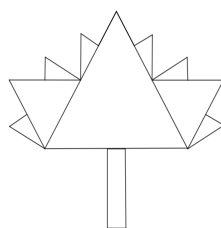
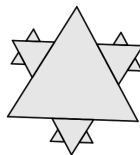


- Daniel decides he desires something deciduous, deciding on double dogwood trees in his yard. The bases of the trees are 80 feet apart, one tree is 40 feet tall, and the other is 20 feet tall. Assuming his yard is perfectly flat, how many feet are there between the tops of the trees?
A. 100 B. $20\sqrt{13}$ C. $20\sqrt{17}$ D. 200 E. NOTA
- The American Bladdernut is a deciduous shrub that is very real. Shawn decides to get his hands on a bladdernut fruit. If the fruit is shaped like a perfect sphere with radius 6, what is the volume of Shawn's bladdernut?
A. 216π B. 288π C. 144π D. 180π E. NOTA
- Canadians love their maple trees! Allen wants to find the area of his maple leaf. The maple leaf is an equilateral triangle with side length 4, then it sprouts two equilateral triangles of half its length, then each of those sprouts two 30-60-90 right triangles, with the side opposite the 60° angle having length equal to half of the smaller equilateral triangles' side lengths. The stem is a rectangle of length 2 and width $\frac{1}{2}$. What is the area of Allen's maple leaf?



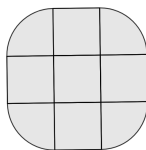
- A. $10\sqrt{3}$ B. $8\sqrt{3} + 1$ C. $7\sqrt{3} + 1$ D. $9\sqrt{3} + 1$ E. NOTA
- Johnny was preparing for his run through the forest, so he prepares fat stacks of Johnnycakes. His Johnnycakes are cylinders with height 1, and he makes Johnnycakes with radii of 4, 3, 2, and 1. He then stacks them on top of each other concentrically, starting with the radius 4 at the bottom, then the 3, and so on. What is the surface area of his stack of Johnnycakes? Include the top and bottom.
A. 80π B. 52π C. 56π D. 90π E. NOTA
- A square tree has leaves in the shape of squares that have integer area. If the leaves can be placed on the coordinate plane such that all of its square vertices lie on lattice points, which one of the answer choices could be the area of the leaves? A lattice point is a point where both of its coordinates are integers.
A. 19 B. 35 C. 56 D. 73 E. NOTA
- You are walking to Dr. Deciduous's house when suddenly, Karen blocks your path and asks you to find the area of a triangle with side lengths 13, 14, and 15. What should you tell her?
A. 14 B. 28 C. 42 D. 84 E. NOTA
- Professor Oak Tree is making a deciduous tree-shaped cake for research purposes, and he uses frosting to make the leaves. He pipes his frosting onto the cake using a cake piper. His cake piper is a cone with a height of 60, and a radius of 15. What is the volume of Professor Oak Tree's cake piper?
A. 3595.5π B. 3600π C. 4495.5π D. 4500π E. NOTA
- Chi is doing a watercolor drawing of a beech tree, except she messes up and spills her colors onto the paper. Before the spill, she had a square with side length 6 drawn, and after the spill, the square was perfectly circumscribed by a circle. How much area was added to the drawing from the spill?
A. 36 B. 18π C. $36\pi - 18$ D. $36\pi - 36$ E. NOTA

9. Many scientists are wondering how to combat climate change, but Professor Oak Tree thinks he has the perfect solution! Oak Tree knows he needs to combat carbon emissions by developing carbon sinks, like oak trees! Professor Oak Tree makes an oak tree farm in the shape of a square formed by connecting the midpoints of every other side of a regular octagon. If the side length of the octagon is $4\sqrt{2}$, what is the area of the farm?
- A. $64 + 64\sqrt{2}$ B. $64 + 32\sqrt{2}$ C. $24 + 16\sqrt{2}$ D. $48 + 32\sqrt{2}$ E. NOTA
10. Dr. Deciduous needs some medicine, but he needs to go to the his office to get a prescription first. His office is anywhere on the x -axis, Dr. Deciduous is at $A = (0, 1)$, and the pharmacy is at $B = (3, 3)$. Dr. Deciduous, being excited to get his medicine, figures out the fastest way to get to the his office before getting to the pharmacy. What is the length of AC , where C is the location of his office?
- A. $\frac{5}{4}$ B. $\frac{5}{3}$ C. $\frac{5}{2}$ D. 5 E. NOTA
11. Emre loves geometry, deciduous forests, and cake! Inspired by Professor Oak Tree, he also made a cake in the shape of a tree trunk. If the cake is a cylinder with radius 3 and the height 6, what is the volume of the cake?
- A. 36π B. 72π C. 90π D. 108π E. NOTA
12. Shawn walks from his house at $(8, 0)$, stops in the forest at $(16, 6)$ for 4 hours, naps at a river at $(16, -6)$ for 3 hours, and goes back home. If Shawn walks at 1 unit per hour, how many hours is he away from home for?
- A. 31 B. 32 C. 38 D. 39 E. NOTA
13. Modern philosopher Daniel Slang, a Tree Sage and a teacher of wisdom, gave this puzzle to his students. Let $\triangle ABC$ be an isosceles triangle with $AB = AC$ and $\angle BAC = 50^\circ$. If the angle bisectors of $\angle ABC$ and $\angle BAC$ intersect at I , what is $\angle BIC$?
- A. 110° B. 135° C. 130° D. 115° E. NOTA
14. Canada has some deciduous forests, but it also has a lot of snow. Allen walks into a forest and sees a snowflake growing bigger! Originally an equilateral triangle of side length 4, the snowflake adds an equilateral triangle in the middle of each side, and then repeats this indefinitely. What area will the snowflake approach? The first two growths are shown.



- A. $\frac{27\sqrt{3}}{4}$ B. $\frac{32\sqrt{3}}{5}$ C. $\frac{40\sqrt{3}}{7}$ D. $5\sqrt{3}$ E. NOTA
15. Shawn is similar to a fractal, in that when you look closely at his muscles, even his muscles have muscles. If his first muscle has volume π , his second muscle has volume $\frac{\pi}{3}$, and so on with each muscle having $\frac{1}{3}$ rd the volume of the previous one, what is the volume of Shawn's muscles?
- A. $\frac{4\pi}{3}$ B. $\frac{3\pi}{2}$ C. 2π D. 3π E. NOTA
16. Dr. Deciduous finds a tree at the point $(-10, -20)$. Upon closer inspection, Dr. Deciduous makes a horrid observation: the tree is actually evergreen! In a fit of rage, Dr. Deciduous throws the tree around, in such a way that can be represented as reflecting over line $y = x$, then translating it up by 4, and finally rotating it 90° counterclockwise about the origin. Where is the tree located now?
- A. $(6, -20)$ B. $(-6, -20)$ C. $(-20, 10)$ D. $(-10, -14)$ E. NOTA

17. Ziad was playing his favorite mobile game, Deciduous Royale. He throws a fireball at the opposing side's deciduous treehouse, destroying it. If the fireball leaves a hemispherical crater with radius 3, what is the volume of space inside the crater?
- A. $\frac{27}{2}\pi$ B. 18π C. 27π D. 36π E. NOTA
18. Daniel frequently goes to Costco, Walmart, Publix, and Kohl's to get supplies to grow his deciduous double dogwood trees. Costco, Walmart, Publix, and Kohl's form a quadrilateral with vertices $(-15, 0)$, $(-1, -8)$, $(6, -7)$, $(3, 4)$. If Daniel's house is placed optimally so that the sum of the distances from his home to the four stores is minimized, where is his house?
- A. $(-\frac{7}{4}, -\frac{11}{4})$ B. $(-\frac{11}{4}, \frac{1}{2})$ C. $(0, -5)$ D. $(1, -3)$ E. NOTA
19. Scientists have found a "squircle" shaped apple. A squircle is defined by a radius and a length. Divide a circle of the radius chosen into fourths, then add rectangles with sides equal to the radius and length chosen between the fourths as shown in the diagram. Finally, add a square in the middle with the side length equal to the length. What is the area of a squircle with length 8 and radius 2?



An example of a squircle with length 1 and radius 1.

- A. $20 + 4\pi$ B. $128 + 4\pi$ C. $320 + 4\pi$ D. $320 + 64\pi$ E. NOTA
20. Shayan and Daniel are playing basketball on their deciduous court, and Daniel blocks Shayan's shot with his entire hand. Shayan gets mad, and he punches Daniel's square head so hard it rotates 90° about its center. If Daniel's head has an area of 100, what is the area of the region Daniel's head traces as it rotates? Assume that Daniel is two-dimensional.
- A. 100 B. 50π C. 200 D. 100π E. NOTA
21. Shawn has several curves, one of which being the curve $y = \sqrt{-x^2 + 4}$. Shawn wants to figure out the area between his curve and the x -axis from -2 to 2 , but Shawn doesn't know how. What is the closest integer to the area between Shawn's curve and the x -axis from -2 to 2 ?
- A. 4 B. 5 C. 6 D. 7 E. NOTA
22. Darth Deciduous is up to no good! To thwart his evil plans, you must locate his office located at the orthocenter of his giant triangular house! Darth Deciduous's house has vertices at $(-18, 0)$, $(0, 36)$, and $(24, 0)$. Where is his office located?
- A. $(0, 24)$ B. $(6, -12)$ C. $(3, 24)$ D. $(0, 12)$ E. NOTA
23. Professor Oak Tree planted 3 oak trees A , B , C , where $AB = AC = 5$ and $BC = 8$. If G is the centroid of $\triangle ABC$, what is $\cos \angle BGC$?
- A. $-\frac{4\sqrt{17}}{17}$ B. $-\frac{15}{17}$ C. $-\frac{8}{17}$ D. $-\frac{\sqrt{17}}{17}$ E. NOTA
24. Jonathan decides enough is enough, and he lights his local deciduous forest on fire. The fire radiated outward from where Jonathan lit his first tree in every direction for 20 seconds, which was enough to burn down the entire forest. If the fire radiated outward at a speed of 1 unit per second, what is the maximum possible area of the forest?
- A. 400π B. 1600 C. 425π D. 1700 E. NOTA

25. Roger finds a peculiar tree in the shape of a hexagon! What is the sum of the angles in a hexagon in degrees?
- A. 180 B. 360 C. 540 D. 720 E. NOTA
26. Dr. Deciduous got angry at Jonathan for burning down his sacred deciduous forest, deciding to take revenge. Dr. Deciduous decided that if Jonathan can solve his research problem for him, then he will let Johnny go: Find the locus of points in the coordinate plane that satisfies the equation $x^3 + y^3 + x^2y + xy^2 - x - y = 0$.
- A. A circle and a line
 B. Two circles and a line
 C. A cubic curve and a circle
 D. A cubic curve and a line
 E. NOTA
27. Dr. Deciduous finds an arrangement of tree that forms a regular polygon with an interior angle measure of 150° . How many sides does this polygon have?
- A. 6 B. 9 C. 12 D. 15 E. NOTA
28. Sophie and Daniel are sitting in a tree, when Sophie pushes Daniel off. The tree can be represented by a cylinder with equal diameter and height, topped with a sphere with radius equal to the the cylinder's diameter. If the tree is 36 feet tall, what is the volume of the tree in ft^3 ?
- A. 1680π B. 2880π C. 1440π D. 2736π E. NOTA
29. Math is one of Jonathan's favorite subjects, rivaled only by environmental science. Being an environmental science enthusiast, Jonathan loved and wished to protect the deciduous forests of the world, but now he is mad that he didn't get into his favorite class! So, Johnny goes to the local forest, chops down some trees, and places the logs in his plastic box. If the logs are $18 \times 4 \times 4$ rectangular prisms and the box is an $18 \times 10 \times 8$ rectangular prism, what is the most amount of logs that can fit in the box?
- A. 2 B. 3 C. 4 D. 5 E. NOTA
30. The answer is not not not not A, not B, not not not C, not not not not not not not D, and not not not not not E. What is the answer?
- A. Pick me! B. No, pick me! C. You better pick me. D. D E. NOTA