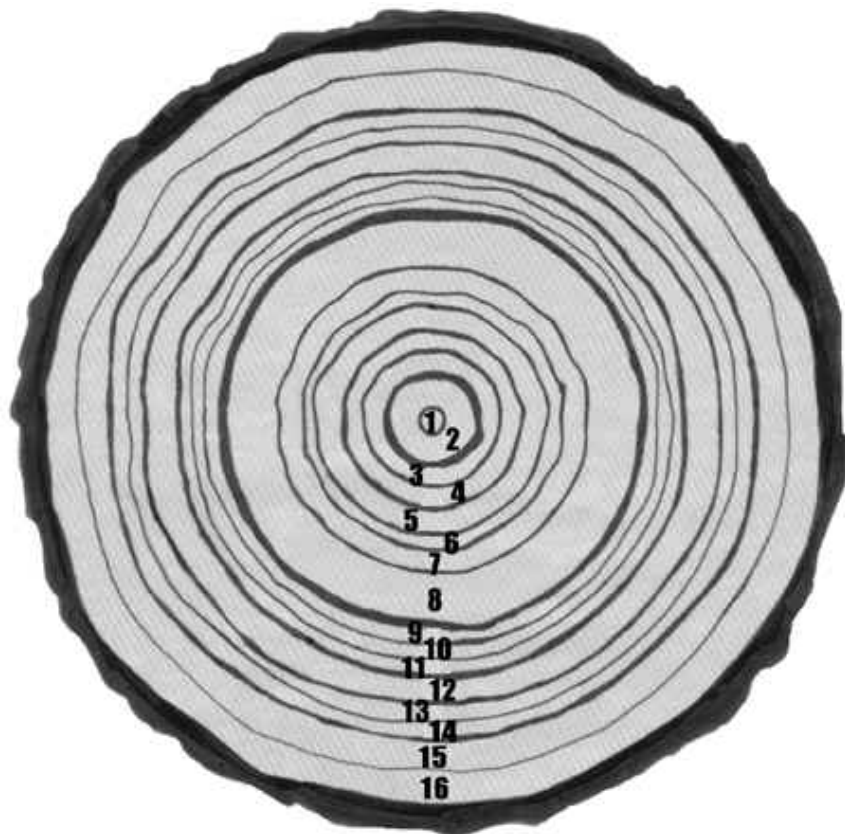
11. How old is the tree pictured here?

12. a) What do you think it means when the rings are really wide?

b) During what two years did the tree grow a lot?

13. a) What were the ecological conditions when the rings are really close together?

b) When were three consecutive very dry years for this tree?

Biologists measure tree's circumference, which is related to the tree's age. Say the diameter of the tree is 24 centimeters. Draw this on the image above.

14. a) What is the radius?

b) What is the circumference?

15. Using the relationship between circumference and age of the tree above, what would be the estimated age of a tree whose circumference were 95? What is this tree's diameter?