Grissom Math Tournament
Geometry Test
January 13, 2007

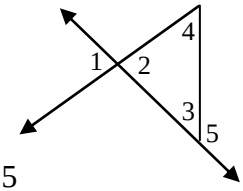
1. ΔGHS is isosceles with vertex angle *S*. If $m\angle G = 3x - 6$ and $m\angle S = 2x$, find $m\angle H$.

   A. 24 B. 46 C. 48 D. 66 E. 90

2. Find the largest possible number of distinct points of intersection for two triangles if no side of either triangle is collinear with a side of the other.

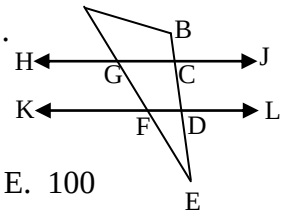
   A. 2 B. 3 C. 4 D. 6 E. 8

3. Find *k* if $\angle 2 \cong \angle 4$ and $m\angle 5 = k(m\angle 1)$.



   A. 1 B. 2 C. 3 D. 4 E. 5

4. In the figure, $\overleftrightarrow{HJ} \parallel \overleftrightarrow{KL}$, $m\angle HGF = 110°$ and $m\angle BCJ = 100°$. Find $m\angle DEF$.

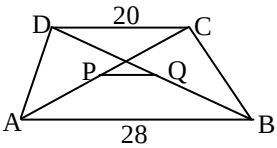


   A. 10 B. 30 C. 70 D. 80 E. 100

5. $\angle R$ and $\angle S$ are complementary angles, and $\angle U$ and $\angle V$ are also complementary angles. If $m\angle R = y - 2$, $m\angle S = 2x + 3$, $m\angle U = 2x - y$, and $m\angle V = x - 1$, find $x+y$.

   A. 17 B. 19 C. 36 D. 53 E. 90

6. In trapezoid *ABCD*, *AP* = *PC* and *BQ* = *QD*. Find *PQ* if *AB* = 28 and *DC* = 20.

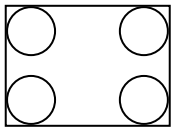


   A. 4 B. 5 C. 9 D. 14 E. 24

7. A rectangular box has width of 4 inches, length of 6 inches and height of 12 inches. What is the maximum number of cubes with edge 2 that will fill the box?

   A. 24 B. 27 C. 36 D. 48 E. 144

8. Four circles, each with a radius of 1, are tangent to sides of a rectangle at the corners. The distances between the centers are 3, 4 and 5 units. Find the area of the rectangle.

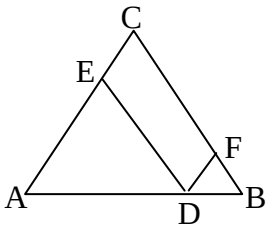


   A. 7 B. 12 C. 30 D. 42 E. 56

9. Find the ratio of the measure of an interior angle of a regular pentagon to the interior angle of a regular decagon.

A. 1:2 B. 2:1 C. 3:4 D. 3:8 E. 4:3

10. ΔABC is isosceles with $AC=BC$, $\overline{ED} \parallel \overline{CB}$ and $\overline{DF} \parallel \overline{AC}$. Find the perimeter of parallelogram *CEDF*.



A. $AC + AB$ B. $AC + BC$ C. $2(AB)$ D. $2(AE)$ E. $2(AD)$

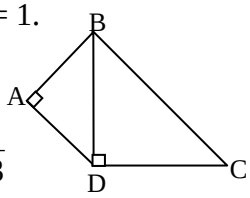
11. Each of two equilateral triangles is rotated about its altitude forming two right circular cones. Find the ratio of the volume of the larger cone to the volume of the smaller cone if the area of the larger triangle is $64\sqrt{3}$ and the smaller triangle is $36\sqrt{3}$.

A. 3:4 B. 4:3 C. 16:9 D. 27:64 E. 64:27

12. Find the standard form of the equation of the perpendicular bisector of (2,1) and (-1, -2).

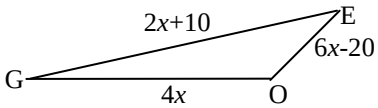
A. x - y = -1 B. x - y = 1 C. x+y = 0 D. x+y = 1 E. x+y = -1

13. In the given figure, ΔABD is an isosceles right triangle, $m\angle BCD = 30°$ and $AB = 1$. Find BC-BD.



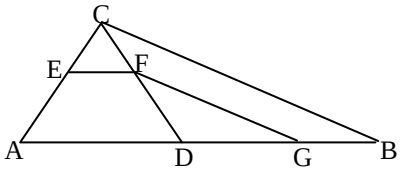
A. 1 B. $\sqrt{2}$ C. $\sqrt{6}$ D. $2\sqrt{2}$ E. $2\sqrt{3}$

14. In the given triangle, $m\angle G < m\angle E < m\angle O$. Find the sum for all possible integral values of x.



A. 4 B. 7 C. 9 D. 10 E. 12

15. In the figure, $\overline{EF} \parallel \overline{AD}$ and $\overline{FG} \parallel \overline{CB}$. If AE=6, EC=4 and DB=9, find DG.

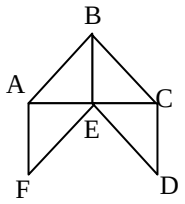


A. $\frac{18}{5}$ B. $\frac{27}{5}$ C. 6 D. 12 E. $\frac{27}{2}$

16. In each of 2 rectangles, the length is one more than the width. The ratio of the areas of these two rectangles is 3:5. If the sum of their perimeters is 32, find the sum of their areas.

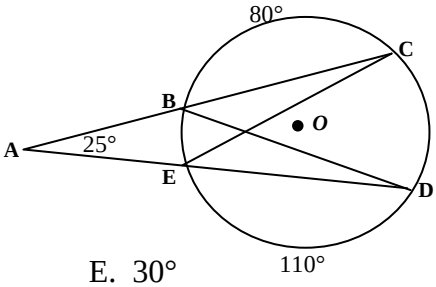
A. 24 B. 28 C. 30 D. 32 E. 34

17. Four identical isosceles right triangles, each with an area of 98, are joined, without overlapping, as shown. Find the perimeter of polygon ABCDEF.



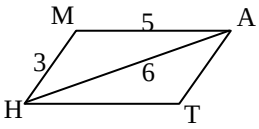
A. $28(2\sqrt{2}+1)$ B. 84 C. $56\sqrt{2}$ D. $56(\sqrt{2}+1)$ E. $28(2\sqrt{3}+1)$

18. Given circle *O*, find $m\angle BDE$.



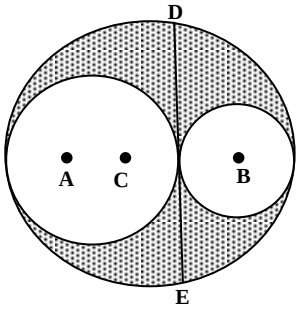
A. 10° B. 15° C. 20° D. 25° E. 30°

19. If *MATH* is a parallelogram with the given measurements and *X* the midpoint of $\overline{AH}$, find *MX*.



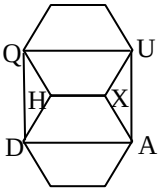
A. $\sqrt{2}$ B. $2\sqrt{2}$ C. $4\sqrt{2}$ D. $4\sqrt{3}$ E. 8

20. Circles A and B are externally tangent to one another and internally tangent to circle C. Points A, B and C are collinear and *DE* is externally tangent to both circles A and B. If $DE = 12$ and the ratio of the area of circle A to circle B is 4:1, find the area of the shaded region.



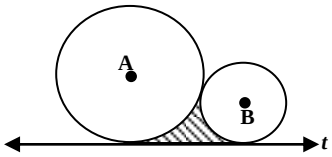
A. 12π B. 18π C. 24π D. 30π E. 36π

21. Two regular hexagons share the side $\overline{HX}$. If the perimeter of the quadrilateral *QUAD* is $56+28\sqrt{3}$, find the area of ΔQHD.



A. $\frac{49\sqrt{3}}{2}$ B. $49\sqrt{3}$ C. $63\sqrt{3}$ D. $98\sqrt{3}$ E. $196\sqrt{3}$

22. Circles A and B are externally tangent to each other and to line *t*. Find the area of the shaded region bounded by the circles and the line if AB = 12 and the radius of circle A is three times that of circle B.

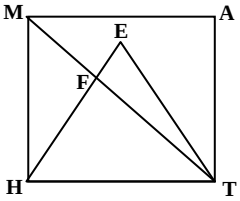


A. $18\sqrt{3}-\frac{33\pi}{2}$ B. $18\sqrt{3}-33\pi$ C. $36\sqrt{3}-\frac{33\pi}{2}$ D. $36\sqrt{3}-33\pi$ E. $\frac{33\sqrt{3}}{2}-16\pi$

23. An equilateral triangle with area $48\sqrt{3}$ is folded along a median to one of its sides. The new triangle is then inscribed in a circle. Find the area of the circle.

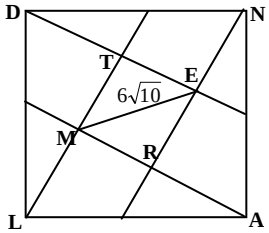
A. 36π B. 48π C. 64π D. 72π E. 192π

24. Given the square *MATH* with equilateral ΔTHE with *F* being the point of intersection of $\overline{EH}$ and the diagonal $\overline{MT}$. If each side of the square measures $1+\sqrt{3}$, find the area of ΔTHF.



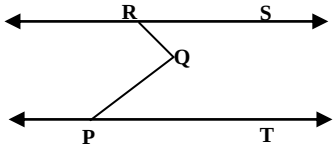
A. $\frac{1}{2}(3+\sqrt{3})$ B. $3+\sqrt{3}$ C. $3+2\sqrt{3}$ D. $2(3+\sqrt{3})$ E. None of these.

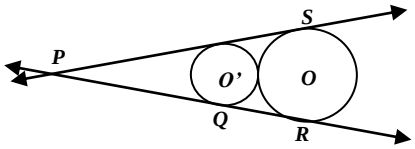
25. In the figure, segments extend from the corners of square LAND to the midpoints of its sides, forming square TERM. Find *LA* if $EM=6\sqrt{10}$.



A. 15 B. $12\sqrt{5}$ C. 30 D. $10\sqrt{10}$ E. $18\sqrt{5}$

TB1. In the figure, $\overleftrightarrow{RS} \parallel \overleftrightarrow{PT}$, $m\angle PQR = 70°$, $m\angle QRS = 45°$, find $m\angle QPT$.



TB2. The perimeter of a triangle is 40. One side is cut by the bisector of the opposite angle into two segments having lengths 6 and 10. Find the twice the length of the shortest side of the triangle divided by 3.

TB3. Circles O and O' with radii of lengths 5 and 3 are externally tangent. If $\overleftrightarrow{SP}$ and $\overleftrightarrow{RP}$ are tangents of circles *O* and *O*' that intersect at P, find *(PQ)(PS)*.