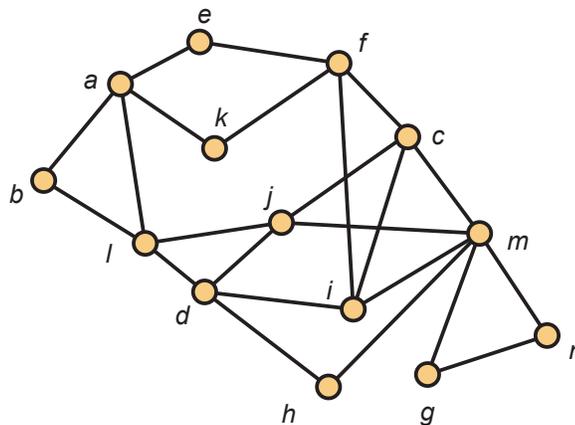


1. A rhombus has corners  $(0, 0), (3, 5), (7, 0), (10, 5)$ . Find the point where the two diagonals intersect.
2. If  $C$  chords are drawn in a circle, with no three of them concurrent, and they intersect in  $I$  points, the number of regions inside the circle is  $C + I + 1$ . Explain why this is correct.
3. Let  $T$  be a triangle drawn inside a circle of radius  $r$  such that one side of  $T$  is a diameter of the circle and all three vertices of  $T$  are distinct points on the circle. Show that  $T$  is a right triangle.
4. The point  $A$  is at  $(0, 0)$  and the point  $B$  is at  $(8, 0)$ , a point  $C$  will be added to form a triangle. Describe the set of points where
  - ◆ The triangle is a right triangle, and  $\overline{AB}$  is a leg.
  - ◆ The triangle is a right triangle, and  $\overline{AB}$  is the hypotenuse.
  - ◆ The triangle is an equilateral triangle.
5. How many edges must a polyhedron have if every face has 5 sides and every vertex is incident to 3 edges.
6. How many walks does it take to traverse a graph with  $2m$  odd degree vertices?
7. Consider an equilateral triangle with side length 1. An arbitrary point  $P$  is chosen in the interior of the triangle, and lines perpendicular to the sides are drawn to  $P$ . What is the sum of the lengths of those lines?
8. Consider a pyramid with a square base with side length  $12in$  has height  $8in$ . If the pyramid is cut parallel to the base at a height of  $4in$ , what is the volume of the bottom piece.
9. A right circular cone is formed by taking a circle of radius  $10ft$  and removing  $1/5$  of the circle, then glueing the cut ends together and attaching a base. What is the surface area of the cone formed?
10. A triangle with side lengths 13, 14, and 15 is drawn in the plane. Give one potential set of coordinates for the vertices of the triangle.
11. Explain why for any four angles,  $0 < w, x, y, z < 180$  there is a quadrilateral having those 4 angles as interior angles if and only if  $w + x + y + z = 360$ .
12. Explain why alternate interior angles of a parallelogram are congruent.
13. If 10 miles per hour is 26,880 furlongs per fortnight, how many feet are there in a furlong? It may be helpful to know that a fortnight is 14 days.
14. A float attached to two ropes of length 200' is being placed on the shore to form a swimming area (so the swimming area will be an isosceles triangle). What angle should the two ropes make to maximize the area of the swimming area and what is that area?
15. A rain gauge is formed by place a funnel with a diameter of  $10in$  into a tube with diameter  $6in$ . How far apart should the markings on the tube be to mark one inch of rainfall?

16. (5 points) The point  $A$  is at  $(0, 0)$  and the point  $B$  is at  $(8, 0)$ , a point  $C$  will be added to form a triangle. Describe the set of points where
- ◆ The triangle is a right triangle, and  $\overline{AB}$  is a leg.
  - ◆ The triangle is a right triangle, and  $\overline{AB}$  is the hypotenuse.
  - ◆ The triangle is an equilateral triangle.
17. (5 points) How many edges must a polyhedron have if every face has 5 sides and every vertex is incident to 3 edges.
18. (5 points) Consider a pyramid with a square base with side length  $12in$  has height  $8in$ . If the pyramid is cut parallel to the base at a height of  $4in$ , what is the volume of the bottom piece.

19. (5 points) A right circular cone is formed by taking a circle of radius 10 *ft* and removing  $\frac{1}{5}$  of the circle, then glueing the cut ends together and attaching a base. What is the surface area of the cone formed?
20. (5 points) If 10 miles per hour is 26,880 furlongs per fortnight, how many feet are there in a furlong? It may be helpful to know that a fortnight is 14 days.
21. (5 points) A float attached to two ropes of length 200' is being placed on the shore to form a swimming area (so the swimming area will be an isosceles triangle). What angle should the two ropes make to maximize the area of the swimming area and what is that area?
22. (5 points) If an interior angle of a polygon has measure  $m$ , then  $360^\circ - m$  is the measure of the conjugate angle. What is the sum of the conjugate angles of an  $n$ -gon?
23. (5 points) Water boils at  $212^\circ$  Fahrenheit and freezes as  $32^\circ$  Fahrenheit. Water also boils and freezes at approximately  $373^\circ$  Kelvin and  $273^\circ$  Kelvin. Find an equation to convert from degrees Kelvin to degrees Fahrenheit and determine when the two are equal.
24. (5 points) Let  $\mathbf{G}$  be the graph below.



Determine if  $\mathbf{G}$  has an eulerian circuit. If it does, find an eulerian circuit. If it is not, give a reason why it is not.

25. (5 points) Consider a right triangle with legs of length 8 and 6. If a circle has the same diameter of as the hypotenuse of the right triangle, what is its area and circumference?