

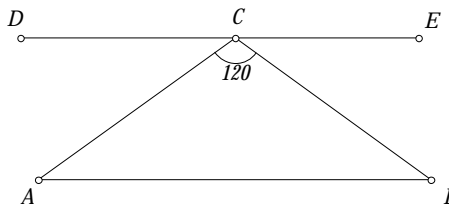
Geometry Test 2001

Indicate the best answer by filling in the appropriate letter on your answer key.

1. Two angles are said to be complementary if the sum of their measures is

- a)  $90^\circ$ .
- b)  $270^\circ$ .
- c)  $180^\circ$ .
- d) None of these.

2. In the figure to the right, the line segments  $\overline{AB}$  and  $\overline{DE}$  are parallel. Suppose that  $m\angle ACD = m\angle ABC$  and  $m\angle ACB = 120^\circ$ . Then,



- a)  $m\angle CAB = m\angle CBA = 60^\circ$ .
- b)  $m\angle BCE = 60^\circ$ .
- c)  $m\angle ACD = m\angle BCE = 30^\circ$ .
- d) None of these.

3. The measure of an angle is one fourth of the measure of the supplement of the angle. What is the measure of the angle?

- a)  $36^\circ$ .
- b)  $18^\circ$ .
- c)  $45^\circ$ .
- d) None of these.

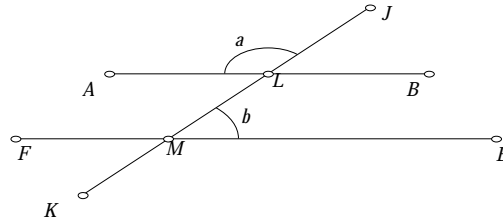
4. If two lines in the Euclidean Plane are parallel, then

- a) these lines intersect at right angles.
- b) these lines are equivalent.
- c) these lines eventually intersect.
- d) None of these.

5. Suppose a geometric object  $A$  is congruent to a geometric object  $B$ , and  $B$  is congruent to a geometric object  $C$ . Which property of congruence in Euclidean geometry allows us to say that  $A$  is congruent to  $C$ ?

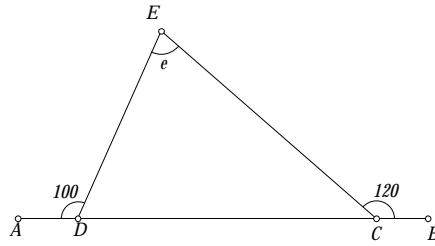
- a) Reflexive.
- b) Transitive.
- c) Additive.
- d) None of these.

6. In the figure to the right, suppose that the segments  $\overline{AB}$  and  $\overline{FE}$  are parallel and  $m\angle a = 120^\circ$ . Then,



- a)  $m\angle b = 120^\circ$ .                      b)  $m\angle b = 60^\circ$ .  
 c)  $m\angle b$  cannot be found.            d) None of these.

7. In the figure to the right, suppose that  $m\angle ADE = 100^\circ$ ,  $m\angle BCE = 120^\circ$ , and  $m\angle DEC = e^\circ$ . Then,



- a)  $e = 120$ .                                      b)  $e = (100 + 120)/2 = 110$ .  
 c)  $e = 40$ .                                        d) None of these.

8. Suppose two lines in the Euclidean Plane are perpendicular. Then, these lines

- a) never intersect.                              b) may intersect at exactly one point, or not at all.  
 c) will intersect at exactly one point.      d) None of these.

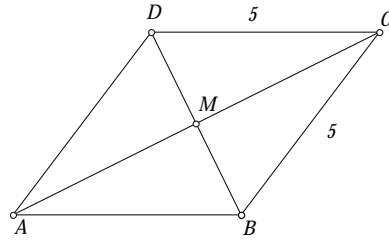
9. An isosceles triangle

- a) has three equal interior angles.      b) has sides that are all of different lengths.  
 c) has two interior angles of measure greater than  $90^\circ$ .      d) None of these.

10. In the Euclidean Plane, the set of all points that lie a distance of 2 units from the origin is

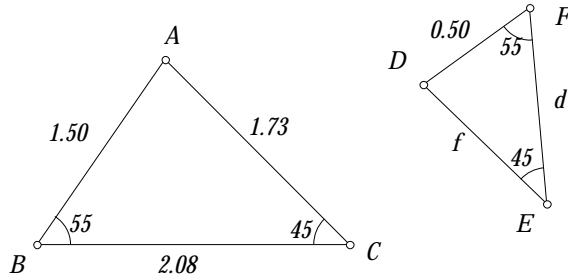
- a) two points.                                      b) the straight line from 0 to 2.  
 c) the circle centered at the origin, having radius 2 units.      d) None of these.

11. The quadrilateral  $ABCD$  to the right is a rhombus. If the sides of  $ABCD$  have length 5 inches, and the lengths of the diagonals are  $AC = 8$  inches and  $BD = 6$  inches, then the area of  $ABCD$  is



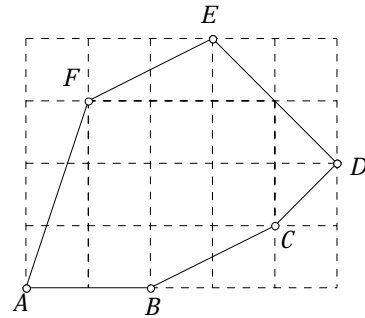
- a) 25 square inches.                      b) 12 square inches.  
 c) 12 cubic inches.                      d) None of these.

12. In the triangles to the right, angular measure is in degrees and length is measured in inches. Find the length of  $f$ .



- a)  $f \approx 0.58$  inches inches.                      b) The length  $f$  cannot be found.  
 c)  $f \approx 0.87$  inches                      d) None of these.

13. In the figure to the right, each small dashed square has dimensions 1 inch by 1 inch. Find the area of the region enclosed by the hexagon  $ABCDEF$ .

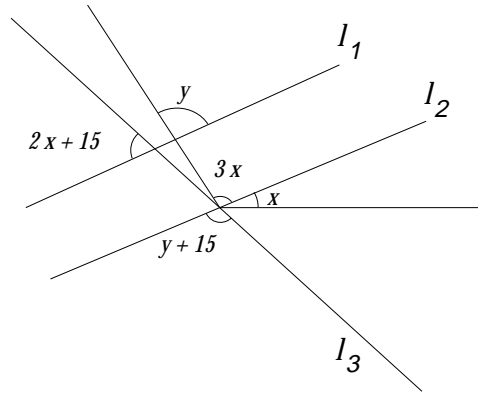


- a) The area of  $ABCDEF$  cannot be found.                      b) 7 square inches.  
 c) 10 square inches.                      d) None of these.

14. The geometric mean of two numbers is 8. Find these two numbers if one of them is four times the other.

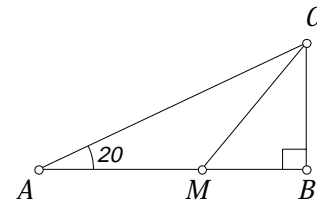
- a) 10 and 40.                      b) 2 and 8.  
 c) 4 and 16.                      d) None of these.

15. In the figure to the right, the lines  $l_1$  and  $l_2$  are parallel and cut by transversal  $l_3$ . Find the angular measures  $m\angle x$  and  $m\angle y$  in degrees.



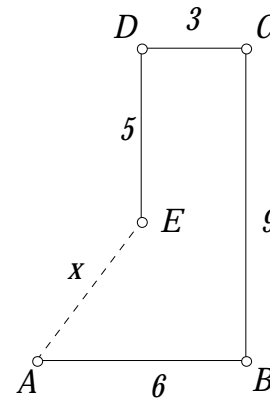
- a) The measures cannot be found.    b)  $m\angle x = 30^\circ$  and  $m\angle y = 90^\circ$ .  
 c)  $m\angle x = 20^\circ$  and  $m\angle y = 75^\circ$ .    d) None of these.

16. In the right triangle  $\triangle ABC$  shown to the right, suppose  $MA = MC$  and  $m\angle CAM = 20^\circ$ . Then,



- a)  $m\angle MCB = 40^\circ$     b)  $AM = MB$   
 c)  $m\angle MCB = 50^\circ$     d) None of these.

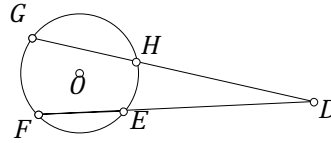
17. Residents of town  $A$  have two ways to get to town  $E$  (see figure to the right). They can drive 6 miles East to town  $B$ , then 9 miles North to town  $C$ , then 3 miles West to town  $D$ , and finally, 5 miles South to town  $E$ . Or, they can ride a bike directly to town  $E$  along a bike trail that is  $x$  miles long. The average driving speed is 40 mph and the average biking speed is 15 mph. Assuming good weather, is it quicker for residents of town  $A$  to drive, or bike to town  $E$ ?



- a) Driving is quicker.    b) Biking is quicker.  
 c) Both take the same amount of time.    d) None of these.

18. In the figure to the right, if  $m\angle GF = 80^\circ$  and  $m\angle EH = 50^\circ$ , then  $m\angle D$  equals

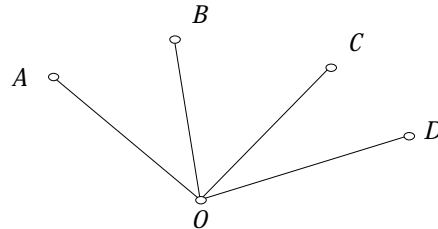
- a)  $30^\circ$ .                      b)  $130^\circ$ .  
 c)  $15^\circ$                         d) None of these.



19. Let  $x$  and  $y$  be real numbers. A counter-example to show that the statement “If  $x \leq y$  then  $x^2 \leq y^2$ ” is false is

- a)  $x = -1, y = 1$ .                      b)  $x = -2, y = 1$ .  
 c) No counter example, the statement is true.                      d) None of these.

20. In the figure to the right,  $m\angle AOB = m\angle DOC$ . Which of the following properties is used to prove that  $m\angle AOC = m\angle DOB$ ?



- a) The addition property of equality.                      b) The reflexive property of equality.  
 c) The multiplication property of equality.                      d) None of these.

21. A plane takes off from Saint Cloud, MN airport and heads due North for 30 minutes. The pilot then heads  $N 30^\circ W$  for 20 minutes and then due West for 10 minutes, after which she turns due South and lands 5 minutes later at Lake Wobegon, MN airport. If there is no wind, and the plane flies an average speed of 120 mph, what is the shortest distance between Saint Cloud and Lake Wobegon?

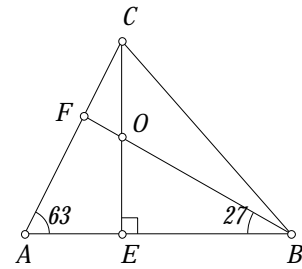
- a) Approximately 130 miles.                      b) Approximately 144.64 miles.  
 c) Approximately 93.62 miles.                      d) None of these.

22. Which of the following **cannot** happen:  
 If two planes in space are cut by a third plane in space, then the resulting lines of intersection

- a) are perpendicular.                      b) are parallel.  
 c) are coincident.                      d) None of these.

23. Refer to the figure below. Which of the following statements is **not** true?

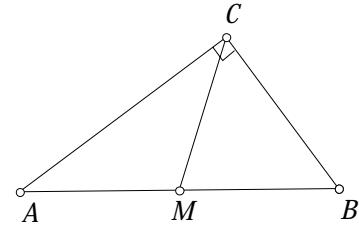
- a)  $\triangle ABF \sim \triangle ACE$ .                      b)  $m\angle AFB = 90^\circ$   
 c)  $m\angle COB = 117^\circ$                       d) None of these.



24. Suppose that  $\overline{AB}$  is one side of a regular  $n$ -gon with  $n > 4$ , and the sides adjacent to  $\overline{AB}$  are extended to meet at the point  $I$ . Find  $m\angle AIB$  in terms of  $n$ ?

- a) The answer cannot be found.                      b)  $m\angle AIB = \frac{360^\circ}{n}$ .  
 c)  $m\angle AIB = \frac{180(n-4)^\circ}{n}$ .                      d) None of these.

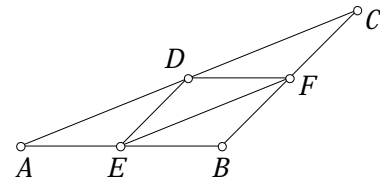
25. In the triangle  $\triangle ABC$  given to the right, suppose that  $M$  is the midpoint of  $\overline{AB}$  and  $m\angle ACB = 90^\circ$ . Which of the following statements are true.



- a) The points  $A$ ,  $B$  and  $C$  lie on the circle centered at  $M$ .                      b)  $m\angle MAC = m\angle MCA$ .  
 c) Both statements a) and b) are true.                      d) None of these.

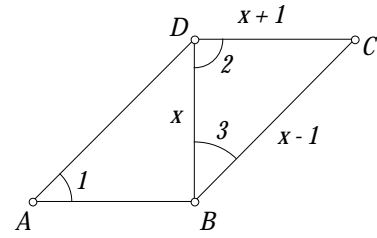
26. In the figure to the right, suppose that  $D$  is the midpoint of  $AC$ ,  $AE = DF$ , and  $ED = FC$ . Which of the following statements is true?

- a)  $\triangle DEF$  is an isosceles triangle.                      b)  $EBFD$  is a square.  
 c)  $EF = AD$ .                      d) None of these.



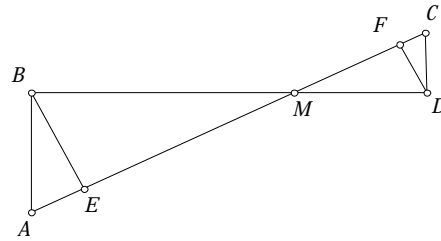


32. Refer to the figure on the right (not to scale). Suppose  $\overline{DC} \parallel \overline{AB}$ ,  $\overline{AD} \parallel \overline{BC}$ , and the numbers 1, 2, and 3 represent angles. Arrange these three angles in the order of the magnitude their respective measures.



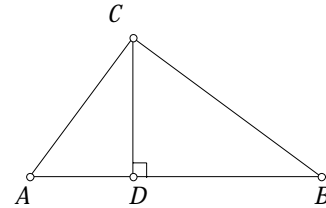
- a)  $m\angle 3 > m\angle 2 > m\angle 1$                       b)  $m\angle 1 > m\angle 2 > m\angle 3$   
c)  $m\angle 3 > m\angle 1 > m\angle 2$                       d) None of these.

33. In the figure to the right, suppose that the sides  $\overline{BE}$  and  $\overline{DF}$  are parallel, and that  $m\angle ABE = m\angle CDF$ . Which triangles in this figure are similar?



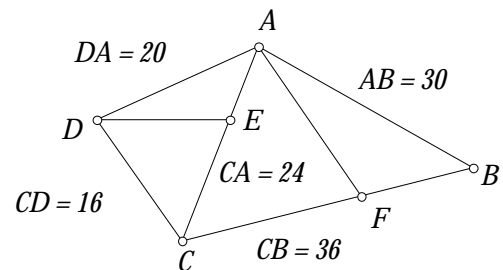
- a)  $\triangle ABE \sim \triangle CDF$  only.                      b)  $\triangle BEM \sim \triangle DFM$  only.  
c)  $\triangle ABM \sim \triangle AEB$  only.                      d) None of these.

34. In the figure to the right, the segments  $\overline{AB}$  and  $\overline{DC}$  are perpendicular. What can be said about the triangles  $\triangle ADC$  and  $\triangle BDC$ ?



- a)  $\triangle ADC \sim \triangle BDC$ .                      b)  $\triangle ADC \sim \triangle ACB$ .  
c)  $\triangle ACB \sim \triangle BDC$ .                      d) None of these.

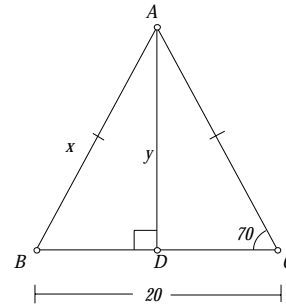
35. Which of the two triangles are similar in the figure to the right?



- a)  $\triangle DEA \sim \triangle AFB$ .                      b)  $\triangle CDE \sim \triangle CAF$ .  
c)  $\triangle CDA \sim \triangle CAB$ .                      d) None of these.

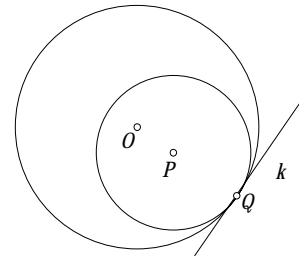


41. Find the value of the variable  $x$  in the figure to the right if  $AB = AC$  and  $AD \perp BC$ .



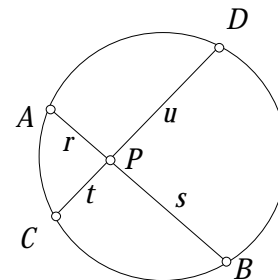
- a)  $x \approx 12.22$ .                      b)  $x \approx 24.44$ .  
 c)  $x = 10$ .                              d) None of these.

42. Refer to the figure on the right. If the line  $k$  is tangent to  $\odot O$  and  $\odot P$  at  $Q$ , which one of the following is true about  $\odot O$  and  $\odot P$ .



- a)  $\odot O$  and  $\odot P$  are concentric circles.      b)  $\odot O$  and  $\odot P$  are externally tangent.  
 c)  $\odot O$  and  $\odot P$  are internally tangent.      d) None of these.

43. In the figure to the right  $r, s, t$ , and  $u$  are measures of length. Which of the following is true.



- a)  $r + u = t + s$ .                      b)  $s + u = 2(r + t)$ .  
 c)  $r \cdot s = t \cdot u$ .                      d) None of these.

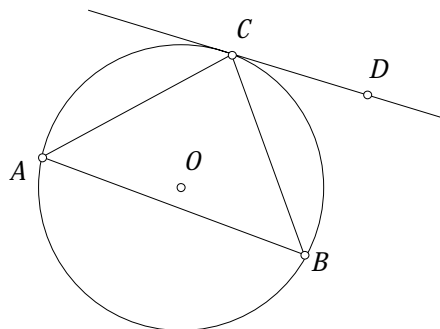
44. The surface area of a sphere of radius  $r$  units is

- a)  $\pi r^2$ .                                      b)  $\frac{4}{3}\pi r^3$ .  
 c)  $4\pi r$ .                                      d) None of these.

45. Suppose  $C$  is a solid cube with sides of length  $x$  and suppose  $D$  is a solid cube with sides of length  $(x + 5)$ . Which of the following is true.

- a) The surface area of  $D$  is 25 square units greater than that of  $C$ .  
 b)  $C$  and  $D$  are congruent.  
 c) The volume of  $D$  is 5 times the volume of  $C$ .  
 d) None of these.

46. In the figure to the right,  $\overline{CD}$  is tangent to  $\odot O$  at  $C$ , and  $m\angle BAC = 45^\circ$ . Find  $m\angle BCD$ .

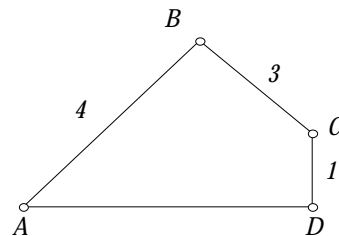


- a)  $m\angle BCD = 90^\circ$ .  
 b)  $m\angle BCD$  cannot be found.  
 c)  $m\angle BCD = 45^\circ$ .  
 d) None of these.

47. To circumscribe a circle about  $\triangle ABC$ , draw the circle centered at  $O$  with radius  $OA$ , where

- a)  $O$  is the intersection of the perpendicular bisectors of  $\overline{AC}$  and  $\overline{AB}$ .  
 b)  $O$  is any point inside  $\triangle ABC$ .  
 c)  $O$  lies halfway between  $A$  and  $B$ .  
 d) None of these.

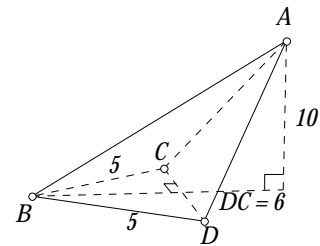
48. In the quadrilateral  $ABCD$  to the right,  $m\angle B = m\angle D = 90^\circ$ , and the lengths of the sides are as shown. Find the area enclosed by  $ABCD$ .



- a)  $\sqrt{12}$  square units.  
 b) 7.5 square units.  
 c)  $6\sqrt{6}$  square units.  
 d) None of these.

49. Find the volume of the solid region  $ABCD$  in the figure below.

- a) 250.3 cubic units.                      b) 50 cubic units.  
 c) 100 cubic units.                        d) None of these.



50. Let  $A(5, -4)$  and  $B(-3, 6)$  be points in the Euclidean Plane, and let  $M$  be the midpoint of  $\overline{AB}$ . Find an equation of the line perpendicular to  $\overline{AB}$  that passes through  $M$ .

- a)  $5x - 4y + 1 = 0$ .                      b)  $4x - 5y - 1 = 0$   
 c)  $4x + 5y + 1 = 0$ .                      d) None of these.