

1. Tim the Tarantula King decides to go on a voyage through the Amazon Rainforest to find the perfect meal. To start his journey, he decides to make a sailboat. Which of these sails has the largest area?
A. A triangle with sides 3, 5, 4
B. A square with side length 3
C. An equilateral triangle with side length 4
D. A circle with a radius 2
E. NOTA
2. Before setting out, Tim asks his friend Linsey the Lizard to come with him. However, wherever Linsey goes, she needs to bring her favorite log, which is the shape of a cylinder with a radius of 2 cm and height of 8 cm. What is the volume of the log in cm^3 ?
A. 32π B. 16π C. 4π D. 18π E. NOTA
3. Tim and Linsey set sail! On their journey, they encounter Yimo the capybara collecting seeds. If Yimo wants to collect at least $192\pi \text{ cm}^3$ of seeds, and each seed is in the shape of sphere with radius 2 cm, how many seeds must Yimo collect?
A. 16 B. 20 C. 12 D. 18 E. NOTA
4. Linsey, seeing the seeds, becomes hungry and steals some. Yimo sees her running away with his seeds and gets angry. While Tim and Linsey escape on their boat, Yimo decides to fire seeds at them in hopes of sinking their boat. Yimo is at the point (2, 3) while Tim and Linsey are at the point (7, 9). How far does Yimo have to fire the seeds in order to reach Tim and Linsey?
A. $\sqrt{65}$ B. $\sqrt{61}$ C. 11 D. 8 E. NOTA
5. Tim and Linsey manage to escape! While continuing their journey, they meet David, a poison dart frog. David tells them there is a stream along the line $y = -2$ that contains honey. Tim, at the point (0, 7) decides that he will get some honey and tells Linsey to meet him at the point (24, 7). What is the minimum distance that Tim must travel to get honey and then meet Linsey?
A. 15 B. 30 C. $24\sqrt{2}$ D. 25 E. NOTA
6. When Tim sees the honey stream, he encounters Queen Bee Nonoko, who decides that she will give Tim honey only if he can find the outer surface area of her hive. If her hive is made exclusively of 156 regular hexagons with side lengths of 6, what should Tim say in order to get some honey?
A. $8424\sqrt{3}$ B. $1404\sqrt{3}$ C. $936\sqrt{3}$ D. $1872\sqrt{3}$ E. NOTA
7. Tim got it right and gets some honey! As a parting gift, Nonoko decides to give Tim a hat in the shape of a frustum. The hat has a top radius of length 3, a bottom radius of length 6, and a height of 4. What is the surface area of the hat?
A. $45\pi + 18$ B. 45π C. 63π D. 90π E. NOTA
8. After meeting back up with Linsey, Tim continues on his journey. After a while, Tim sees a stowaway: a Nematode (a super big nematode)! In exchange for safe transit, the Nematode offers to give Tim a flower in the shape of a 22-sided n -gon. How many diagonals does this flower have?
A. 420 B. 209 C. 19 D. 290 E. NOTA
9. Tim wants to know how the sum of the exterior angles of the flower. Find the sum of the exterior angles of a 22-sided polygon.
A. 36 B. 3600 C. 360 D. 36000 E. NOTA

10. Linsey, realizing that the Nimatode has been eating her seeds, kicks the Nimatode into the river. This leaves a puddle made of 2 concentric circles of radii 8 and 12. What is the area between the circles?
- A. 32π B. 16π C. 60π D. 144π E. NOTA
11. As they continue along their voyage, Tim and Linsey see a sign that reads “Aisle of Monkeys” and decide to get off the boat and travel through the aisle. While walking, they see Aaron the Squirrel Monkey, climbing across the trees on a path modelled by the line $y = 8x + 4$. In order to avoid Aaron, Tim and Linsey travel along the path $y = 8x + 9$. What is the distance between the two paths?
- A. $5\sqrt{13}$ B. 5 C. $\frac{5\sqrt{65}}{13}$ D. $\frac{\sqrt{65}}{13}$ E. NOTA
12. Moving onward, Tim and Linsey spot Shaoyang the Howler Monkey. Noticing them, he screams at the 140 decibels. Linsey notices that Shaoyang’s mouth while screaming forms a circle with a radius of 8 inches. What is the difference between the areas of the largest triangle that can be circumscribed by the circle and the smallest triangle that can be inscribed by the circle?
- A. $192\sqrt{3}$ B. $96\sqrt{3}$ C. $144\sqrt{3}$ D. $72\sqrt{3}$ E. NOTA
13. Holding onto a branch, Shaoyang shouts a question at Linsey: “WHICH OF THE FOLLOWING SIDE LENGTHS COULD NOT FORM A TRIANGLE?” What should Linsey answer to get the question right?
- A. 1, 10, 10 B. 1, 100, 100 C. 20, 30, 40 D. 25, 50, 75 E. NOTA
14. After answering the question correctly, Tim and Linsey make a run for it. While running, the pair spot Miles the Spider Monkey on his web. Miles’s web is in the shape of an octagon with a side length of 8 meters. What is the length of the apothem of the octagon?
- A. $4 + 4\sqrt{2}$ B. $8 + 8\sqrt{2}$ C. $4\sqrt{3}$ D. $4 + 8\sqrt{2}$ E. NOTA
15. Continuing through the Aisle of Monkeys, the pair spot Nelson the Sloth. Nelson is lying on a branch 16 meters above the ground, and Tim and Linsey are 12 meters from the base of the tree. The tree and the ground make a right angle. Tim bets Linsey that he can web his way straight to the top of the tree (along the hypotenuse) and get to the top before Linsey can run the 12 meters to the tree and climb 16 meters up. If Tim webs at a rate of 3 m/s and Linsey runs and climbs at rates of 5 m/s and 4 m/s respectively, who reaches the top first and how long does it take them, rounded to the nearest tenth?
- A. Tim, 6.4 seconds B. Linsey, 6.4 seconds C. Tim, 6.6 seconds D. Linsey, 6.6 seconds E. NOTA
16. As soon as both of them reach the top, Heewon the Harpy Eagle swoops in and eats Nelson. Stunned, Tim notices that Heewon’s wings look like two $13 - 14 - 15$ triangles. What is the total area of both of Heewon’s wings?
- A. 84 B. 168 C. 144 D. 42 E. NOTA
17. Hadriel the Macaw spots Tim still in shock and agrees to help the pair get to the perfect worm if they correctly answer his 3 riddles. Tim, immediately forgetting the death he just witnessed, eagerly accepts. But he needs your help to answer all of them! Riddle 1: My favorite leaf is a triangle $\triangle ABC$, where point D is on \overline{AC} such that \overline{BD} bisects $\angle ABC$. If $AB = 6$, $AD = 3$, and $DC = 2$, compute BC .
- A. 4 B. 4.5 C. 1 D. Not a triangle E. NOTA
18. Not bad! Riddle 2: Jason is a fearless explorer who comes across a temple dedicated to the Geometry gods. In the temple, he spots a mural depicting a man and his dad putting a bomb in the sink! The bomb is a triangle $\triangle ABC$ with side lengths $AB = 5$, $BC = 6$, and $CA = 2$. Jason wants to add his own touch to the mural so he draws a point D located on segment \overline{BC} . If $BD = 2$, find the length of AD .
- A. 4 B. $\sqrt{3}$ C. $\sqrt{\frac{11}{2}}$ D. $\sqrt{10}$ E. NOTA

19. Wow, you're almost there! Riddle 3: Two jungle trees (with negligible width), 30 ft and 50 ft tall, are 40 ft apart and perpendicular to the ground. The trees are supported by vines attached from the top of each tree to the bottom of the other. If a is the height from the ground at the point where the two vines cross, and b is the horizontal distance from the point where the two vines cross to the taller tree, what is $a + b$ in feet?
A. 18.75 B. 37.5 C. 40 D. 43.75 E. NOTA
20. Tim successfully answers all 3 riddles correctly, so Hadriel agrees to fly them. While flying, they spot the Jaguars James and Jay having a duel to the death to see who is the better Jaguar. Tim notices that their footprints are in the shape of a regular pentagon with a side length of 11. What is the semiperimeter of James's foot?
A. 22 B. 33 C. 44 D. 55 E. NOTA
21. While flying, a breeze comes by that pushes Linsey off! After reaching the point (9,17), Hadriel nose dives towards Linsey on the line $y = \frac{4}{3}x + 5$ while traveling at a rate of 5 units per second. If Linsey starts at the point (3,17) and is falling at a rate of 4 units per second in the negative y -direction and the ground is represented as the x -axis, will Hadriel catch her, and if so, at what coordinates?
A. Yes, (3,5) B. Yes, (3,9) C. Yes, (3,13) D. No E. NOTA
22. Luckily, Tim uses his webbing to catch Linsey. Hadriel drops Tim and Linsey at the top of a tree. The tree can be represented as a cylinder with radius 2 meters and height of 69 meters, topped with a cone of radius 8 meters and height of 42 meters. Find the volume of the tree.
A. 1032π B. 1114π C. 1132π D. 1172π E. NOTA
23. While continuing on their journey, Linsey wonders whether Tim is worthy to be the Tarantula King. As a test, Linsey asks Tim what the external tangent of 2 circles with centers 25 units apart and radii of 11 and 4 units is. To prove that he is the true Tarantula King, what should Tim answer?
A. 25 B. 20 C. 12 D. 18 E. NOTA
24. Tim gets it right! However, Linsey is still skeptical, and asks another question: What is the length of the internal tangent of the two circles in last question? Help Tim answer this correctly.
A. 47 B. 28 C. 20 D. 49 E. NOTA
25. Tim and Linsey are almost at the end of their journey! They run into Arib the Indian Anaconda, who is not only the guardian of the perfect meal, but the longest creature in the world at a whopping 350 meters. If the average person is 175 cm, how many times as long as the average person is Arib?
A. 200 B. 250 C. 120 D. 210 E. NOTA
26. Arib gives Tim the location of the perfect meal, a majestic, delectable, whimsical worm. If it is at the point (80,50) on the Cartesian plane and Arib and Tim are located at the point (20,25), what is the shortest distance that Tim must travel to get to the worm?
A. 85 B. 65 C. 75 D. 95 E. NOTA
27. After a long journey, Tim reaches and eats the perfect worm. The worm is in the shape of a cylinder of radius 2 and height 8 with hemispheres of radii 2 on the end of the cylinder. What is the surface area of the worm?
A. 48π B. 60π C. 40π D. 32π E. NOTA
28. It's a trap! While eating the worm, Tim is trapped in a cage by Mr. Hallett, who Arib had given a heads up to. If the cage is in the shape of a $4 \times 8 \times 11$ box without a top (assume the top is a 4×8 side) and is made up of graphene, how many square units of graphene did Mr. Hallett use to make the cage? (Assume the box's sides are 2 dimensional and that it is empty on the inside.)

- A. 300 B. 328 C. 304 D. 332 E. NOTA

29. In order to save Tim, Linsey carves her log (from question 2) into a key. If the key is in the shape of a rectangular prism with dimensions $2\text{ cm} \times 2\text{ cm} \times 6\text{ cm}$, can Linsey carve her log to fit the dimensions of the key, and if so, how much does she have to shave off (in cm^3)?

- A. Yes, $32\pi - 18$ B. Yes, $32\pi - 24$ C. Yes, $18\pi - 32$ D. No E. NOTA

30. Linsey is able to get Tim out and the pair escape! With his mission complete, Tim decides to head home. Before leaving, he leaves a marking on the tree closest to where he found the perfect worm. The marking is a triangle with side lengths of 6, 8, and 10. What is the area of the triangle?

- A. 12 B. 24 C. 48 D. 60 E. NOTA