1 The vertices of square $RSTV$ have coordinates $R(-1,5)$, $S(-3,1)$, $T(-7,3)$, and $V(-5,7)$. What is the perimeter of $RSTV$?
   1) $\sqrt{20}$
   2) $\sqrt{40}$
   3) $4\sqrt{20}$
   4) $4\sqrt{40}$

2 In the diagram below, the circle has a radius of 25 inches. The area of the **unshaded** sector is $500\pi$ in$^2$. Determine and state the degree measure of angle $Q$, the central angle of the shaded sector.

3 If $ABCD$ is a parallelogram, which statement would prove that $ABCD$ is a rhombus?
   1) $\angle ABC \cong \angle CDA$
   2) $AC \cong BD$
   3) $AC \perp BD$
   4) $AB \perp CD$

4 New streetlights will be installed along a section of the highway. The posts for the streetlights will be 7.5 m tall and made of aluminum. The city can choose to buy the posts shaped like cylinders or the posts shaped like rectangular prisms. The cylindrical posts have a hollow core, with aluminum 2.5 cm thick, and an outer diameter of 53.4 cm. The rectangular-prism posts have a hollow core, with aluminum 2.5 cm thick, and a square base that measures 40 cm on each side. The density of aluminum is 2.7 g/cm$^3$, and the cost of aluminum is $0.38 per kilogram. If all posts must be the same shape, which post design will cost the town less? How much money will be saved per streetlight post with the less expensive design?

5 The regular polygon below is rotated about its center.

Which angle of rotation will carry the figure onto itself?
   1) $60^\circ$
   2) $108^\circ$
   3) $216^\circ$
   4) $540^\circ$
6. An equation of circle $O$ is $x^2 + y^2 + 4x - 8y = -16$. The statement that best describes circle $O$ is the
   1) center is $(2, -4)$ and is tangent to the x-axis
   2) center is $(2, -4)$ and is tangent to the y-axis
   3) center is $(-2, 4)$ and is tangent to the x-axis
   4) center is $(-2, 4)$ and is tangent to the y-axis

7. Skye says that the two triangles below are congruent. Margaret says that the two triangles are similar.

Are Skye and Margaret both correct? Explain why.

8. In the diagram shown below, $PA$ is tangent to circle $T$ at $A$, and secant $PBC$ is drawn where point $B$ is on circle $T$.

If $PB = 3$ and $BC = 15$, what is the length of $PA$?
   1) $3\sqrt{5}$
   2) $3\sqrt{6}$
   3) 3
   4) 9

9. In the diagram below, a sequence of rigid motions maps $ABCD$ onto $JKLM$.

If $m\angle A = 82^\circ$, $m\angle B = 104^\circ$, and $m\angle L = 121^\circ$, the measure of $\angle M$ is
   1) 53°
   2) 82°
   3) 104°
   4) 121°

10. The image of $\triangle DEF$ is $\triangle D'E'F'$. Under which transformation will the triangles not be congruent?
    1) a reflection through the origin
    2) a reflection over the line $y = x$
    3) a dilation with a scale factor of 1 centered at $(2,3)$
    4) a dilation with a scale factor of $\frac{3}{2}$ centered at the origin

11. Under which transformation would $\triangle A'B'C'$, the image of $\triangle ABC$, not be congruent to $\triangle ABC$?
    1) reflection over the y-axis
    2) rotation of $90^\circ$ clockwise about the origin
    3) translation of 3 units right and 2 units down
    4) dilation with a scale factor of 2 centered at the origin
12. The base of a pyramid is a rectangle with a width of 4.6 cm and a length of 9 cm. What is the height, in centimeters, of the pyramid if its volume is 82.8 cm³?

1) 6
2) 2
3) 9
4) 18

13. In the diagram below, two concentric circles with center O, and radii OC, OD, OGE, and ODF are drawn.

If OC = 4 and OE = 6, which relationship between the length of arc EF and the length of arc CD is always true?

1) The length of arc EF is 2 units longer than the length of arc CD.
2) The length of arc EF is 4 units longer than the length of arc CD.
3) The length of arc EF is 1.5 times the length of arc CD.
4) The length of arc EF is 2.0 times the length of arc CD.

14. A parallelogram is always a rectangle if

1) the diagonals are congruent
2) the diagonals bisect each other
3) the diagonals intersect at right angles
4) the opposite angles are congruent

15. In the diagram below, AD intersects BE at C, and AB || DE.

If CD = 6.6 cm, DE = 3.4 cm, CE = 4.2 cm, and BC = 5.25 cm, what is the length of AC, to the nearest hundredth of a centimeter?

1) 2.70
2) 3.34
3) 5.28
4) 8.25

16. A regular pyramid has a square base. The perimeter of the base is 36 inches and the height of the pyramid is 15 inches. What is the volume of the pyramid in cubic inches?

1) 180
2) 405
3) 540
4) 1215
17 The coordinates of the endpoints of $\overline{AB}$ are $A(2,3)$ and $B(5,-1)$. Determine the length of $A'B'$, the image of $\overline{AB}$, after a dilation of $\frac{1}{2}$ centered at the origin. [The use of the set of axes below is optional.]

18 In the diagram below of $\triangle ABC$ and $\triangle XYZ$, a sequence of rigid motions maps $\angle A$ onto $\angle X$, $\angle C$ onto $\angle Z$, and $\overline{AC}$ onto $\overline{XZ}$.

Determine and state whether $\overline{BC} \cong \overline{YZ}$. Explain why.

19 Bob places an 18-foot ladder 6 feet from the base of his house and leans it up against the side of his house. Find, to the nearest degree, the measure of the angle the bottom of the ladder makes with the ground.

20 The pyramid shown below has a square base, a height of 7, and a volume of 84.

What is the length of the side of the base?
1) 6
2) 12
3) 18
4) 36

21 In parallelogram $ABCD$ shown below, the bisectors of $\angle ABC$ and $\angle DCB$ meet at $E$, a point on $\overline{AD}$.

If $m\angle A = 68^\circ$, determine and state $m\angle BEC$.
22. As shown in the diagram below, \( \overrightarrow{ABC} \parallel \overrightarrow{EFG} \) and \( BF \cong EF \).

If \( m\angle CBF = 42.5^\circ \), then \( m\angle EBF \) is
1) 42.5°  
2) 68.75°  
3) 95°  
4) 137.5°

23. The equation of a circle is \( x^2 + y^2 - 6x + 2y = 6 \). What are the coordinates of the center and the length of the radius of the circle?
1) center \((-3, 1)\) and radius 4  
2) center \((3, -1)\) and radius 4  
3) center \((-3, 1)\) and radius 16  
4) center \((3, -1)\) and radius 16

24. The line represented by the equation \( 4y = 3x + 7 \) is transformed by a dilation centered at the origin. Which linear equation could represent its image?
1) \( 3x - 4y = 9 \)  
2) \( 3x + 4y = 9 \)  
3) \( 4x - 3y = 9 \)  
4) \( 4x + 3y = 9 \)

25. Triangle \(QRS\) is graphed on the set of axes below.

On the same set of axes, graph and label \( \triangle Q'R'S' \), the image of \( \triangle QRS \) after a dilation with a scale factor of \( \frac{3}{2} \) centered at the origin. Use slopes to explain why \( Q'R'\parallel QR \).

26. In the diagram below of circle \( O \), chord \( CD \) is parallel to diameter \( AOB \) and \( m\angle CD = 130^\circ \).

What is \( m\angle AC \)?
1) 25  
2) 50  
3) 65  
4) 115
27 In the diagram below, $\overline{AC}$ has endpoints with coordinates $A(-5,2)$ and $C(4,-10)$.

If $B$ is a point on $\overline{AC}$ and $AB:BC = 1:2$, what are the coordinates of $B$?

1) $(-2, -2)$
2) $\left(\frac{1}{2}, -4\right)$
3) $\left(0, \frac{-14}{3}\right)$
4) $(1, -6)$

28 Randy's basketball is in the shape of a sphere with a maximum circumference of 29.5 inches. Determine and state the volume of the basketball, to the nearest cubic inch.

29 Given $\triangle ABC \cong \triangle DEF$, which statement is not always true?

1) $BC \cong DF$
2) $m\angle A = m\angle D$
3) area of $\triangle ABC = \text{area of } \triangle DEF$
4) perimeter of $\triangle ABC = \text{perimeter of } \triangle DEF$

30 In the diagram below of $\triangle ABC$, $\angle ABC$ is a right angle, $AC = 12$, $AD = 8$, and altitude $BD$ is drawn.

What is the length of $\overline{BC}$?

1) $4\sqrt{2}$
2) $4\sqrt{3}$
3) $4\sqrt{5}$
4) $4\sqrt{6}$

31 In the diagram of right triangle $ADE$ below, $BC \parallel DE$.

Which ratio is always equivalent to the sine of $\angle A$?

1) $\frac{AD}{DE}$
2) $\frac{AE}{AD}$
3) $\frac{BC}{AB}$
4) $\frac{AB}{AC}$
32 In the diagram below, $\triangle ABC \cong \triangle DEF$.

Which sequence of transformations maps $\triangle ABC$ onto $\triangle DEF$?
1) a reflection over the $x$-axis followed by a translation
2) a reflection over the $y$-axis followed by a translation
3) a rotation of $180^\circ$ about the origin followed by a translation
4) a counterclockwise rotation of $90^\circ$ about the origin followed by a translation

33 Rhombus $STAR$ has vertices $S(-1,2)$, $T(2,3)$, $A(3,0)$, and $R(0,-1)$. What is the perimeter of rhombus $STAR$?
1) $\sqrt{34}$
2) $4\sqrt{34}$
3) $\sqrt{10}$
4) $4\sqrt{10}$

34 Triangle $A'B'C'$ is the image of triangle $ABC$ after a translation of 2 units to the right and 3 units up. Is triangle $ABC$ congruent to triangle $A'B'C'$? Explain why.

35 In the circle below, $\overline{AB}$ is a chord. Using a compass and straightedge, construct a diameter of the circle. [Leave all construction marks.]

36 In the diagram below, tangent $\overline{DA}$ and secant $\overline{DBC}$ are drawn to circle $O$ from external point $D$, such that $\overline{AC} \cong \overline{BC}$.

If $m\angle BC = 152^\circ$, determine and state $m\angle D$. 

37 Aliyah says that when the line $4x + 3y = 24$ is dilated by a scale factor of 2 centered at the point $(3,4)$, the equation of the dilated line is $y = -\frac{4}{3}x + 16$. Is Aliyah correct? Explain why.

38 Using a compass and straightedge, construct the median to side $\overline{AC}$ in $\triangle ABC$ below. [Leave all construction marks.]

39 In the diagram below of $\triangle HAR$ and $\triangle NTY$, angles $H$ and $N$ are right angles, and $\triangle HAR \sim \triangle NTY$.

If $AR = 13$ and $HR = 12$, what is the measure of angle $Y$, to the nearest degree?
1) 23°
2) 25°
3) 65°
4) 67°

40 The diagram shows rectangle $ABCD$, with diagonal $\overline{BD}$.

What is the perimeter of rectangle $ABCD$, to the nearest tenth?
1) 28.4
2) 32.8
3) 48.0
4) 62.4
41 A rectangular in-ground pool is modeled by the prism below. The inside of the pool is 16 feet wide and 35 feet long. The pool has a shallow end and a deep end, with a sloped floor connecting the two ends. Without water, the shallow end is 9 feet long and 4.5 feet deep, and the deep end of the pool is 12.5 feet long.

If the sloped floor has an angle of depression of 16.5 degrees, what is the depth of the pool at the deep end, to the nearest tenth of a foot? Find the volume of the inside of the pool to the nearest cubic foot. A garden hose is used to fill the pool. Water comes out of the hose at a rate of 10.5 gallons per minute. How much time, to the nearest hour, will it take to fill the pool 6 inches from the top? [1 ft³=7.48 gallons]

42 A bakery sells hollow chocolate spheres. The larger diameter of each sphere is 4 cm. The thickness of the chocolate of each sphere is 0.5 cm. Determine and state, to the nearest tenth of a cubic centimeter, the amount of chocolate in each hollow sphere. The bakery packages 8 of them into a box. If the density of the chocolate is 1.308 g/cm³, determine and state, to the nearest gram, the total mass of the chocolate in the box.

43 In right triangle $ABC$, hypotenuse $AB$ has a length of 26 cm, and side $BC$ has a length of 17.6 cm. What is the measure of angle $B$, to the nearest degree?
1) 48°
2) 47°
3) 43°
4) 34°

44 Sue believes that the two cylinders shown in the diagram below have equal volumes. Is Sue correct? Explain why.
45 In the coordinate plane, the vertices of triangle $PAT$ are $P(-1, -6)$, $A(-4, 5)$, and $T(5, -2)$. Prove that $\triangle PAT$ is an isosceles triangle. State the coordinates of $R$ so that quadrilateral $PART$ is a parallelogram. Prove that quadrilateral $PART$ is a parallelogram. [The use of the set of axes below is optional.]

46 Triangle $ABC$, with vertices at $A(0,0)$, $B(3,5)$, and $C(0,5)$, is graphed on the set of axes shown below. Which figure is formed when $\triangle ABC$ is rotated continuously about $BC$?

47 A parallelogram must be a rhombus if its diagonals
1) are congruent
2) bisect each other
3) do not bisect its angles
4) are perpendicular to each other
48 In the diagram below of \( \triangle PQR \), \( ST \) is drawn parallel to \( PR \), \( PS = 2 \), \( SQ = 5 \), and \( TR = 5 \).

[Diagram of \( \triangle PQR \) with \( ST \) parallel to \( PR \)]

What is the length of \( QR \)?
1) 7
2) 2
3) \( 12 \frac{1}{2} \)
4) \( 17 \frac{1}{2} \)

49 In the diagram below of circle \( O \), chords \( AB \) and \( CD \) intersect at \( E \).

[Diagram of circle \( O \) with chords \( AB \) and \( CD \) intersecting at \( E \)]

If \( \widehat{AC} = 72^\circ \) and \( \angle AEC = 58^\circ \), how many degrees are in \( \widehat{DB} \)?
1) \( 108^\circ \)
2) \( 65^\circ \)
3) \( 44^\circ \)
4) \( 14^\circ \)

50 In square \( GEOM \), the coordinates of \( G \) are \((2, -2)\) and the coordinates of \( O \) are \((-4, 2)\). Determine and state the coordinates of vertices \( E \) and \( M \). [The use of the set of axes below is optional.]

[Diagram of square \( GEOM \) with coordinates labeled]

51 When instructed to find the length of \( HJ \) in right triangle \( HJG \), Alex wrote the equation \( \sin 28^\circ = \frac{HJ}{20} \) while Marlene wrote \( \cos 62^\circ = \frac{HJ}{20} \). Are both students’ equations correct? Explain why.

[Diagram of right triangle \( HJG \) with angle labeled]
52 Triangle $ABC$ and triangle $ADE$ are graphed on the set of axes below.

![Diagram of triangles ABC and ADE]

Describe a transformation that maps triangle $ABC$ onto triangle $ADE$. Explain why this transformation makes triangle $ADE$ similar to triangle $ABC$.

54 Line segment $CD$ is the altitude drawn to hypotenuse $EF$ in right triangle $ECF$. If $EC = 10$ and $EF = 24$, then, to the nearest tenth, $ED$ is

1) 4.2
2) 5.4
3) 15.5
4) 21.8

55 In the diagram below, line $m$ is parallel to line $n$. Figure 2 is the image of Figure 1 after a reflection over line $m$. Figure 3 is the image of Figure 2 after a reflection over line $n$.

![Diagram of reflections]

Which single transformation would carry Figure 1 onto Figure 3?

1) a dilation
2) a rotation
3) a reflection
4) a translation

53 In the diagram below, $AEFB \parallel CGD$, and $GE$ and $GF$ are drawn.

![Diagram of parallel lines and segments]

If $m\angle EFG = 32^\circ$ and $m\angle AEG = 137^\circ$, what is $m\angle EGF$?

1) 11°
2) 43°
3) 75°
4) 105°
56. In the diagram below, $\overline{AF}$, and $\overline{DB}$ intersect at $C$, and $\overline{AD}$ and $\overline{FBE}$ are drawn such that $m\angle D = 65^\circ$, $m\angle CBE = 115^\circ$, $DC = 7.2$, $AC = 9.6$, and $FC = 21.6$.

What is the length of $CB$?
1) 3.2  
2) 4.8  
3) 16.2  
4) 19.2

57. The coordinates of the endpoints of $\overline{AB}$ are $A(−8,−2)$ and $B(16,6)$. Point $P$ is on $\overline{AB}$. What are the coordinates of point $P$, such that $AP:PB$ is 3:5?
1) (1,1)  
2) (7,3)  
3) (9,6,3,6)  
4) (6,4,2,8)

58. In the accompanying diagram of right triangle $ABC$, altitude $BD$ is drawn to hypotenuse $\overline{AC}$.

Which statement must always be true?
1) $\frac{AD}{AB} = \frac{BC}{AC}$  
2) $\frac{AD}{AB} = \frac{AB}{AC}$  
3) $\frac{BD}{BC} = \frac{AB}{AD}$  
4) $\frac{AB}{BC} = \frac{BD}{AC}$

59. In the diagram below of right triangle $ABC$, altitude $BD$ is drawn to hypotenuse $\overline{AC}$.

If $BD = 4$, $AD = x − 6$, and $CD = x$, what is the length of $CD$?
1) 5  
2) 2  
3) 8  
4) 11
60. Parallelogram $HAND$ is drawn below with diagonals $HN$ and $AD$ intersecting at $S$. Which statement is always true?

1) $AN = \frac{1}{2} AD$
2) $AS = \frac{1}{2} AD$
3) $\angle AHS \cong \angle ANS$
4) $\angle HDS \cong \angle NDS$

61. In the diagram below, $\overline{DE}$, $\overline{DF}$, and $\overline{EF}$ are midsegments of $\triangle ABC$. The perimeter of quadrilateral $ADEF$ is equivalent to

1) $AB + BC + AC$
2) $\frac{1}{2} AB + \frac{1}{2} AC$
3) $2AB + 2AC$
4) $AB + AC$

62. Given: Trapezoid $JKLM$ with $\overline{JK} \parallel \overline{ML}$
Using a compass and straightedge, construct the altitude from vertex $J$ to $\overline{ML}$. [Leave all construction marks.]

63. A water cup in the shape of a cone has a height of 4 inches and a maximum diameter of 3 inches. What is the volume of the water in the cup, to the nearest tenth of a cubic inch, when the cup is filled to half its height?

1) 1.2
2) 3.5
3) 4.7
4) 14.1

64. Triangle $ABC$ and triangle $DEF$ are drawn below.
If $\overline{AB} \cong \overline{DE}$, $\overline{AC} \cong \overline{DF}$, and $\angle A \cong \angle D$, write a sequence of transformations that maps triangle $ABC$ onto triangle $DEF$. 
65. On the set of axes below, the vertices of \( \triangle PQR \) have coordinates \( P(-6,7), Q(2,1), \) and \( R(-1,-3) \).

What is the area of \( \triangle PQR \)?
1) 10
2) 20
3) 25
4) 50

66. What is an equation of circle \( O \) shown in the graph below?
1) \( x^2 + 10x + y^2 + 4y = -13 \)
2) \( x^2 - 10x + y^2 - 4y = -13 \)
3) \( x^2 + 10x + y^2 + 4y = -25 \)
4) \( x^2 - 10x + y^2 - 4y = -25 \)

67. As shown in the graph below, the quadrilateral is a rectangle.

Which transformation would not map the rectangle onto itself?
1) a reflection over the \( x \)-axis
2) a reflection over the line \( x = 4 \)
3) a rotation of 180° about the origin
4) a rotation of 180° about the point (4,0)

68. In \( \triangle ABC \) shown below, side \( AC \) is extended to point \( D \) with \( \angle DAB = (180 - 3x)^\circ \), \( \angle B = (6x - 40)^\circ \), and \( \angle C = (x + 20)^\circ \).

What is \( \angle BAC \)?
1) 20°
2) 40°
3) 60°
4) 80°
69 If \( \sin(2x + 7) = \cos(4x - 7) \), what is the value of \( x \)?
1) 7
2) 15
3) 21
4) 30

70 The map of a campground is shown below. Campsite \( C \), first aid station \( F \), and supply station \( S \) lie along a straight path. The path from the supply station to the tower, \( T \), is perpendicular to the path from the supply station to the campsite. The length of path \( FS \) is 400 feet. The angle formed by path \( TF \) and path \( FS \) is 72°. The angle formed by path \( TC \) and path \( CS \) is 55°.

Determine and state, to the nearest foot, the distance from the campsite to the tower.

71 Determine and state the coordinates of the center and the length of the radius of a circle whose equation is \( x^2 + y^2 - 6x = 56 - 8y \).

What is an equation of the line that passes through the point \((6,8)\) and is perpendicular to a line with equation \( y = \frac{3}{2}x + 5 \)?
1) \( y - 8 = \frac{3}{2}(x - 6) \)
2) \( y - 8 = -\frac{2}{3}(x - 6) \)
3) \( y + 8 = \frac{3}{2}(x + 6) \)
4) \( y + 8 = -\frac{2}{3}(x + 6) \)

73 To build a handicapped-access ramp, the building code states that for every 1 inch of vertical rise in height, the ramp must extend out 12 inches horizontally, as shown in the diagram below.

What is the angle of inclination, \( x \), of this ramp, to the nearest hundredth of a degree?
1) 4.76
2) 4.78
3) 85.22
4) 85.24
74 Ian needs to replace two concrete sections in his sidewalk, as modeled below. Each section is 36 inches by 36 inches and 4 inches deep. He can mix his own concrete for $3.25 per cubic foot.

How much money will it cost Ian to replace the two concrete sections?

75 In circle $M$ below, diameter $AC$, chords $AB$ and $BC$, and radius $MB$ are drawn.

Which statement is not true?
1) $\triangle ABC$ is a right triangle.
2) $\triangle ABM$ is isosceles.
3) $m\angle BC = m\angle BMC$
4) $m\angle AB = \frac{1}{2} m\angle ACB$

76 Triangle $RJM$ has an area of 6 and a perimeter of 12. If the triangle is dilated by a scale factor of 3 centered at the origin, what are the area and perimeter of its image, triangle $R'J'M'$?
1) area of 9 and perimeter of 15
2) area of 18 and perimeter of 36
3) area of 54 and perimeter of 36
4) area of 54 and perimeter of 108

77 The diagram below shows circle $O$ with radii $OA$ and $OB$. The measure of angle $AOB$ is 120°, and the length of a radius is 6 inches.

Which expression represents the length of arc $AB$, in inches?
1) $\frac{120}{360} (6\pi)$
2) $120(6)$
3) $\frac{1}{3} (36\pi)$
4) $\frac{1}{3} (12\pi)$

78 A machinist creates a solid steel part for a wind turbine engine. The part has a volume of 1015 cubic centimeters. Steel can be purchased for $0.29 per kilogram, and has a density of 7.95 g/cm³. If the machinist makes 500 of these parts, what is the cost of the steel, to the nearest dollar?
79 In the diagram below of right triangle $AED$, $\overrightarrow{BC} \parallel \overrightarrow{DE}$.

Which statement is always true?

1) $\frac{AC}{BC} = \frac{DE}{AE}$
2) $\frac{AB}{AD} = \frac{BC}{DE}$
3) $\frac{AC}{CE} = \frac{BC}{DE}$
4) $\frac{DE}{BC} = \frac{DB}{AB}$

80 In the diagram below, triangle $ACD$ has points $B$ and $E$ on sides $AC$ and $AD$, respectively, such that $\overrightarrow{BE} \parallel \overrightarrow{CD}$, $AB = 1$, $BC = 3.5$, and $AD = 18$.

What is the length of $AE$, to the nearest tenth?

1) 14.0
2) 5.1
3) 3.3
4) 4.0

81 The vertices of quadrilateral $MATH$ have coordinates $M(-4,2)$, $A(-1,-3)$, $T(9,3)$, and $H(6,8)$. Prove that quadrilateral $MATH$ is a parallelogram. Prove that quadrilateral $MATH$ is a rectangle. [The use of the set of axes below is optional.]

82 In the diagram below, $\angle GRS \cong \angle ART$, $GR = 36$, $SR = 45$, $AR = 15$, and $RT = 18$.

Which triangle similarity statement is correct?

1) $\triangle GRS \sim \triangle ART$ by AA.
2) $\triangle GRS \sim \triangle ART$ by SAS.
3) $\triangle GRS \sim \triangle ART$ by SSS.
4) $\triangle GRS$ is not similar to $\triangle ART$. 
83. The vertices of \( \triangle PQR \) have coordinates \( P(2,3) \), \( Q(3,8) \), and \( R(7,3) \). Under which transformation of \( \triangle PQR \) are distance and angle measure preserved?

1) \((x,y) \rightarrow (2x,3y)\)
2) \((x,y) \rightarrow (x + 2, 3y)\)
3) \((x,y) \rightarrow (2x,y + 3)\)
4) \((x,y) \rightarrow (x + 2,y + 3)\)

84. What is an equation of the perpendicular bisector of the line segment shown in the diagram below?

![Diagram](image)

1) \(y + 2x = 0\)
2) \(y - 2x = 0\)
3) \(2y + x = 0\)
4) \(2y - x = 0\)

86. In the diagram below of \( \triangle ABC \), \( D, E \), and \( F \) are the midpoints of \( AB, BC \), and \( CA \), respectively.

What is the ratio of the area of \( \triangle CFE \) to the area of \( \triangle CAB \)?

1) 1:1
2) 1:2
3) 1:3
4) 1:4

87. Given: Parallelogram \( ABCD \), \( BF \perp AFD \), and \( DE \perp BEC \).

Prove: \( BEDF \) is a rectangle.
88 Rectangle $A'B'C'D'$ is the image of rectangle $ABCD$ after a dilation centered at point $A$ by a scale factor of $\frac{2}{3}$. Which statement is correct?

1) Rectangle $A'B'C'D'$ has a perimeter that is $\frac{2}{3}$ the perimeter of rectangle $ABCD$.
2) Rectangle $A'B'C'D'$ has a perimeter that is $\frac{3}{2}$ the perimeter of rectangle $ABCD$.
3) Rectangle $A'B'C'D'$ has an area that is $\frac{2}{3}$ the area of rectangle $ABCD$.
4) Rectangle $A'B'C'D'$ has an area that is $\frac{3}{2}$ the area of rectangle $ABCD$.

89 In the diagram below, $AC = 7.2$ and $CE = 2.4$.

Which statement is not sufficient to prove $\triangle ABC \sim \triangle EDC$?

1) $AB \parallel ED$
2) $DE = 2.7$ and $AB = 8.1$
3) $CD = 3.6$ and $BC = 10.8$
4) $DE = 3.0$, $AB = 9.0$, $CD = 2.9$, and $BC = 8.7$

90 Which equation represents the line that passes through the point $(-2,2)$ and is parallel to $y = \frac{1}{2}x + 8$?

1) $y = \frac{1}{2}x$
2) $y = -2x - 3$
3) $y = \frac{1}{2}x + 3$
4) $y = -2x + 3$

91 In the diagram below, rectangle $ABCD$ has vertices whose coordinates are $A(7,1)$, $B(9,3)$, $C(3,9)$, and $D(1,7)$.

Which transformation will not carry the rectangle onto itself?

1) a reflection over the line $y = x$
2) a reflection over the line $y = -x + 10$
3) a rotation of $180^\circ$ about the point $(6,6)$
4) a rotation of $180^\circ$ about the point $(5,5)$
92 A fabricator is hired to make a 27-foot-long solid metal railing for the stairs at the local library. The railing is modeled by the diagram below. The railing is 2.5 inches high and 2.5 inches wide and is comprised of a rectangular prism and a half-cylinder.

How much metal, to the nearest cubic inch, will the railing contain?
1) 151
2) 795
3) 1808
4) 2025

93 A gas station has a cylindrical fueling tank that holds the gasoline for its pumps, as modeled below. The tank holds a maximum of 20,000 gallons of gasoline and has a length of 34.5 feet.

A metal pole is used to measure how much gas is in the tank. To the nearest tenth of a foot, how long does the pole need to be in order to reach the bottom of the tank and still extend one foot outside the tank? Justify your answer. [1 ft³ = 7.48 gallons]

94 In the diagram below, \( \overline{DE} \) divides \( \overline{AB} \) and \( \overline{AC} \) proportionally, \( m\angle C = 26^\circ \), \( m\angle A = 82^\circ \), and \( DF \) bisects \( \angle BDE \).

The measure of angle \( DFB \) is
1) 36°
2) 54°
3) 72°
4) 82°

95 Given: Parallelogram \( ABCD \) with diagonal \( \overline{AC} \) drawn

Prove: \( \triangle ABC \cong \triangle CDA \)

96 A right cylinder is cut perpendicular to its base. The shape of the cross section is a
1) circle
2) cylinder
3) rectangle
4) triangular prism
97 In the diagram below of circle $O$, chord $DF$ bisects chord $BC$ at $E$.

![Diagram of circle O with chord DF bisecting chord BC at E.]

If $BC = 12$ and $FE$ is 5 more than $DE$, then $FE$ is

1) 13
2) 9
3) 6
4) 4

98 Quadrilaterals $BIKE$ and $GOLF$ are graphed on the set of axes below.

![Quadrilateral BIKE and GOLF on a coordinate plane.]

Describe a sequence of transformations that maps quadrilateral $BIKE$ onto quadrilateral $GOLF$.

99 In the model below, a support wire for a telephone pole is attached to the pole and anchored to a stake in the ground 15 feet from the base of the telephone pole. Jamal places a 6-foot wooden pole under the support wire parallel to the telephone pole, such that one end of the pole is on the ground and the top of the pole is touching the support wire. He measures the distance between the bottom of the pole and the stake in the ground.

![Diagram of support wire and pole.]  
Jamal says he can approximate how high the support wire attaches to the telephone pole by using similar triangles. Explain why the triangles are similar.

100 In right triangle $ABC$, $m\angle A = 32^\circ$, $m\angle B = 90^\circ$, and $AC = 6.2$ cm. What is the length of $BC$, to the nearest tenth of a centimeter?

1) 3.3
2) 3.9
3) 5.3
4) 11.7
101 If $\triangle ABC$ is mapped onto $\triangle DEF$ after a line reflection and $\triangle DEF$ is mapped onto $\triangle XYZ$ after a translation, the relationship between $\triangle ABC$ and $\triangle XYZ$ is that they are always
1) congruent and similar
2) congruent but not similar
3) similar but not congruent
4) neither similar nor congruent

102 In circle $A$ below, chord $BC$ and diameter $DAE$ intersect at $F$.

If $\widehat{CD} = 46^\circ$ and $\widehat{DB} = 102^\circ$, what is $m\angle CFE$?

103 In circle $O$, secants $ADB$ and $AEC$ are drawn from external point $A$ such that points $D$, $B$, $E$, and $C$ are on circle $O$. If $AD = 8$, $AE = 6$, and $EC$ is 12 more than $BD$, the length of $BD$ is
1) 6
2) 22
3) 36
4) 48

104 Determine and state, in terms of $\pi$, the area of a sector that intercepts a $40^\circ$ arc of a circle with a radius of 4.5.

105 In the diagram below, $\triangle ADE$ is the image of $\triangle ABC$ after a reflection over the line $AC$ followed by a dilation of scale factor $\frac{AE}{AC}$ centered at point $A$.

Which statement must be true?
1) $m\angle BAC \cong m\angle AED$
2) $m\angle ABC \cong m\angle ADE$
3) $m\angle DAE \cong \frac{1}{2} m\angle BAC$
4) $m\angle ACB \cong \frac{1}{2} m\angle DAB$

106 In the diagram of rhombus $PQRS$ below, the diagonals $PR$ and $QS$ intersect at point $T$, $PR = 16$, and $QS = 30$. Determine and state the perimeter of $PQRS$. 

- - -

www.jmap.org
107 What is an equation of a line that is perpendicular to the line whose equation is \(2y = 3x - 10\) and passes through \((-6,1)\)?

1) \(y = -\frac{2}{3}x - 5\)
2) \(y = -\frac{2}{3}x - 3\)
3) \(y = \frac{2}{3}x + 1\)
4) \(y = \frac{2}{3}x + 10\)

108 The diagram below shows parallelogram \(ABCD\) with diagonals \(AC\) and \(BD\) intersecting at \(E\).

What additional information is sufficient to prove that parallelogram \(ABCD\) is also a rhombus?

1) \(BD\) bisects \(AC\).
2) \(AB\) is parallel to \(CD\).
3) \(AC\) is congruent to \(BD\).
4) \(AC\) is perpendicular to \(BD\).

109 Line \(MN\) is dilated by a scale factor of 2 centered at the point \((0,6)\). If \(MN\) is represented by \(y = -3x + 6\), which equation can represent the image of \(MN\)?

1) \(y = -3x + 12\)
2) \(y = -3x + 6\)
3) \(y = -6x + 12\)
4) \(y = -6x + 6\)

110 A child's tent can be modeled as a pyramid with a square base whose sides measure 60 inches and whose height measures 84 inches. What is the volume of the tent, to the nearest cubic foot?

1) 35
2) 58
3) 82
4) 175

111 Kirstie is testing values that would make triangle \(KLM\) a right triangle when \(LN\) is an altitude, and \(KM = 16\), as shown below.

Which lengths would make triangle \(KLM\) a right triangle?

1) \(LM = 13\) and \(KN = 6\)
2) \(LM = 12\) and \(NM = 9\)
3) \(KL = 11\) and \(KN = 7\)
4) \(LN = 8\) and \(NM = 10\)
112 A rectangle whose length and width are 10 and 6, respectively, is shown below. The rectangle is continuously rotated around a straight line to form an object whose volume is $150\pi$.

Which line could the rectangle be rotated around?
1) a long side
2) a short side
3) the vertical line of symmetry
4) the horizontal line of symmetry

113 In a circle with a diameter of 32, the area of a sector is $\frac{512\pi}{3}$. The measure of the angle of the sector, in radians, is
1) $\frac{\pi}{3}$
2) $\frac{4\pi}{3}$
3) $\frac{16\pi}{3}$
4) $\frac{64\pi}{3}$

114 The equation of a circle is $x^2 + y^2 - 12y + 20 = 0$. What are the coordinates of the center and the length of the radius of the circle?
1) center (0,6) and radius 4
2) center (0,–6) and radius 4
3) center (0,6) and radius 16
4) center (0,–6) and radius 16

115 A storage tank is in the shape of a cylinder with a hemisphere on the top. The highest point on the inside of the storage tank is 13 meters above the floor of the storage tank, and the diameter inside the cylinder is 8 meters. Determine and state, to the nearest cubic meter, the total volume inside the storage tank.

116 Quadrilateral $MATH$ and its image $M"A"T"H"$ are graphed on the set of axes below.

Describe a sequence of transformations that maps quadrilateral $MATH$ onto quadrilateral $M"A"T"H"$. 
117 Triangle $ABC$ has vertices with coordinates $A(-1,-1)$, $B(4,0)$, and $C(0,4)$. Prove that $\triangle ABC$ is an isosceles triangle but not an equilateral triangle. [The use of the set of axes below is optional.]

118 In the diagram of $\triangle ABC$ below, $DE$ is parallel to $AB$, $CD = 15$, $AD = 9$, and $AB = 40$.

The length of $DE$ is
1) 15
2) 24
3) 25
4) 30

119 A solid metal prism has a rectangular base with sides of 4 inches and 6 inches, and a height of 4 inches. A hole in the shape of a cylinder, with a radius of 1 inch, is drilled through the entire length of the rectangular prism.

What is the approximate volume of the remaining solid, in cubic inches?
1) 19
2) 77
3) 93
4) 96

120 In triangle $ABC$, points $D$ and $E$ are on sides $AB$ and $BC$, respectively, such that $DE \parallel AC$, and $AD:DB = 3:5$.

If $DB = 6.3$ and $AC = 9.4$, what is the length of $DE$, to the nearest tenth?
1) 3.8
2) 5.6
3) 5.9
4) 15.7
121 Which set of statements would describe a parallelogram that can always be classified as a rhombus?
   I. Diagonals are perpendicular bisectors of each other.
   II. Diagonals bisect the angles from which they are drawn.
   III. Diagonals form four congruent isosceles right triangles.
1) I and II
2) I and III
3) II and III
4) I, II, and III

122 The diagram below shows two figures. Figure A is a right triangular prism and figure B is an oblique triangular prism. The base of figure A has a height of 5 and a length of 8 and the height of prism A is 14. The base of figure B has a height of 8 and a length of 5 and the height of prism B is 14.

Use Cavalieri's Principle to explain why the volumes of these two triangular prisms are equal.

123 A circle with a diameter of 10 cm and a central angle of 30° is drawn below.

What is the area, to the nearest tenth of a square centimeter, of the sector formed by the 30° angle?
1) 5.2
2) 6.5
3) 13.1
4) 26.2

124 The equation of a circle is \(x^2 + y^2 - 6y + 1 = 0\).
What are the coordinates of the center and the length of the radius of this circle?
1) center (0,3) and radius \(= 2\sqrt{2}\)
2) center (0,−3) and radius \(= 2\sqrt{2}\)
3) center (0,6) and radius \(= \sqrt{35}\)
4) center (0,−6) and radius \(= \sqrt{35}\)

125 An isosceles right triangle whose legs measure 6 is continuously rotated about one of its legs to form a three-dimensional object. The three-dimensional object is a
1) cylinder with a diameter of 6
2) cylinder with a diameter of 12
3) cone with a diameter of 6
4) cone with a diameter of 12
126 A man was parasailing above a lake at an angle of elevation of 32° from a boat, as modeled in the diagram below.

![Diagram of parasailing](image)

If 129.5 meters of cable connected the boat to the parasail, approximately how many meters above the lake was the man?

1) 68.6
2) 80.9
3) 109.8
4) 244.4

127 In the diagram of \( \triangle ABC \) below, points \( D \) and \( E \) are on sides \( AB \) and \( CB \) respectively, such that \( DE \parallel AC \).

![Diagram of triangle](image)

If \( EB \) is 3 more than \( DB \), \( AB = 14 \), and \( CB = 21 \), what is the length of \( AD \)?

1) 6
2) 8
3) 9
4) 12

128 Kelly is completing a proof based on the figure below.

![Diagram of triangle](image)

She was given that \( \angle A \cong \angle EDF \), and has already proven \( AB \cong DE \). Which pair of corresponding parts and triangle congruency method would not prove \( \triangle ABC \cong \triangle DEF \)?

1) \( AC \cong DF \) and SAS
2) \( BC \cong EF \) and SAS
3) \( \angle C \cong \angle F \) and AAS
4) \( \angle CBA \cong \angle FED \) and ASA

129 On the graph below, point \( A(3,4) \) and \( BC \) with coordinates \( B(4,3) \) and \( C(2,1) \) are graphed.

![Graph with points](image)

What are the coordinates of \( B' \) and \( C' \) after \( BC \) undergoes a dilation centered at point \( A \) with a scale factor of 2?

1) \( B'(5,2) \) and \( C'(1,−2) \)
2) \( B'(6,1) \) and \( C'(0,−1) \)
3) \( B'(5,0) \) and \( C'(1,−2) \)
4) \( B'(5,2) \) and \( C'(3,0) \)
130 The graph below shows two congruent triangles, $ABC$ and $A'B'C'$.

Which rigid motion would map $\triangle ABC$ onto $\triangle A'B'C'$?

1) a rotation of 90 degrees counterclockwise about the origin
2) a translation of three units to the left and three units up
3) a rotation of 180 degrees about the origin
4) a reflection over the line $y = x$

131 In right triangle $ABC$ shown below, altitude $\overline{CD}$ is drawn to hypotenuse $AB$. Explain why $\triangle ABC \sim \triangle ACD$.

132 A plane intersects a hexagonal prism. The plane is perpendicular to the base of the prism. Which two-dimensional figure is the cross section of the plane intersecting the prism?

1) triangle
2) trapezoid
3) hexagon
4) rectangle

133 In the diagram below, $\overline{AB} \parallel \overline{DFC}$, $\overline{EDA} \parallel \overline{CBG}$, and $\overline{EFB}$ and $\overline{AG}$ are drawn.

Which statement is always true?

1) $\triangle DEF \cong \triangle CBF$
2) $\triangle BAG \cong \triangle BAE$
3) $\triangle BAG \sim \triangle AEB$
4) $\triangle DEF \sim \triangle AEB$
134 Given: \(RS\) and \(TV\) bisect each other at point \(X\)
\[
\text{Prove: } TR \parallel SV
\]

135 In the diagram below of parallelogram \(ROCK\),
\[
m\angle C = 70^\circ \text{ and } m\angle ROS = 65^\circ.
\]
What is \(m\angle KSO\)?
1) 45º  
2) 110º  
3) 115º  
4) 135º

136 When volleyballs are purchased, they are not fully inflated. A partially inflated volleyball can be modeled by a sphere whose volume is approximately 180 in\(^3\). After being fully inflated, its volume is approximately 294 in\(^3\). To the nearest tenth of an inch, how much does the radius increase when the volleyball is fully inflated?

137 In triangle \(SRK\) below, medians \(SC\), \(KE\), and \(RL\) intersect at \(M\).

Which statement must always be true?
1) \(3MC = SC\)
2) \(MC = \frac{1}{3}(SM)\)
3) \(RM = 2MC\)
4) \(SM = KM\)

138 In regular hexagon \(ABCDEF\) shown below, \(AD\), \(BE\), and \(CF\) all intersect at \(G\).

When \(\triangle ABG\) is reflected over \(BG\) and then rotated 180° about point \(G\), \(\triangle ABG\) is mapped onto
1) \(\triangle FEG\)
2) \(\triangle AFG\)
3) \(\triangle CBG\)
4) \(\triangle DEG\)
139 In quadrilateral $ABCD$, $AB \cong CD$, $AB \parallel CD$, and $BF$ and $DE$ are perpendicular to diagonal $AC$ at points $F$ and $E$.

Prove: $AE \cong CF$

140 In the diagram below of circle $O$, $GO = 8$ and $m \angle GOJ = 60^\circ$.

What is the area, in terms of $\pi$, of the shaded region?

1) $\frac{4\pi}{3}$
2) $\frac{20\pi}{3}$
3) $\frac{32\pi}{3}$
4) $\frac{160\pi}{3}$

141 The graph below shows $\triangle ABC$ and its image, $\triangle A'B'C'$. 

Describe a sequence of rigid motions which would map $\triangle ABC$ onto $\triangle A'B'C'$.

142 In the diagram below, secants $\overline{RST}$ and $\overline{RQP}$, drawn from point $R$, intersect circle $O$ at $S$, $T$, $Q$, and $P$.

If $RS = 6$, $ST = 4$, and $RP = 15$, what is the length of $RQ$?
143 As shown in the diagram below, an island (I) is due north of a marina (M). A boat house (H) is 4.5 miles due west of the marina. From the boat house, the island is located at an angle of 54° from the marina.

Determine and state, to the nearest tenth of a mile, the distance from the boat house (H) to the island (I). Determine and state, to the nearest tenth of a mile, the distance from the island (I) to the marina (M).

144 Circle O is centered at the origin. In the diagram below, a quarter of circle O is graphed.

Which three-dimensional figure is generated when the quarter circle is continuously rotated about the y-axis?

1) cone
2) sphere
3) cylinder
4) hemisphere

145 Given: $\triangle ABC$, $\triangle AEC$, $\overline{BDE}$ with $\angle ABE \cong \angle CBE$, and $\angle ADE \cong \angle CDE$

Prove: $\overline{BDE}$ is the perpendicular bisector of $\overline{AC}$

Fill in the missing statement and reasons below.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 $\triangle ABC$, $\triangle AEC$, $\overline{BDE}$ with $\angle ABE \cong \angle CBE$, and $\angle ADE \cong \angle CDE$</td>
<td>1 Given</td>
</tr>
<tr>
<td>2 $BD \cong BD$</td>
<td>2</td>
</tr>
<tr>
<td>3 $\angle BDA$ and $\angle ADE$ are supplementary. $\angle BDC$ and $\angle CDE$ are supplementary.</td>
<td>3 Linear pairs of angles are supplementary.</td>
</tr>
<tr>
<td>4</td>
<td>4 Supplements of congruent angles are congruent.</td>
</tr>
<tr>
<td>5 $\triangle ABD \cong \triangle CBD$</td>
<td>5 ASA</td>
</tr>
<tr>
<td>6 $AD \cong CD$, $AB \cong CB$</td>
<td>6</td>
</tr>
<tr>
<td>7 $\overline{BDE}$ is the perpendicular bisector of $\overline{AC}$</td>
<td>7</td>
</tr>
</tbody>
</table>
146 The diagram below shows two similar triangles.

If \( \tan \theta = \frac{3}{7} \), what is the value of \( x \), to the nearest tenth?
1) 1.2
2) 5.6
3) 7.6
4) 8.8

147 In the diagram below, right triangle \( ABC \) has legs whose lengths are 4 and 6.

What is the volume of the three-dimensional object formed by continuously rotating the right triangle around \( AB \)?
1) \( 32\pi \)
2) \( 48\pi \)
3) \( 96\pi \)
4) \( 144\pi \)

148 In the diagram below, \( \overline{ABC} = 268^\circ \).

What is the number of degrees in the measure of \( \angle ABC \)?
1) 134°
2) 92°
3) 68°
4) 46°
150 The greenhouse pictured below can be modeled as a rectangular prism with a half-cylinder on top. The rectangular prism is 20 feet wide, 12 feet high, and 45 feet long. The half-cylinder has a diameter of 20 feet.

To the nearest cubic foot, what is the volume of the greenhouse?
1) 17,869
2) 24,937
3) 39,074
4) 67,349

151 Given \( \triangle MRO \) shown below, with trapezoid \( PTRO \), \( MR = 9 \), \( MP = 2 \), and \( PO = 4 \).

What is the length of \( TR \)?
1) 4.5
2) 5
3) 3
4) 6

152 A right hexagonal prism is shown below. A two-dimensional cross section that is perpendicular to the base is taken from the prism.

Which figure describes the two-dimensional cross section?
1) triangle
2) rectangle
3) pentagon
4) hexagon

153 Using a compass and straightedge, construct the line of reflection over which triangle \( RST \) reflects onto triangle \( R'S'T' \). [Leave all construction marks.]
The 2010 U.S. Census populations and population densities are shown in the table below.

<table>
<thead>
<tr>
<th>State</th>
<th>Population Density (people/mi²)</th>
<th>Population in 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Florida</td>
<td>350.6</td>
<td>18,801,310</td>
</tr>
<tr>
<td>Illinois</td>
<td>231.1</td>
<td>12,830,632</td>
</tr>
<tr>
<td>New York</td>
<td>411.2</td>
<td>19,378,102</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>283.9</td>
<td>12,702,379</td>
</tr>
</tbody>
</table>

Based on the table above, which list has the states' areas, in square miles, in order from largest to smallest?

1) Illinois, Florida, New York, Pennsylvania
2) New York, Florida, Illinois, Pennsylvania

Identify which sequence of transformations could map pentagon $ABCDE$ onto pentagon $A'B'C'D'E'$, as shown below.

1) dilation followed by a rotation
2) translation followed by a rotation
3) line reflection followed by a translation
4) line reflection followed by a line reflection

A regular decagon is rotated $n$ degrees about its center, carrying the decagon onto itself. The value of $n$ could be

1) 10°
2) 150°
3) 225°
4) 252°

An ice cream waffle cone can be modeled by a right circular cone with a base diameter of 6.6 centimeters and a volume of $54.45\pi$ cubic centimeters. What is the number of centimeters in the height of the waffle cone?

1) $3\frac{3}{4}$
2) 5
3) 15
4) $24\frac{3}{4}$
158 A line segment is dilated by a scale factor of 2 centered at a point not on the line segment. Which statement regarding the relationship between the given line segment and its image is true?
1) The line segments are perpendicular, and the image is one-half of the length of the given line segment.
2) The line segments are perpendicular, and the image is twice the length of the given line segment.
3) The line segments are parallel, and the image is twice the length of the given line segment.
4) The line segments are parallel, and the image is one-half of the length of the given line segment.

159 Triangle \(ABC\) and point \(D(1,2)\) are graphed on the set of axes below.

Graph and label \(A'B'C'\), the image of \(\triangle ABC\), after a dilation of scale factor 2 centered at point \(D\).

160 After a counterclockwise rotation about point \(X\), scalene triangle \(ABC\) maps onto \(\triangle RST\), as shown in the diagram below.

Which statement must be true?
1) \(\angle A \cong \angle R\)
2) \(\angle A \cong \angle S\)
3) \(\overline{CB} \cong \overline{TR}\)
4) \(\overline{CA} \cong \overline{TS}\)

161 Which transformation would not carry a square onto itself?
1) a reflection over one of its diagonals
2) a 90° rotation clockwise about its center
3) a 180° rotation about one of its vertices
4) a reflection over the perpendicular bisector of one side

162 In a right triangle, the acute angles have the relationship \(\sin(2x + 4) = \cos(46)\). What is the value of \(x\)?
1) 20
2) 21
3) 24
4) 25
163 The coordinates of the endpoints of directed line segment $ABC$ are $A(-8,7)$ and $C(7,-13)$. If $AB:BC = 3:2$, the coordinates of $B$ are
1) $(1,-5)$
2) $(-2,-1)$
3) $(-3,0)$
4) $(3,-6)$

164 The line whose equation is $3x - 5y = 4$ is dilated by a scale factor of $\frac{5}{3}$ centered at the origin. Which statement is correct?
1) The image of the line has the same slope as the pre-image but a different $y$-intercept.
2) The image of the line has the same $y$-intercept as the pre-image but a different slope.
3) The image of the line has the same slope and the same $y$-intercept as the pre-image.
4) The image of the line has a different slope and a different $y$-intercept from the pre-image.

165 The diagram below shows circle $O$ with diameter $AB$. Using a compass and straightedge, construct a square that is inscribed in circle $O$. [Leave all construction marks.]

166 In the diagram below of triangle $MNO$, $\angle M$ and $\angle O$ are bisected by $MS$ and $OR$, respectively. Segments $MS$ and $OR$ intersect at $T$, and $m\angle N = 40^\circ$.

If $m\angle TMR = 28^\circ$, the measure of angle $OTS$ is
1) $40^\circ$
2) $50^\circ$
3) $60^\circ$
4) $70^\circ$

167 Quadrilateral $ABCD$ is inscribed in circle $O$, as shown below.

If $m\angle A = 80^\circ$, $m\angle B = 75^\circ$, $m\angle C = (y + 30)^\circ$, and $m\angle D = (x - 10)^\circ$, which statement is true?
1) $x = 85$ and $y = 50$
2) $x = 90$ and $y = 45$
3) $x = 110$ and $y = 75$
4) $x = 115$ and $y = 70$
168 In right triangle $ABC$, $m\angle C = 90^\circ$. If $\cos B = \frac{5}{13}$, which function also equals $\frac{5}{13}$?

1) $\tan A$
2) $\tan B$
3) $\sin A$
4) $\sin B$

169 A two-dimensional cross section is taken of a three-dimensional object. If this cross section is a triangle, what can not be the three-dimensional object?

1) cone
2) cylinder
3) pyramid
4) rectangular prism

170 In quadrilateral $BLUE$ shown below, $BE \cong UL$.

Which information would be sufficient to prove quadrilateral $BLUE$ is a parallelogram?

1) $BL \parallel EU$
2) $LU \parallel BE$
3) $BE \cong BL$
4) $LU \cong EU$

171 A ladder 20 feet long leans against a building, forming an angle of $71^\circ$ with the level ground. To the nearest foot, how high up the wall of the building does the ladder touch the building?

1) 15
2) 16
3) 18
4) 19

172 Given: Right triangle $ABC$ with right angle at $C$. If $\sin A$ increases, does $\cos B$ increase or decrease? Explain why.

173 In the diagram below of circle $O$, tangent $EC$ is drawn to diameter $AC$. Chord $BC$ is parallel to secant $ADE$, and chord $AB$ is drawn.

Prove: $\frac{BC}{CA} = \frac{AB}{EC}$

174 In a right triangle, $\sin(40 - x) = \cos(3x)^\circ$. What is the value of $x$?

1) 10
2) 15
3) 20
4) 25
175 In the diagram below, $\overline{AB} \parallel \overline{DEF}$, $\overline{AE}$ and $\overline{BD}$ intersect at $C$, $m\angle B = 43^\circ$, and $m\angle CEF = 152^\circ$.

Which statement is true?
1) $m\angle D = 28^\circ$
2) $m\angle A = 43^\circ$
3) $m\angle ACD = 71^\circ$
4) $m\angle BCE = 109^\circ$

176 Given $\triangle ABC$ with $m\angle B = 62^\circ$ and side $\overline{AC}$ extended to $D$, as shown below.

Which value of $x$ makes $\overline{AB} \cong \overline{CB}$?
1) 59°
2) 62°
3) 118°
4) 121°

177 Point $Q$ is on $\overline{MN}$ such that $MQ:QN = 2:3$. If $M$ has coordinates $(3,5)$ and $N$ has coordinates $(8,-5)$, the coordinates of $Q$ are
1) $(5,1)$
2) $(5,0)$
3) $(6,-1)$
4) $(6,0)$

178 Quadrilateral $MATH$ has both pairs of opposite sides congruent and parallel. Which statement about quadrilateral $MATH$ is always true?
1) $\overline{MT} \cong \overline{AH}$
2) $\overline{MT} \perp \overline{AH}$
3) $\angle MHT \cong \angle ATH$
4) $\angle MAT \cong \angle MHT$

179 Triangle $DAN$ is graphed on the set of axes below. The vertices of $\triangle DAN$ have coordinates $D(-6,-1)$, $A(6,3)$, and $N(-3,10)$.

What is the area of $\triangle DAN$?
1) 60
2) 120
3) $20\sqrt{13}$
4) $40\sqrt{13}$
180 Yolanda is making a springboard to use for gymnastics. She has 8-inch-tall springs and wants to form a 16.5° angle with the base, as modeled in the diagram below.

To the nearest tenth of an inch, what will be the length of the springboard, \( x \)?

1) 2.3
2) 8.3
3) 27.0
4) 28.2

181 In the diagram below, \( \overline{XS} \) and \( \overline{YR} \) intersect at \( Z \). Segments \( \overline{XY} \) and \( \overline{RS} \) are drawn perpendicular to \( \overline{YR} \) to form triangles \( \triangle XYZ \) and \( \triangle SRZ \).

Which statement is always true?

1) \( (XY)(SR) = (XZ)(RZ) \)
2) \( \triangle XYZ \cong \triangle SRZ \)
3) \( \overline{XS} \cong \overline{YR} \)
4) \( \frac{XY}{SR} = \frac{YZ}{RZ} \)

182 A homeowner is building three steps leading to a deck, as modeled by the diagram below. All three step rises, \( HA, FG, \) and \( DE \), are congruent, and all three step runs, \( HG, FE, \) and \( DC \), are congruent. Each step rise is perpendicular to the step run it joins. The measure of \( \angle CAB = 36^\circ \) and \( \angle CBA = 90^\circ \).

If each step run is parallel to \( \overline{AB} \) and has a length of 10 inches, determine and state the length of each step rise, to the nearest tenth of an inch. Determine and state the length of \( \overline{AC} \), to the nearest inch.

183 In \( \triangle ABC \), \( \overline{BD} \) is the perpendicular bisector of \( \overline{ADC} \). Based upon this information, which statements below can be proven?

I. \( \overline{BD} \) is a median.
II. \( \overline{BD} \) bisects \( \angle ABC \).
III. \( \triangle ABC \) is isosceles.

1) I and II, only
2) I and III, only
3) II and III, only
4) I, II, and III
184 In the graph below, \( \triangle ABC \) has coordinates 
\( A(-9,2), B(-6,-6), \) and \( C(-3,-2), \) and \( \triangle RST \) has 
coordinates \( R(-2,9), S(5,6), \) and \( T(2,3). \)

Is \( \triangle ABC \) congruent to \( \triangle RST? \) Use the properties 
of rigid motions to explain your reasoning.

185 In the diagram below of isosceles triangle \( ABC, \)
\( AB \cong CB \) and angle bisectors \( AD, BF, \) and \( CE \) are 
drawn and intersect at \( X. \)

If \( \angle BAC = 50^\circ, \) find \( \angle AXC. \)

186 In the diagram below, \( \overline{AKS}, \overline{NKC}, \overline{AN}, \) and \( \overline{SC} \) are 
drawn such that \( \overline{AN} \cong \overline{SC}. \)

Which additional statement is sufficient to prove 
\( \triangle KAN \cong \triangle KSC \) by AAS?
1) \( \overline{AS} \) and \( \overline{NC} \) bisect each other.
2) \( K \) is the midpoint of \( \overline{NC}. \)
3) \( \overline{AS} \perp \overline{CN} \)
4) \( \overline{AN} \parallel \overline{SC} \)

187 Keira has a square poster that she is framing and 
placing on her wall. The poster has a diagonal 58 
cm long and fits exactly inside the frame. The 
width of the frame around the picture is 4 cm.

Determine and state the total area of the poster and 
frame to the nearest tenth of a square centimeter.
188 Which equation represents a line that is perpendicular to the line represented by \( y = \frac{2}{3}x + 1 \)?

1) \( 3x + 2y = 12 \)  
2) \( 3x - 2y = 12 \)  
3) \( y = \frac{3}{2}x + 2 \)  
4) \( y = -\frac{2}{3}x + 4 \)

189 Triangle \( ABC \) has vertices at \( A(-5,2) \), \( B(-4,7) \), and \( C(-2,7) \), and triangle \( DEF \) has vertices at \( D(3,2) \), \( E(2,7) \), and \( F(0,7) \). Graph and label \( \Delta ABC \) and \( \Delta DEF \) on the set of axes below. Determine and state the single transformation where \( \Delta DEF \) is the image of \( \Delta ABC \). Use your transformation to explain why \( \Delta ABC \cong \Delta DEF \).

190 Shae has recently begun kickboxing and purchased training equipment as modeled in the diagram below. The total weight of the bag, pole, and unfilled base is 270 pounds. The cylindrical base is 18 inches tall with a diameter of 20 inches. The dry sand used to fill the base weighs 95.46 lbs per cubic foot.

To the nearest pound, determine and state the total weight of the training equipment if the base is filled to 85% of its capacity.

191 Which figure always has exactly four lines of reflection that map the figure onto itself?

1) square  
2) rectangle  
3) regular octagon  
4) equilateral triangle
192 Line \( n \) is represented by the equation \( 3x + 4y = 20 \). Determine and state the equation of line \( p \), the image of line \( n \), after a dilation of scale factor \( \frac{1}{3} \) centered at the point (4,2). [The use of the set of axes below is optional.] Explain your answer.

193 Triangle \( A'B'C' \) is the image of \( \triangle ABC \) after a dilation followed by a translation. Which statement(s) would always be true with respect to this sequence of transformations?

I. \( \triangle ABC \cong \triangle A'B'C' \)
II. \( \triangle ABC \sim \triangle A'B'C' \)
III. \( AB \parallel A'B' \)
IV. \( AA' = BB' \)

1) II, only
2) I and II
3) II and III
4) II, III, and IV

194 Trapezoids \( ABCD \) and \( A'B'C'D' \) are graphed on the set of axes below. Describe a sequence of transformations that maps trapezoid \( ABCD \) onto trapezoid \( A'B'C'D' \).

195 Freda, who is training to use a radar system, detects an airplane flying at a constant speed and heading in a straight line to pass directly over her location. She sees the airplane at an angle of elevation of \( 15^\circ \) and notes that it is maintaining a constant altitude of 6250 feet. One minute later, she sees the airplane at an angle of elevation of \( 52^\circ \). How far has the airplane traveled, to the nearest foot?

Determine and state the speed of the airplane, to the nearest mile per hour.
196 Line segment $RW$ has endpoints $R(-4,5)$ and $W(6,20)$. Point $P$ is on $RW$ such that $RP:PW$ is 2:3. What are the coordinates of point $P$?
1) (2,9)
2) (0,11)
3) (2,14)
4) (10,2)

197 Isosceles trapezoid $ABCD$ has bases $DC$ and $AB$ with nonparallel legs $AD$ and $BC$. Segments $AE$, $BE$, $CE$, and $DE$ are drawn in trapezoid $ABCD$ such that $\angle CDE \cong \angle DCE$, $AE \perp DE$, and $BE \perp CE$.

Prove $\triangle ADE \cong \triangle BCE$ and prove $\triangle AEB$ is an isosceles triangle.

198 What is an equation of a line which passes through (6,9) and is perpendicular to the line whose equation is $4x - 6y = 15$?
1) $y - 9 = -\frac{3}{2}(x - 6)$
2) $y - 9 = \frac{2}{3}(x - 6)$
3) $y + 9 = -\frac{3}{2}(x + 6)$
4) $y + 9 = -\frac{2}{3}(x + 6)$

199 In the diagram below, if $\triangle ABE \cong \triangle CDF$ and $\overline{AEFC}$ is drawn, then it could be proven that quadrilateral $ABCD$ is a
1) square
2) rhombus
3) rectangle
4) parallelogram

200 In the diagram below, $\overline{GI}$ is parallel to $\overline{NT}$, and $\overline{IN}$ intersects $\overline{GT}$ at $A$.

Prove: $\triangle GIA \sim \triangle TNA$

201 In the two distinct acute triangles $ABC$ and $DEF$, $\angle B \cong \angle E$. Triangles $ABC$ and $DEF$ are congruent when there is a sequence of rigid motions that maps
1) $\angle A$ onto $\angle D$, and $\angle C$ onto $\angle F$
2) $\overline{AC}$ onto $\overline{DF}$, and $\overline{BC}$ onto $\overline{EF}$
3) $\angle C$ onto $\angle F$, and $\overline{BC}$ onto $\overline{EF}$
4) point $A$ onto point $D$, and $\overline{AB}$ onto $\overline{DE}$
202 A farmer has 64 feet of fence to enclose a rectangular vegetable garden. Which dimensions would result in the biggest area for this garden?
1) the length and the width are equal
2) the length is 2 more than the width
3) the length is 4 more than the width
4) the length is 6 more than the width

203 Given square $RSTV$, where $RS = 9$ cm. If square $RSTV$ is dilated by a scale factor of 3 about a given center, what is the perimeter, in centimeters, of the image of $RSTV$ after the dilation?
1) 12
2) 27
3) 36
4) 108

204 Quadrilateral $PQRS$ has vertices $P(-2,3)$, $Q(3,8)$, $R(4,1)$, and $S(-1,-4)$. Prove that $PQRS$ is a rhombus. Prove that $PQRS$ is not a square. [The use of the set of axes below is optional.]

205 Parallelogram $ABCD$ has coordinates $A(0,7)$ and $C(2,1)$. Which statement would prove that $ABCD$ is a rhombus?
1) The midpoint of $AC$ is $(1,4)$.
2) The length of $BD$ is $\sqrt{40}$.
3) The slope of $BD$ is $\frac{1}{3}$.
4) The slope of $AB$ is $\frac{1}{3}$.

206 Using a compass and straightedge, construct a regular hexagon inscribed in circle $O$. [Leave all construction marks.]

207 Directed line segment $DE$ has endpoints $D(-4,-2)$ and $E(1,8)$. Point $F$ divides $DE$ such that $DF:FE$ is 2:3. What are the coordinates of $F$?
1) $(-3,0)$
2) $(-2,2)$
3) $(-1,4)$
4) $(2,4)$
208 A candle maker uses a mold to make candles like the one shown below.

The height of the candle is 13 cm and the circumference of the candle at its widest measure is 31.416 cm. Use modeling to approximate how much wax, to the nearest cubic centimeter, is needed to make this candle. Justify your answer.

209 In the diagram of $\triangle RST$ below, $m\angle T = 90^\circ$, $RS = 65$, and $ST = 60$.

What is the measure of $\angle S$, to the nearest degree?
1) 23°
2) 43°
3) 47°
4) 67°

210 Which rotation about its center will carry a regular decagon onto itself?
1) 54°
2) 162°
3) 198°
4) 252°

211 Using a compass and straightedge, construct a regular hexagon inscribed in circle $O$ below. Label it $ABCDEF$. [Leave all construction marks.]

If chords $FB$ and $FC$ are drawn, which type of triangle, according to its angles, would $\triangle FBC$ be? Explain your answer.

212 In the diagram below, secant $ACD$ and tangent $AB$ are drawn from external point $A$ to circle $O$.

Prove the theorem: If a secant and a tangent are drawn to a circle from an external point, the product of the lengths of the secant segment and its external segment equals the length of the tangent segment squared. ($AC \cdot AD = AB^2$)
213 Triangles $ABC$ and $DEF$ are drawn below.

If $AB = 9$, $BC = 15$, $DE = 6$, $EF = 10$, and $\angle B \cong \angle E$, which statement is true?

1) $\angle CAB \cong \angle DEF$
2) $\frac{AB}{CB} = \frac{FE}{DE}$
3) $\triangle ABC \sim \triangle DEF$
4) $\frac{AB}{DE} = \frac{FE}{CB}$

214 In the diagram below, triangles $XYZ$ and $UVZ$ are drawn such that $\angle X \cong \angle U$ and $\angle XZY \cong \angle UZV$.

Describe a sequence of similarity transformations that shows $\triangle XYZ$ is similar to $\triangle UVZ$.

215 In the figure shown below, quadrilateral $TAEO$ is circumscribed around circle $D$. The midpoint of $TA$ is $R$, and $HO \cong PE$.

If $AP = 10$ and $EO = 12$, what is the perimeter of quadrilateral $TAEO$?

1) 56
2) 64
3) 72
4) 76

216 The density of the American white oak tree is 752 kilograms per cubic meter. If the trunk of an American white oak tree has a circumference of 4.5 meters and the height of the trunk is 8 meters, what is the approximate number of kilograms of the trunk?

1) 13
2) 9694
3) 13,536
4) 30,456
217 The equation of a circle is $x^2 + y^2 + 6y = 7$. What are the coordinates of the center and the length of the radius of the circle?
1) center (0,3) and radius 4
2) center (0,-3) and radius 4
3) center (0,3) and radius 16
4) center (0,-3) and radius 16

218 In $\triangle ABC$, where $\angle C$ is a right angle, $\cos A = \frac{\sqrt{21}}{5}$. What is $\sin B$?
1) $\frac{\sqrt{21}}{5}$
2) $\frac{\sqrt{21}}{2}$
3) $\frac{2}{5}$
4) $\frac{5}{\sqrt{21}}$

219 In the diagram of right triangle $ABC$, $\overline{CD}$ intersects hypotenuse $\overline{AB}$ at $D$.

If $AD = 4$ and $DB = 6$, which length of $\overline{AC}$ makes $\overline{CD} \perp \overline{AB}$?
1) $2\sqrt{6}$
2) $2\sqrt{10}$
3) $2\sqrt{15}$
4) $4\sqrt{2}$

220 Kevin’s work for deriving the equation of a circle is shown below.
$$x^2 + 4x = -(y^2 - 20)$$

**STEP 1**
$$x^2 + 4x = -y^2 + 20$$

**STEP 2**
$$x^2 + 4x + 4 = -y^2 + 20 - 4$$

**STEP 3**
$$(x + 2)^2 = -y^2 + 20 - 4$$

**STEP 4**
$$(x + 2)^2 + y^2 = 16$$

In which step did he make an error in his work?
1) Step 1
2) Step 2
3) Step 3
4) Step 4

221 A carpenter leans an extension ladder against a house to reach the bottom of a window 30 feet above the ground. As shown in the diagram below, the ladder makes a $70^\circ$ angle with the ground. To the nearest foot, determine and state the length of the ladder.

222 A line that passes through the points whose coordinates are (1, 1) and (5, 7) is dilated by a scale factor of 3 and centered at the origin. The image of the line
1) is perpendicular to the original line
2) is parallel to the original line
3) passes through the origin
4) is the original line
223 In the diagram below, DB and AF intersect at point C, and AD and FBE are drawn.

If AC = 6, DC = 4, FC = 15, m∠D = 65°, and m∠CBE = 115°, what is the length of CB?
1) 10
2) 12
3) 17
4) 22.5

224 Linda is designing a circular piece of stained glass with a diameter of 7 inches. She is going to sketch a square inside the circular region. To the nearest tenth of an inch, the largest possible length of a side of the square is
1) 3.5
2) 4.9
3) 5.0
4) 6.9

225 In right triangle ABC with the right angle at C, sin A = 2x + 0.1 and cos B = 4x - 0.7. Determine and state the value of x. Explain your answer.

226 Triangle ABC and triangle DEF are graphed on the set of axes below.

Which sequence of transformations maps triangle ABC onto triangle DEF?
1) a reflection over the x-axis followed by a reflection over the y-axis
2) a 180° rotation about the origin followed by a reflection over the line y = x
3) a 90° clockwise rotation about the origin followed by a reflection over the y-axis
4) a translation 8 units to the right and 1 unit up followed by a 90° counterclockwise rotation about the origin

227 Lines AE and BD are tangent to circles O and P at A, E, B, and D, as shown in the diagram below. If AC:CE = 5:3, and BD = 56, determine and state the length of CD.
228 Quadrilateral $ABCD$ has diagonals $AC$ and $BD$. Which information is not sufficient to prove $ABCD$ is a parallelogram?
1) $AC$ and $BD$ bisect each other.
2) $AB \cong CD$ and $BC \cong AD$
3) $AB \cong CD$ and $AB \parallel CD$
4) $AB \cong CD$ and $BC \parallel AD$

229 In isosceles $\triangle MNP$, line segment $NO$ bisects vertex $\angle MNP$, as shown below. If $MP = 16$, find the length of $MO$ and explain your answer.

230 As shown in the diagram below, a ship is heading directly toward a lighthouse whose beacon is 125 feet above sea level. At the first sighting, point $A$, the angle of elevation from the ship to the light was $7^\circ$. A short time later, at point $D$, the angle of elevation was $16^\circ$.

To the nearest foot, determine and state how far the ship traveled from point $A$ to point $D$.

231 An equation of a line perpendicular to the line represented by the equation $y = -\frac{1}{2}x - 5$ and passing through $(6, -4)$ is
1) $y = -\frac{1}{2}x + 4$
2) $y = -\frac{1}{2}x - 1$
3) $y = 2x + 14$
4) $y = 2x - 16$

232 In the diagram of circle $A$ shown below, chords $CD$ and $EF$ intersect at $G$, and chords $CE$ and $FD$ are drawn.

Which statement is not always true?
1) $CG \cong FG$
2) $\angle CEG \cong \angle FDG$
3) $\frac{CE}{EG} = \frac{FD}{DG}$
4) $\triangle CEG \sim \triangle FDG$
233 Which object is formed when right triangle $RST$ shown below is rotated around leg $RS$?

1) a pyramid with a square base  
2) an isosceles triangle  
3) a right triangle  
4) a cone

234 The image of $\triangle ABC$ after a rotation of 90º clockwise about the origin is $\triangle DEF$, as shown below.

Which statement is true?

1) $BC \cong DE$  
2) $AB \cong DF$  
3) $\angle C \cong \angle E$  
4) $\angle A \cong \angle D$

235 If $x^2 + 4x + y^2 - 6y - 12 = 0$ is the equation of a circle, the length of the radius is

1) 25  
2) 16  
3) 5  
4) 4

236 The grid below shows $\triangle ABC$ and $\triangle DEF$.

Let $\triangle A'B'C$ be the image of $\triangle ABC$ after a rotation about point $A$. Determine and state the location of $B'$ if the location of point $C'$ is $(8, -3)$. Explain your answer. Is $\triangle DEF$ congruent to $\triangle A'B'C$? Explain your answer.

237 The coordinates of vertices $A$ and $B$ of $\triangle ABC$ are $A(3, 4)$ and $B(3, 12)$. If the area of $\triangle ABC$ is 24 square units, what could be the coordinates of point $C$?

1) $(3, 6)$  
2) $(8, -3)$  
3) $(-3, 8)$  
4) $(6, 3)$
238 The water tower in the picture below is modeled by the two-dimensional figure beside it. The water tower is composed of a hemisphere, a cylinder, and a cone. Let \( C \) be the center of the hemisphere and let \( D \) be the center of the base of the cone.

If \( AC = 8.5 \) feet, \( BF = 25 \) feet, and \( \angle EFD = 47^\circ \), determine and state, to the nearest cubic foot, the volume of the water tower. The water tower was constructed to hold a maximum of 400,000 pounds of water. If water weighs 62.4 pounds per cubic foot, can the water tower be filled to 85% of its volume and not exceed the weight limit? Justify your answer.

239 Tennis balls are sold in cylindrical cans with the balls stacked one on top of the other. A tennis ball has a diameter of 6.7 cm. To the nearest cubic centimeter, what is the minimum volume of the can that holds a stack of 4 tennis balls?

1) 236
2) 282
3) 564
4) 945

240 Triangle \( MNP \) is the image of triangle \( JKL \) after a 120° counterclockwise rotation about point \( Q \). If the measure of angle \( L \) is 47° and the measure of angle \( N \) is 57°, determine the measure of angle \( M \). Explain how you arrived at your answer.

241 In the diagram below, \( \triangle ABC \) and \( \triangle XYZ \) are graphed.

Use the properties of rigid motions to explain why \( \triangle ABC \cong \triangle XYZ \).
242 Using the information given below, which set of triangles can not be proven similar?

1)  

2)  

3)  

4)  

243 A contractor needs to purchase 500 bricks. The dimensions of each brick are 5.1 cm by 10.2 cm by 20.3 cm, and the density of each brick is 1920 kg / m³. The maximum capacity of the contractor’s trailer is 900 kg. Can the trailer hold the weight of 500 bricks? Justify your answer.

244 Which sequence of transformations will map \( \triangle ABC \) onto \( \triangle A'B'C' \)?

1) reflection and translation  
2) rotation and reflection  
3) translation and dilation  
4) dilation and rotation  

245 In the diagram below of circle \( O \), the area of the shaded sector \( LOM \) is \( 2\pi \) cm².

If the length of \( NL \) is 6 cm, what is \( m\angle N \)?

1) 10°  
2) 20°  
3) 40°  
4) 80°
246 Triangle \( PQR \) has vertices \( P(-3,-1), Q(-1,7), \) and \( R(3,3), \) and points \( A \) and \( B \) are midpoints of \( PQ \) and \( RQ, \) respectively. Use coordinate geometry to prove that \( AB \) is parallel to \( PR \) and is half the length of \( PR. \) [The use of the set of axes below is optional.]

247 Given: Quadrilateral \( ABCD \) with diagonals \( AC \) and \( BD \) that bisect each other, and \( \angle 1 \approx \angle 2. \)

Prove: \( \triangle ACD \) is an isosceles triangle and \( \triangle AEB \) is a right triangle

248 In the diagram below of circle \( O, \overline{OB} \) and \( \overline{OC} \) are radii, and chords \( \overline{AB}, \overline{BC}, \) and \( \overline{AC} \) are drawn.

Which statement must always be true?
1) \( \angle BAC \cong \angle BOC \)
2) \( m\angle BAC = \frac{1}{2} m\angle BOC \)
3) \( \triangle BAC \) and \( \triangle BOC \) are isosceles.
4) The area of \( \triangle BAC \) is twice the area of \( \triangle BOC. \)

249 The aspect ratio (the ratio of screen width to height) of a rectangular flat-screen television is 16:9. The length of the diagonal of the screen is the television's screen size. Determine and state, to the nearest inch, the screen size (diagonal) of this flat-screen television with a screen height of 20.6 inches.

250 A circle with a radius of 5 was divided into 24 congruent sectors. The sectors were then rearranged, as shown in the diagram below.

To the nearest integer, the value of \( x \) is
1) 31
2) 16
3) 12
4) 10
251 In the diagram below, $FE \parallel AC$ at $B$, and $GE$ bisects $BD$ at $C$.

Which statement is always true?
1) $AB \cong DC$
2) $FB \cong EB$
3) $BD \parallel GE$ at $C$.
4) $AC \parallel FE$ at $B$.

252 The diagonals of rhombus $TEAM$ intersect at $P(2,1)$. If the equation of the line that contains diagonal $TA$ is $y = -x + 3$, what is the equation of a line that contains diagonal $EM$?
1) $y = x - 1$
2) $y = x - 3$
3) $y = -x - 1$
4) $y = -x - 3$

253 Which regular polygon has a minimum rotation of $45^\circ$ to carry the polygon onto itself?
1) octagon
2) decagon
3) hexagon
4) pentagon

254 In the diagram below, $\triangle ERM \sim \triangle JTM$.

Which statement is always true?
1) $\cos J = \frac{RM}{RE}$
2) $\cos R = \frac{JM}{JT}$
3) $\tan T = \frac{RM}{EM}$
4) $\tan E = \frac{TM}{JM}$

255 In the diagram below, a window of a house is 15 feet above the ground. A ladder is placed against the house with its base at an angle of $75^\circ$ with the ground. Determine and state the length of the ladder to the nearest tenth of a foot.
256 The diameter of a basketball is approximately 9.5 inches and the diameter of a tennis ball is approximately 2.5 inches. The volume of the basketball is about how many times greater than the volume of the tennis ball?
1) 3591
2) 65
3) 55
4) 4

257 The Great Pyramid of Giza was constructed as a regular pyramid with a square base. It was built with an approximate volume of 2,592,276 cubic meters and a height of 146.5 meters. What was the length of one side of its base, to the nearest meter?
1) 73
2) 77
3) 133
4) 230

258 The line $y = 2x - 4$ is dilated by a scale factor of $\frac{3}{2}$ and centered at the origin. Which equation represents the image of the line after the dilation?
1) $y = 2x - 4$
2) $y = 2x - 6$
3) $y = 3x - 4$
4) $y = 3x - 6$

259 Line $y = 3x - 1$ is transformed by a dilation with a scale factor of 2 and centered at (3, 8). The line's image is
1) $y = 3x - 8$
2) $y = 3x - 4$
3) $y = 3x - 2$
4) $y = 3x - 1$

260 Given: Quadrilateral $ABCD$ is a parallelogram with diagonals $AC$ and $BD$ intersecting at $E$

Prove: $\triangle AED \cong \triangle CEB$
Describe a single rigid motion that maps $\triangle AED$ onto $\triangle CEB$.

261 A sequence of transformations maps rectangle $ABCD$ onto rectangle $A'B'C'D'$, as shown in the diagram below.

Which sequence of transformations maps $ABCD$ onto $A'B'C'D'$ and then maps $A'B'C'D'$ onto $A''B''C''D''$?
1) a reflection followed by a rotation
2) a reflection followed by a translation
3) a translation followed by a rotation
4) a translation followed by a reflection
262. A wooden cube has an edge length of 6 centimeters and a mass of 137.8 grams. Determine the density of the cube, to the nearest thousandth. State which type of wood the cube is made of, using the density table below.

<table>
<thead>
<tr>
<th>Type of Wood</th>
<th>Density (g/cm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pine</td>
<td>0.373</td>
</tr>
<tr>
<td>Hemlock</td>
<td>0.431</td>
</tr>
<tr>
<td>Elm</td>
<td>0.554</td>
</tr>
<tr>
<td>Birch</td>
<td>0.601</td>
</tr>
<tr>
<td>Ash</td>
<td>0.638</td>
</tr>
<tr>
<td>Maple</td>
<td>0.676</td>
</tr>
<tr>
<td>Oak</td>
<td>0.711</td>
</tr>
</tbody>
</table>

263. A water glass can be modeled by a truncated right cone (a cone which is cut parallel to its base) as shown below.

The diameter of the top of the glass is 3 inches, the diameter at the bottom of the glass is 2 inches, and the height of the glass is 5 inches. The base with a diameter of 2 inches must be parallel to the base with a diameter of 3 inches in order to find the height of the cone. Explain why. Determine and state, in inches, the height of the larger cone. Determine and state, to the nearest tenth of a cubic inch, the volume of the water glass.

264. In the coordinate plane, the vertices of \( \triangle RST \) are \( R(6,-1), S(1,-4), \) and \( T(-5,6) \). Prove that \( \triangle RST \) is a right triangle. State the coordinates of point \( P \) such that quadrilateral \( RSTP \) is a rectangle. Prove that your quadrilateral \( RSTP \) is a rectangle. [The use of the set of axes below is optional.]
265 A parallelogram must be a rectangle when its
1) diagonals are perpendicular
2) diagonals are congruent
3) opposite sides are parallel
4) opposite sides are congruent

266 Quadrilateral \(ABCD\) is graphed on the set of axes below.

When \(ABCD\) is rotated 90° in a counterclockwise direction about the origin, its image is quadrilateral \(A'B'C'D'\). Is distance preserved under this rotation, and which coordinates are correct for the given vertex?
1) no and \(C'(1,2)\)
2) no and \(D'(2,4)\)
3) yes and \(A'(6,2)\)
4) yes and \(B'(-3,4)\)

267 The equation of line \(h\) is \(2x + y = 1\). Line \(m\) is the image of line \(h\) after a dilation of scale factor 4 with respect to the origin. What is the equation of the line \(m\)?
1) \(y = -2x + 1\)
2) \(y = -2x + 4\)
3) \(y = 2x + 4\)
4) \(y = 2x + 1\)

268 In the diagram below, \(\triangle ABC\) has coordinates \(A(1,1), B(4,1), \) and \(C(4,5)\). Graph and label \(\triangle A'B'C'\), the image of \(\triangle ABC\) after the translation five units to the right and two units up followed by the reflection over the line \(y = 0\).

269 Explain why \(\cos(x) = \sin(90 - x)\) for \(x\) such that \(0 < x < 90\).

270 A company is creating an object from a wooden cube with an edge length of 8.5 cm. A right circular cone with a diameter of 8 cm and an altitude of 8 cm will be cut out of the cube. Which expression represents the volume of the remaining wood?
1) \((8.5)^3 - \pi(8)^2(8)\)
2) \((8.5)^3 - \pi(4)^2(8)\)
3) \((8.5)^3 - \frac{1}{3} \pi(8)^2(8)\)
4) \((8.5)^3 - \frac{1}{3} \pi(4)^2(8)\)
271 In the diagram below, quadrilateral \( ABCD \) is inscribed in circle \( P \).

What is \( m \angle ADC \)?
1) \( 70^\circ \)
2) \( 72^\circ \)
3) \( 108^\circ \)
4) \( 110^\circ \)

272 As shown in the diagram below, the angle of elevation from a point on the ground to the top of the tree is \( 34^\circ \).

If the point is 20 feet from the base of the tree, what is the height of the tree, to the nearest tenth of a foot?
1) 29.7
2) 16.6
3) 13.5
4) 11.2

273 A triangle is dilated by a scale factor of 3 with the center of dilation at the origin. Which statement is true?
1) The area of the image is nine times the area of the original triangle.
2) The perimeter of the image is nine times the perimeter of the original triangle.
3) The slope of any side of the image is three times the slope of the corresponding side of the original triangle.
4) The measure of each angle in the image is three times the measure of the corresponding angle of the original triangle.

274 Triangle \( RST \) is graphed on the set of axes below.

How many square units are in the area of \( \triangle RST \)?
1) \( 9\sqrt{3} + 15 \)
2) \( 9\sqrt{5} + 15 \)
3) 45
4) 90
275 In the diagram shown below, $\overline{AC}$ is tangent to circle $O$ at $A$ and to circle $P$ at $C$, $\overline{OP}$ intersects $\overline{AC}$ at $B$, $OA = 4$, $AB = 5$, and $PC = 10$.

What is the length of $BC$?
1) 6.4
2) 8
3) 12.5
4) 16

276 In the diagram of parallelogram $FRED$ shown below, $\overline{ED}$ is extended to $A$, and $\overline{AF}$ is drawn such that $\overline{AF} \cong \overline{DF}$.

If $m\angle R = 124^\circ$, what is $m\angle AFD$?
1) 124°
2) 112°
3) 68°
4) 56°

277 In the diagram below, $\triangle DEF$ is the image of $\triangle ABC$ after a clockwise rotation of 180° and a dilation where $AB = 3$, $BC = 5.5$, $AC = 4.5$, $DE = 6$, $FD = 9$, and $EF = 11$.

Which relationship must always be true?
1) $\frac{m\angle A}{m\angle D} = \frac{1}{2}$
2) $\frac{m\angle C}{m\angle F} = \frac{2}{1}$
3) $\frac{m\angle A}{m\angle C} = \frac{m\angle F}{m\angle D}$
4) $\frac{m\angle B}{m\angle E} = \frac{m\angle C}{m\angle F}$

278 Given right triangles $ABC$ and $DEF$ where $\angle C$ and $\angle F$ are right angles, $\overline{AC} \cong \overline{DF}$ and $\overline{CB} \cong \overline{FE}$.
Describe a precise sequence of rigid motions which would show $\triangle ABC \cong \triangle DEF$. 

$\overline{AC}$ is tangent to circle $O$ at $A$ and to circle $P$ at $C$, $\overline{OP}$ intersects $\overline{AC}$ at $B$, $OA = 4$, $AB = 5$, and $PC = 10$. 

$\overline{ED}$ is extended to $A$, and $\overline{AF}$ is drawn such that $\overline{AF} \cong \overline{DF}$.

$m\angle R = 124^\circ$, what is $m\angle AFD$?
1) 124°
2) 112°
3) 68°
4) 56°
279 As shown below, a canoe is approaching a lighthouse on the coastline of a lake. The front of the canoe is 1.5 feet above the water and an observer in the lighthouse is 112 feet above the water.

At 5:00, the observer in the lighthouse measured the angle of depression to the front of the canoe to be 6°. Five minutes later, the observer measured and saw the angle of depression to the front of the canoe had increased by 49°. Determine and state, to the nearest foot per minute, the average speed at which the canoe traveled toward the lighthouse.

280 In the diagram below of circle O, the area of the shaded sector \( \text{AOC} \) is \( 12\pi \text{ in}^2 \) and the length of \( \overline{OA} \) is 6 inches. Determine and state \( m\angle \text{AOC} \).

281 In the diagram below, \( \triangle ABC \sim \triangle DEF \).

If \( AB = 6 \) and \( AC = 8 \), which statement will justify similarity by SAS?

1) \( DE = 9, DF = 12, \) and \( \angle A \cong \angle D \)
2) \( DE = 8, DF = 10, \) and \( \angle A \cong \angle D \)
3) \( DE = 36, DF = 64, \) and \( \angle C \cong \angle F \)
4) \( DE = 15, DF = 20, \) and \( \angle C \cong \angle F \)
282 Trees that are cut down and stripped of their branches for timber are approximately cylindrical. A timber company specializes in a certain type of tree that has a typical diameter of 50 cm and a typical height of about 10 meters. The density of the wood is 380 kilograms per cubic meter, and the wood can be sold by mass at a rate of $4.75 per kilogram. Determine and state the minimum number of whole trees that must be sold to raise at least $50,000.

283 As shown in the diagram below, $AB$ and $CD$ intersect at $E$, and $AC \parallel BD$.

Given $\triangle AEC \sim \triangle BED$, which equation is true?

1) $\frac{CE}{DE} = \frac{EB}{EA}$
2) $\frac{AE}{BE} = \frac{AC}{BD}$
3) $\frac{EC}{AE} = \frac{BE}{ED}$
4) $\frac{ED}{EC} = \frac{AC}{BD}$

284 In the diagram of $\triangle LAC$ and $\triangle DNC$ below, $\overline{LA} \cong \overline{DN}$, $\overline{CA} \cong \overline{CN}$, and $\angle DAC \perp \angle LCN$.

a) Prove that $\triangle LAC \cong \triangle DNC$.
b) Describe a sequence of rigid motions that will map $\triangle LAC$ onto $\triangle DNC$.

285 A 20-foot support post leans against a wall, making a $70^\circ$ angle with the ground. To the nearest tenth of a foot, how far up the wall will the support post reach?

1) 6.8
2) 6.9
3) 18.7
4) 18.8

286 In the diagram below, $ABCD$ is a parallelogram, $\overline{AB}$ is extended through $B$ to $E$, and $\overline{CE}$ is drawn.

If $\overline{CE} \cong \overline{BE}$ and $\angle D = 112^\circ$, what is $\angle E$?

1) 44°
2) 56°
3) 68°
4) 112°
287 Triangle $ABC$ is graphed on the set of axes below. Graph and label $\triangle A'B'C'$, the image of $\triangle ABC$ after a reflection over the line $x = 1$.

288 In circle $O$ shown below, diameter $AC$ is perpendicular to $CD$ at point $C$, and chords $AB$, $BC$, $AE$, and $CE$ are drawn.

Which statement is not always true?
1) $\angle ACB \cong \angle BCD$
2) $\angle ABC \cong \angle ACD$
3) $\angle BAC \cong \angle DCB$
4) $\angle CBA \cong \angle AEC$

289 As shown in the diagram below, a regular pyramid has a square base whose side measures 6 inches.

If the altitude of the pyramid measures 12 inches, its volume, in cubic inches, is
1) 72
2) 144
3) 288
4) 432

290 In the diagram below of circle $O$ with diameter $BC$ and radius $OA$, chord $DC$ is parallel to chord $BA$.

If $m \angle BCD = 30^\circ$, determine and state $m \angle AOB$. 
Given the theorem, “The sum of the measures of the interior angles of a triangle is $180^\circ$,” complete the proof for this theorem.

Given: $\triangle ABC$
Prove: $m\angle 1 + m\angle 2 + m\angle 3 = 180^\circ$
Fill in the missing reasons below.

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<th>Statements</th>
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<tr>
<td>(1) $\triangle ABC$</td>
<td>(1) Given</td>
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<td>(2) Through point $C$, draw $\overline{DCE}$ parallel to $\overline{AB}$.</td>
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<td>(3) $m\angle 1 = m\angle ACD$, $m\angle 3 = m\angle BCE$</td>
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<td>(4) $m\angle ACD + m\angle 2 + m\angle BCE = 180^\circ$</td>
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<td>(5) $m\angle 1 + m\angle 2 + m\angle 3 = 180^\circ$</td>
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292 A regular hexagon is rotated in a counterclockwise direction about its center. Determine and state the minimum number of degrees in the rotation such that the hexagon will coincide with itself.

293 Given: \( \triangle ABE \) and \( \triangle CBD \) shown in the diagram below with \( DB \cong BE \).

Which statement is needed to prove \( \triangle ABE \cong \triangle CBD \) using only SAS \( \cong \) SAS?
1) \( \angle CDB \cong \angle AEB \)
2) \( \angle AFD \cong \angle EFC \)
3) \( AD \cong CE \)
4) \( AE \cong CD \)

294 A ladder leans against a building. The top of the ladder touches the building 10 feet above the ground. The foot of the ladder is 4 feet from the building. Find, to the nearest degree, the angle that the ladder makes with the level ground.

295 An equilateral triangle has sides of length 20. To the nearest tenth, what is the height of the equilateral triangle?
1) 10.0
2) 11.5
3) 17.3
4) 23.1

296 In the diagram below, \( DC, AC, DOB, CB, \) and \( AB \) are chords of circle \( O, FDE \) is tangent at point \( D, \) and radius \( AO \) is drawn. Sam decides to apply this theorem to the diagram: “An angle inscribed in a semi-circle is a right angle.”

Which angle is Sam referring to?
1) \( \angle AOB \)
2) \( \angle BAC \)
3) \( \angle DCB \)
4) \( \angle FDB \)

297 In the diagram below, the circle shown has radius 10. Angle \( B \) intercepts an arc with a length of \( 2\pi \).

What is the measure of angle \( B, \) in radians?
1) \( 10 + 2\pi \)
2) \( 20\pi \)
3) \( \frac{\pi}{5} \)
4) \( \frac{5}{\pi} \)
298 Using a compass and straightedge, construct and label $\triangle A'B'C'$, the image of $\triangle ABC$ after a dilation with a scale factor of 2 and centered at $B$. [Leave all construction marks.] Describe the relationship between the lengths of $AC$ and $A'C'$.

299 A shipping container is in the shape of a right rectangular prism with a length of 12 feet, a width of 8.5 feet, and a height of 4 feet. The container is completely filled with contents that weigh, on average, 0.25 pound per cubic foot. What is the weight, in pounds, of the contents in the container?
1) 1,632
2) 408
3) 102
4) 92

300 What are the coordinates of the point on the directed line segment from $K(-5, -4)$ to $L(5, 1)$ that partitions the segment into a ratio of 3 to 2?
1) $(-3, -3)$
2) $(-1, -2)$
3) $\left(0, \frac{3}{2}\right)$
4) $(1, -1)$

301 Which statement is sufficient evidence that $\triangle DEF$ is congruent to $\triangle ABC$?
1) $AB = DE$ and $BC = EF$
2) $\angle D \cong \angle A$, $\angle B \cong \angle E$, $\angle C \cong \angle F$
3) There is a sequence of rigid motions that maps $AB$ onto $DE$, $BC$ onto $EF$, and $AC$ onto $DF$.
4) There is a sequence of rigid motions that maps point $A$ onto point $D$, $AB$ onto $DE$, and $\angle B$ onto $\angle E$.

302 As shown in the diagram below, circle $A$ has a radius of 3 and circle $B$ has a radius of 5.

Use transformations to explain why circles $A$ and $B$ are similar.
303 William is drawing pictures of cross sections of the right circular cone below.

Which drawing can not be a cross section of a cone?

1)  

2)  

3)  

4)  

304 Segment $CD$ is the perpendicular bisector of $AB$ at $E$. Which pair of segments does not have to be congruent?

1) $AD, BD$

2) $AC, BC$

3) $AE, BE$

4) $DE, CE$

305 In $\triangle CED$ as shown below, points $A$ and $B$ are located on sides $CE$ and $ED$, respectively. Line segment $AB$ is drawn such that $AE = 3.75$, $AC = 5$, $EB = 4.5$, and $BD = 6$.

Explain why $AB$ is parallel to $CD$.

306 In $\triangle SCU$ shown below, points $T$ and $O$ are on $SU$ and $CU$, respectively. Segment $OT$ is drawn so that $\angle C \cong \angle OTU$.

If $TU = 4$, $OU = 5$, and $OC = 7$, what is the length of $ST$?

1) 5.6

2) 8.75

3) 11

4) 15
307 In the diagram below, $\overline{CD}$ is the image of $\overline{AB}$ after a dilation of scale factor $k$ with center $E$.

Which ratio is equal to the scale factor $k$ of the dilation?

1) $\frac{EC}{EA}$
2) $\frac{BA}{EA}$
3) $\frac{EA}{BA}$
4) $\frac{EA}{EC}$

308 A fish tank in the shape of a rectangular prism has dimensions of 14 inches, 16 inches, and 10 inches. The tank contains 1680 cubic inches of water. What percent of the fish tank is empty?

1) 10
2) 25
3) 50
4) 75

309 Using a compass and straightedge, construct an altitude of triangle $ABC$ below. [Leave all construction marks.]

310 Given: $\triangle AEC$, $\triangle DEF$, and $\overline{FE} \perp \overline{CE}$

What is a correct sequence of similarity transformations that shows $\triangle AEC \sim \triangle DEF$?

1) a rotation of 180 degrees about point $E$ followed by a horizontal translation
2) a counterclockwise rotation of 90 degrees about point $E$ followed by a horizontal translation
3) a rotation of 180 degrees about point $E$ followed by a dilation with a scale factor of 2 centered at point $E$
4) a counterclockwise rotation of 90 degrees about point $E$ followed by a dilation with a scale factor of 2 centered at point $E$
311 In $\triangle ABC$, the complement of $\angle B$ is $\angle A$. Which statement is always true?
1) $\tan \angle A = \tan \angle B$
2) $\sin \angle A = \sin \angle B$
3) $\cos \angle A = \tan \angle B$
4) $\sin \angle A = \cos \angle B$

312 The vertices of $\triangle JKL$ have coordinates $J(5,1)$, $K(-2,-3)$, and $L(-4,1)$. Under which transformation is the image $\triangle J'K'L'$ not congruent to $\triangle JKL$?
1) a translation of two units to the right and two units down
2) a counterclockwise rotation of 180 degrees around the origin
3) a reflection over the $x$-axis
4) a dilation with a scale factor of 2 and centered at the origin

313 Describe a sequence of transformations that will map $\triangle ABC$ onto $\triangle DEF$ as shown below.

314 Quadrilateral $ABCD$ with diagonals $\overline{AC}$ and $\overline{BD}$ is shown in the diagram below.

Which information is not enough to prove $ABCD$ is a parallelogram?
1) $\overline{AB} \cong \overline{CD}$ and $\overline{AB} \parallel \overline{DC}$
2) $\overline{AB} \cong \overline{CD}$ and $\overline{BC} \cong \overline{DA}$
3) $\overline{AB} \cong \overline{CD}$ and $\overline{BC} \parallel \overline{AD}$
4) $\overline{AB} \parallel \overline{DC}$ and $\overline{BC} \parallel \overline{AD}$

315 In the diagram below, which single transformation was used to map triangle $A$ onto triangle $B$?

1) line reflection
2) rotation
3) dilation
4) translation
316 If $\triangle A'B'C'$ is the image of $\triangle ABC$, under which transformation will the triangles not be congruent?
1) reflection over the $x$-axis
2) translation to the left 5 and down 4
3) dilation centered at the origin with scale factor 2
4) rotation of $270^\circ$ counterclockwise about the origin

317 Which transformation of $OA$ would result in an image parallel to $OA$?
1) a translation of two units down
2) a reflection over the $x$-axis
3) a reflection over the $y$-axis
4) a clockwise rotation of $90^\circ$ about the origin

318 Construct an equilateral triangle inscribed in circle $T$ shown below. [Leave all construction marks.]

319 Steve drew line segments $ABCD$, $EFG$, $BF$, and $CF$ as shown in the diagram below. Scalene $\triangle BFC$ is formed.

Which statement will allow Steve to prove $ABCD \parallel EFG$?
1) $\angle CFG \cong \angle FCB$
2) $\angle ABF \cong \angle BFC$
3) $\angle EFB \cong \angle CFB$
4) $\angle CBF \cong \angle GFC$

320 Given: $D$ is the image of $A$ after a reflection over $CH$.
$CH$ is the perpendicular bisector of $BCE$
$\triangle ABC$ and $\triangle DEC$ are drawn
Prove: $\triangle ABC \cong \triangle DEC$
321 In the diagram below, $\triangle ABE$ is the image of $\triangle ACD$ after a dilation centered at the origin. The coordinates of the vertices are $A(0,0)$, $B(3,0)$, $C(4.5,0)$, $D(0,6)$, and $E(0,4)$.

The ratio of the lengths of $BE$ to $CD$ is
1) $\frac{2}{3}$
2) $\frac{3}{2}$
3) $\frac{3}{4}$
4) $\frac{4}{3}$

322 To find the distance across a pond from point $B$ to point $C$, a surveyor drew the diagram below. The measurements he made are indicated on his diagram.

Use the surveyor's information to determine and state the distance from point $B$ to point $C$, to the nearest yard.

323 Cathy wants to determine the height of the flagpole shown in the diagram below. She uses a survey instrument to measure the angle of elevation to the top of the flagpole, and determines it to be 34.9°. She walks 8 meters closer and determines the new measure of the angle of elevation to be 52.8°. At each measurement, the survey instrument is 1.7 meters above the ground.

Determine and state, to the nearest tenth of a meter, the height of the flagpole.

324 In the diagram of $\triangle ABC$, points $D$ and $E$ are on $AB$ and $CB$, respectively, such that $AC \parallel DE$.

If $AD = 24$, $DB = 12$, and $DE = 4$, what is the length of $AC$?
1) 8
2) 12
3) 16
4) 72
325 In the diagram below, $\overline{EF}$ intersects $\overline{AB}$ and $\overline{CD}$ at $G$ and $H$, respectively, and $\overline{GI}$ is drawn such that $GH \cong HI$.

If $m \angle EGB = 50^\circ$ and $m \angle DIG = 115^\circ$, explain why $AB \parallel CD$.

326 A regular pentagon is shown in the diagram below.

If the pentagon is rotated clockwise around its center, the minimum number of degrees it must be rotated to carry the pentagon onto itself is

1) 54°
2) 72°
3) 108°
4) 360°

327 Walter wants to make 100 candles in the shape of a cone for his new candle business. The mold shown below will be used to make the candles. Each mold will have a height of 8 inches and a diameter of 3 inches. To the nearest cubic inch, what will be the total volume of 100 candles?

Walter goes to a hobby store to buy the wax for his candles. The wax costs $0.10 per ounce. If the weight of the wax is 0.52 ounce per cubic inch, how much will it cost Walter to buy the wax for 100 candles? If Walter spent a total of $37.83 for the molds and charges $1.95 for each candle, what is Walter's profit after selling 100 candles?

328 A flagpole casts a shadow 16.60 meters long. Tim stands at a distance of 12.45 meters from the base of the flagpole, such that the end of Tim's shadow meets the end of the flagpole's shadow. If Tim is 1.65 meters tall, determine and state the height of the flagpole to the nearest tenth of a meter.
329 If the rectangle below is continuously rotated about side w, which solid figure is formed?

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1) pyramid
2) rectangular prism
3) cone
4) cylinder

330 The endpoints of DEF are D(1,4) and F(16,14). Determine and state the coordinates of point E, if \( DE:EF = 2:3 \).

331 A hemispherical water tank has an inside diameter of 10 feet. If water has a density of 62.4 pounds per cubic foot, what is the weight of the water in a full tank, to the nearest pound?

1) 16,336
2) 32,673
3) 130,690
4) 261,381

332 The center of circle \( Q \) has coordinates (3,-2). If circle \( Q \) passes through \( R(7,1) \), what is the length of its diameter?

1) 50
2) 25
3) 10
4) 5

333 The map below shows the three tallest mountain peaks in New York State: Mount Marcy, Algonquin Peak, and Mount Haystack. Mount Haystack, the shortest peak, is 4960 feet tall. Surveyors have determined the horizontal distance between Mount Haystack and Mount Marcy is 6336 feet and the horizontal distance between Mount Marcy and Algonquin Peak is 20,493 feet.

The angle of depression from the peak of Mount Marcy to the peak of Mount Haystack is 3.47 degrees. The angle of elevation from the peak of Algonquin Peak to the peak of Mount Marcy is 0.64 degrees. What are the heights, to the nearest foot, of Mount Marcy and Algonquin Peak? Justify your answer.

334 A circle has a center at (1,-2) and radius of 4. Does the point (3.4,1.2) lie on the circle? Justify your answer.
335 Given $MN$ shown below, with $M(-6, 1)$ and $N(3, -5)$, what is an equation of the line that passes through point $P(6, 1)$ and is parallel to $MN$?

1) $y = -\frac{2}{3}x + 5$
2) $y = -\frac{2}{3}x - 3$
3) $y = \frac{3}{2}x + 7$
4) $y = \frac{3}{2}x - 8$

336 A quadrilateral has vertices with coordinates $(-3, 1), (0, 3), (5, 2), \text{ and } (-1, -2)$. Which type of quadrilateral is this?
1) rhombus
2) rectangle
3) square
4) trapezoid

337 In parallelogram $ABCD$ shown below, diagonals $AC$ and $BD$ intersect at $E$.

![Parallelogram Diagram]

Prove: $\angle ACD \cong \angle CAB$

338 Two right triangles must be congruent if
1) an acute angle in each triangle is congruent
2) the lengths of the hypotenuses are equal
3) the corresponding legs are congruent
4) the areas are equal

339 In the diagram below, $\triangle ABC \sim \triangle ADE$.

![Similar Triangles Diagram]

Which measurements are justified by this similarity?
1) $AD = 3, AB = 6, AE = 4, \text{ and } AC = 12$
2) $AD = 5, AB = 8, AE = 7, \text{ and } AC = 10$
3) $AD = 3, AB = 9, AE = 5, \text{ and } AC = 10$
4) $AD = 2, AB = 6, AE = 5, \text{ and } AC = 15$
340 In parallelogram $ABCD$, diagonals $AC$ and $BD$ intersect at $E$. Which statement does not prove parallelogram $ABCD$ is a rhombus?

1) $AC \cong DB$
2) $AB \cong BC$
3) $AC \perp DB$
4) $AC$ bisects $\angle DCB$

341 In the diagram of right triangle $ABC$ shown below, $AB = 14$ and $AC = 9$. What is the measure of $\angle A$, to the nearest degree?

1) 33
2) 40
3) 50
4) 57

342 What is the area of a sector of a circle with a radius of 8 inches and formed by a central angle that measures $60^\circ$?

1) $\frac{8\pi}{3}$
2) $\frac{16\pi}{3}$
3) $\frac{32\pi}{3}$
4) $\frac{64\pi}{3}$

343 The coordinates of the endpoints of $AB$ are $A(-6,-5)$ and $B(4,0)$. Point $P$ is on $AB$. Determine and state the coordinates of point $P$, such that $AP:PB$ is 2:3. [The use of the set of axes below is optional.]

344 Which transformation would not always produce an image that would be congruent to the original figure?

1) translation
2) dilation
3) rotation
4) reflection
345 Given: Circle $O$, chords $AB$ and $CD$ intersect at $E$

Theorem: If two chords intersect in a circle, the product of the lengths of the segments of one chord is equal to the product of the lengths of the segments of the other chord. Prove this theorem by proving $AE \cdot EB = CE \cdot ED$.

346 On the set of axes below, rectangle $ABCD$ can be proven congruent to rectangle $KLMN$ using which transformation?

347 Find the value of $R$ that will make the equation $\sin 73^\circ = \cos R$ true when $0^\circ < R < 90^\circ$. Explain your answer.

348 Use a compass and straightedge to construct an inscribed square in circle $T$ shown below. [Leave all construction marks.]

349 A designer needs to create perfectly circular necklaces. The necklaces each need to have a radius of 10 cm. What is the largest number of necklaces that can be made from 1000 cm of wire?

1) 15
2) 16
3) 31
4) 32
350 A student has a rectangular postcard that he folds in half lengthwise. Next, he rotates it continuously about the folded edge. Which three-dimensional object below is generated by this rotation?

1)  

2)  

3)  

4)  

351 During an experiment, the same type of bacteria is grown in two petri dishes. Petri dish $A$ has a diameter of 51 mm and has approximately 40,000 bacteria after 1 hour. Petri dish $B$ has a diameter of 75 mm and has approximately 72,000 bacteria after 1 hour.

Determine and state which petri dish has the greater population density of bacteria at the end of the first hour.

352 Line segment $NY$ has endpoints $N(-11,5)$ and $Y(5,-7)$. What is the equation of the perpendicular bisector of $NY$?

1) $y + 1 = \frac{4}{3}(x + 3)$  

2) $y + 1 = -\frac{3}{4}(x + 3)$  

3) $y - 6 = \frac{4}{3}(x - 8)$  

4) $y - 6 = -\frac{3}{4}(x - 8)$  

353 Which expression is always equivalent to $\sin x$ when $0^\circ < x < 90^\circ$?

1) $\cos(90^\circ - x)$  

2) $\cos(45^\circ - x)$  

3) $\cos(2x)$  

4) $\cos x$
354 In the diagram below of circle $O$, diameter $AB$ and radii $OC$ and $OD$ are drawn. The length of $AB$ is 12 and the measure of $\angle COD$ is 20 degrees.

If $AC \cong BD$, find the area of sector $BOD$ in terms of $\pi$.

355 In the diagram below, a square is graphed in the coordinate plane.

A reflection over which line does not carry the square onto itself?
1) $x = 5$
2) $y = 2$
3) $y = x$
4) $x + y = 4$

356 Two stacks of 23 quarters each are shown below. One stack forms a cylinder but the other stack does not form a cylinder.

Use Cavelieri’s principle to explain why the volumes of these two stacks of quarters are equal.

357 Given: Parallelogram $ABCD$, $EFG$, and diagonal $DFB$

Prove: $\triangle DEF \sim \triangle BGF$

358 Molly wishes to make a lawn ornament in the form of a solid sphere. The clay being used to make the sphere weighs .075 pound per cubic inch. If the sphere's radius is 4 inches, what is the weight of the sphere, to the nearest pound?
1) 34
2) 20
3) 15
4) 4
359 Triangles $RST$ and $XYZ$ are drawn below. If $RS = 6$, $ST = 14$, $XY = 9$, $YZ = 21$, and $\angle S \cong \angle Y$, is $\triangle RST$ similar to $\triangle XYZ$? Justify your answer.

360 Point $P$ is on the directed line segment from point $X(-6,-2)$ to point $Y(6,7)$ and divides the segment in the ratio $1:5$. What are the coordinates of point $P$?

1) $\left(4,5\frac{1}{2}\right)$
2) $\left(-1, -4\right)$
3) $\left(-4 \frac{1}{2}, 0\right)$
4) $\left(-4, -\frac{1}{2}\right)$

361 If an equilateral triangle is continuously rotated around one of its medians, which 3-dimensional object is generated?

1) cone
2) pyramid
3) prism
4) sphere

362 A gallon of paint will cover approximately 450 square feet. An artist wants to paint all the outside surfaces of a cube measuring 12 feet on each edge. What is the least number of gallons of paint he must buy to paint the cube?

1) 1
2) 2
3) 3
4) 4

363 Line segment $EA$ is the perpendicular bisector of $\overline{ZT}$, and $\overline{ZE}$ and $\overline{TE}$ are drawn.

Which conclusion can not be proven?

1) $\overline{EA}$ bisects angle $ZE\ell$.
2) Triangle $EZT$ is equilateral.
3) $\overline{EA}$ is a median of triangle $EZT$.
4) Angle $Z$ is congruent to angle $T$. 
364 In the diagram below, $BC$ is the diameter of circle $A$.

Point $D$, which is unique from points $B$ and $C$, is plotted on circle $A$. Which statement must always be true?

1) $\triangle BCD$ is a right triangle.
2) $\triangle BCD$ is an isosceles triangle.
3) $\triangle BAD$ and $\triangle CBD$ are similar triangles.
4) $\triangle BAD$ and $\triangle CAD$ are congruent triangles.

365 In the diagram below, $AC \cong DF$ and points $A$, $C$, $D$, and $F$ are collinear on line $\ell$.

Let $\triangle D'EF$ be the image of $\triangle DEF$ after a translation along $\ell$, such that point $D$ is mapped onto point $A$. Determine and state the location of $F'$. Explain your answer. Let $\triangle D'E'F''$ be the image of $\triangle D'EF$ after a reflection across line $\ell$. Suppose that $E''$ is located at $B$. Is $\triangle DEF$ congruent to $\triangle ABC$? Explain your answer.

366 In parallelogram $QRST$ shown below, diagonal $TR$ is drawn, $U$ and $V$ are points on $TS$ and $QR$, respectively, and $\overline{UV}$ intersects $\overline{TR}$ at $W$.

If $m\angle S = 60^\circ$, $m\angle SRT = 83^\circ$, and $m\angle TWU = 35^\circ$, what is $m\angle WVQ$?

1) $37^\circ$
2) $60^\circ$
3) $72^\circ$
4) $83^\circ$

367 Which point shown in the graph below is the image of point $P$ after a counterclockwise rotation of $90^\circ$ about the origin?

1) $A$
2) $B$
3) $C$
4) $D$
368 In the diagram below, radius $\overline{OA}$ is drawn in circle $O$. Using a compass and a straightedge, construct a line tangent to circle $O$ at point $A$. [Leave all construction marks.]

369 In $\triangle RST$ shown below, altitude $\overline{SU}$ is drawn to $\overline{RT}$ at $U$.

If $SU = h$, $UT = 12$, and $RT = 42$, which value of $h$ will make $\triangle RST$ a right triangle with $\angle RST$ as a right angle?

1) $6\sqrt{3}$
2) $6\sqrt{10}$
3) $6\sqrt{14}$
4) $6\sqrt{35}$

370 What are the coordinates of the center and the length of the radius of the circle represented by the equation $x^2 + y^2 - 4x + 8y + 11 = 0$?

1) center $(2, -4)$ and radius 3
2) center $(-2, 4)$ and radius 3
3) center $(2, -4)$ and radius 9
4) center $(-2, 4)$ and radius 9

371 In rhombus $MATH$, the coordinates of the endpoints of the diagonal $\overline{MT}$ are $M(0, -1)$ and $T(4, 6)$. Write an equation of the line that contains diagonal $\overline{AH}$. [Use of the set of axes below is optional.] Using the given information, explain how you know that your line contains diagonal $\overline{AH}$. 

If $SU = h$, $UT = 12$, and $RT = 42$, which value of $h$ will make $\triangle RST$ a right triangle with $\angle RST$ as a right angle?
372 Given: Parallelogram $ANDR$ with $\overline{AW}$ and $\overline{DE}$ bisecting $NWD$ and $REA$ at points $W$ and $E$, respectively.

Prove that $\triangle ANW \cong \triangle DRE$. Prove that quadrilateral $AWDE$ is a parallelogram.

373 Directed line segment $PT$ has endpoints whose coordinates are $P(-2,1)$ and $T(4,7)$. Determine the coordinates of point $J$ that divides the segment in the ratio 2 to 1. [The use of the set of axes below is optional.]

374 Line $\ell$ is mapped onto line $m$ by a dilation centered at the origin with a scale factor of 2. The equation of line $\ell$ is $3x - y = 4$. Determine and state an equation for line $m$.

375 Prove the sum of the exterior angles of a triangle is $360^\circ$.

376 In the diagram of $\triangle ABC$ shown below, use a compass and straightedge to construct the median to $AB$. [Leave all construction marks.]
377 In the diagram below, $\triangle ABC \sim \triangle DEC$.

If $AC = 12$, $DC = 7$, $DE = 5$, and the perimeter of $\triangle ABC$ is 30, what is the perimeter of $\triangle DEC$?
1) 12.5  
2) 14.0  
3) 14.8  
4) 17.5

378 In the diagram of $\triangle ADC$ below, $EB \parallel DC$, $AE = 9$, $ED = 5$, and $AB = 9.2$.

What is the length of $AC$, to the nearest tenth?
1) 5.1  
2) 5.2  
3) 14.3  
4) 14.4

379 In triangle $CHR$, $O$ is on $\overline{HR}$, and $D$ is on $\overline{CR}$ so that $\angle H \cong \angle RDO$.

If $RD = 4$, $RO = 6$, and $OH = 4$, what is the length of $CD$?
1) $2 \frac{2}{3}$  
2) $6 \frac{2}{3}$  
3) 11  
4) 15

380 The ratio of similarity of $\triangle BOY$ to $\triangle GRL$ is 1:2. If $BO = x + 3$ and $GR = 3x - 1$, then the length of $GR$ is
1) 5  
2) 7  
3) 10  
4) 20

381 A barrel of fuel oil is a right circular cylinder where the inside measurements of the barrel are a diameter of 22.5 inches and a height of 33.5 inches. There are 231 cubic inches in a liquid gallon. Determine and state, to the nearest tenth, the gallons of fuel that are in a barrel of fuel oil.
382 The coordinates of the vertices of $\triangle RST$ are 
$R(-2, -3)$, $S(8, 2)$, and $T(4, 5)$. Which type of 
triangle is $\triangle RST$?
1) right
2) acute
3) obtuse
4) equiangular

383 Using a straightedge and compass, construct a 
square inscribed in circle $O$ below. [Leave all 
construction marks.]

384 The graph below shows $AB$, which is a chord of 
circle $O$. The coordinates of the endpoints of $AB$ 
are $A(3, 3)$ and $B(3, -7)$. The distance from the 
midpoint of $AB$ to the center of circle $O$ is 2 units.

![Graph of circle and line segment AB]

What could be a correct equation for circle $O$?
1) $(x - 1)^2 + (y + 2)^2 = 29$
2) $(x + 5)^2 + (y - 2)^2 = 29$
3) $(x - 1)^2 + (y - 2)^2 = 25$
4) $(x - 5)^2 + (y + 2)^2 = 25$

385 In the diagram below, $\overline{CD}$ is the altitude drawn to 
the hypotenuse $\overline{AB}$ of right triangle $ABC$.

![Diagram of right triangle and altitude CD]

Which lengths would not produce an altitude that 
measures $6\sqrt{2}$?
1) $AD = 2$ and $DB = 36$
2) $AD = 3$ and $AB = 24$
3) $AD = 6$ and $DB = 12$
4) $AD = 8$ and $AB = 17$
386 In the diagram below, the line of sight from the park ranger station, \( P \), to the lifeguard chair, \( L \), on the beach of a lake is perpendicular to the path joining the campground, \( C \), and the first aid station, \( F \). The campground is 0.25 mile from the lifeguard chair. The straight paths from both the campground and first aid station to the park ranger station are perpendicular.

If the path from the park ranger station to the campground is 0.55 mile, determine and state, to the nearest hundredth of a mile, the distance between the park ranger station and the lifeguard chair. Gerald believes the distance from the first aid station to the campground is at least 1.5 miles. Is Gerald correct? Justify your answer.

387 Line segment \( A'B' \), whose endpoints are \((4,-2)\) and \((16,14)\), is the image of \( AB \) after a dilation of \( \frac{1}{2} \) centered at the origin. What is the length of \( AB \)?
1) 5  
2) 10  
3) 20  
4) 40

388 In the diagram below, \( \triangle ABC \) has vertices \( A(4,5) \), \( B(2,1) \), and \( C(7,3) \).

What is the slope of the altitude drawn from \( A \) to \( BC \)?
1) \( \frac{2}{5} \)  
2) \( \frac{3}{2} \)  
3) \( -\frac{1}{2} \)  
4) \( -\frac{5}{2} \)

389 What are the coordinates of the center and length of the radius of the circle whose equation is \( x^2 + 6x + y^2 - 4y = 23 \)?
1) \((3,-2)\) and 36  
2) \((3,-2)\) and 6  
3) \((-3,2)\) and 36  
4) \((-3,2)\) and 6
390 The image of \( \triangle ABC \) after a dilation of scale factor \( k \) centered at point \( A \) is \( \triangle ADE \), as shown in the diagram below.

![Diagram of \( \triangle ABC \) and \( \triangle ADE \)]

Which statement is always true?

1) \( 2AB = AD \)
2) \( AD \perp DE \)
3) \( AC = CE \)
4) \( BC \parallel DE \)

391 The diagram below shows a ramp connecting the ground to a loading platform 4.5 feet above the ground. The ramp measures 11.75 feet from the ground to the top of the loading platform.

![Diagram of ramp and loading platform]

Determine and state, to the nearest degree, the angle of elevation formed by the ramp and the ground.

392 Point \( P \) is on segment \( AB \) such that \( AP:PB = 4:5 \). If \( A \) has coordinates \((4,2)\), and \( B \) has coordinates \((22,2)\), determine and state the coordinates of \( P \).

393 In circle \( O \), diameter \( AB \), chord \( BC \), and radius \( OC \) are drawn, and the measure of arc \( BC \) is \( 108^\circ \).

![Diagram of circle with arc \( BC \)]

Some students wrote these formulas to find the area of sector \( COB \):

- Amy \( \frac{3}{10} \cdot \pi \cdot (BC)^2 \)
- Beth \( \frac{108}{360} \cdot \pi \cdot (OC)^2 \)
- Carl \( \frac{3}{10} \cdot \pi \cdot \left(\frac{1}{2} AB\right)^2 \)
- Dex \( \frac{108}{360} \cdot \pi \cdot \left(\frac{1}{2} AB\right)^2 \)

Which students wrote correct formulas?

1) Amy and Dex
2) Beth and Carl
3) Carl and Amy
4) Dex and Beth

394 A man who is 5 feet 9 inches tall casts a shadow of 8 feet 6 inches. Assuming that the man is standing perpendicular to the ground, what is the angle of elevation from the end of the shadow to the top of the man’s head, to the nearest tenth of a degree?

1) 34.1
2) 34.5
3) 42.6
4) 55.9
395 As graphed on the set of axes below, $\triangle A'B'C'$ is the image of $\triangle ABC$ after a sequence of transformations.

Is $\triangle A'B'C'$ congruent to $\triangle ABC$? Use the properties of rigid motion to explain your answer.

396 A snow cone consists of a paper cone completely filled with shaved ice and topped with a hemisphere of shaved ice, as shown in the diagram below. The inside diameter of both the cone and the hemisphere is 8.3 centimeters. The height of the cone is 10.2 centimeters.

The desired density of the shaved ice is 0.697 $\text{g/cm}^3$, and the cost, per kilogram, of ice is $3.83. Determine and state the cost of the ice needed to make 50 snow cones.

397 Triangle $XYZ$ is shown below. Using a compass and straightedge, on the line below, construct and label $\triangle ABC$, such that $\triangle ABC \cong \triangle XYZ$. [Leave all construction marks.] Based on your construction, state the theorem that justifies why $\triangle ABC$ is congruent to $\triangle XYZ$.

398 The line $3y = -2x + 8$ is transformed by a dilation centered at the origin. Which linear equation could be its image?

1) $2x + 3y = 5$
2) $2x - 3y = 5$
3) $3x + 2y = 5$
4) $3x - 2y = 5$
399 In the diagram below, Circle 1 has radius 4, while Circle 2 has radius 6.5. Angle \(A\) intercepts an arc of length \(\pi\), and angle \(B\) intercepts an arc of length \(\frac{13\pi}{8}\).

Dominic thinks that angles \(A\) and \(B\) have the same radian measure. State whether Dominic is correct or not. Explain why.

400 Triangle \(FGH\) is inscribed in circle \(O\), the length of radius \(OH\) is 6, and \(FH \cong OG\).

What is the area of the sector formed by angle \(FOH\)?
1) \(2\pi\)
2) \(\frac{3}{2}\pi\)
3) \(6\pi\)
4) \(24\pi\)

401 In scalene triangle \(ABC\) shown in the diagram below, \(m\angle C = 90^\circ\).

Which equation is always true?
1) \(\sin A = \sin B\)
2) \(\cos A = \cos B\)
3) \(\cos A = \sin C\)
4) \(\sin A = \cos B\)

402 The cross section of a regular pyramid contains the altitude of the pyramid. The shape of this cross section is a
1) circle
2) square
3) triangle
4) rectangle

403 Given: \(\triangle XYZ\), \(XY \cong ZY\), and \(YW\) bisects \(\angle XYZ\)

Prove that \(\angle YWZ\) is a right angle.
404 In the diagram below, lines $\ell$, $m$, $n$, and $p$ intersect line $r$.

Which statement is true?
1) $\ell \parallel n$
2) $\ell \parallel p$
3) $m \parallel p$
4) $m \parallel n$

405 Which figure can have the same cross section as a sphere?

1) 
2) 
3) 
4) 

406 A hemispherical tank is filled with water and has a diameter of 10 feet. If water weighs 62.4 pounds per cubic foot, what is the total weight of the water in a full tank, to the nearest pound?
1) 16,336
2) 32,673
3) 130,690
4) 261,381

407 A three-inch line segment is dilated by a scale factor of 6 and centered at its midpoint. What is the length of its image?
1) 9 inches
2) 2 inches
3) 15 inches
4) 18 inches

408 Triangle $ABC$ has vertices with $A(x,3)$, $B(-3,-1)$, and $C(-1,-4)$. Determine and state a value of $x$ that would make triangle $ABC$ a right triangle. Justify why $\triangle ABC$ is a right triangle. [The use of the set of axes below is optional.]
409 Seawater contains approximately 1.2 ounces of salt per liter on average. How many gallons of seawater, to the nearest tenth of a gallon, would contain 1 pound of salt?
1) 3.3
2) 3.5
3) 4.7
4) 13.3

410 In the diagram below, $\angle BDC = 100^\circ$, $\angle A = 50^\circ$, and $\angle DBC = 30^\circ$.

Which statement is true?
1) $\triangle ABD$ is obtuse.
2) $\triangle ABC$ is isosceles.
3) $\angle ABD = 80^\circ$
4) $\triangle ABD$ is scalene.

411 The diagram below shows parallelogram $LMNO$ with diagonal $LN$, $\angle M = 118^\circ$, and $\angle LNO = 22^\circ$.

Explain why $\angle NLO$ is 40 degrees.

412 In the diagram below, $\triangle A'B'C'$ is the image of $\triangle ABC$ after a transformation.

Describe the transformation that was performed. Explain why $\triangle A'B'C' \sim \triangle ABC$.

413 As modeled below, a movie is projected onto a large outdoor screen. The bottom of the 60-foot-tall screen is 12 feet off the ground. The projector sits on the ground at a horizontal distance of 75 feet from the screen.

Determine and state, to the nearest tenth of a degree, the measure of $\theta$, the projection angle.
414 In the diagram below, congruent figures 1, 2, and 3 are drawn. Which sequence of transformations maps figure 1 onto figure 2 and then figure 2 onto figure 3?
1) a reflection followed by a translation
2) a rotation followed by a translation
3) a translation followed by a reflection
4) a translation followed by a rotation

415 In the diagram of parallelogram $ABCD$ below, $BE \perp CED$, $DF \perp BFC$, $CE \cong CF$.
Prove $ABCD$ is a rhombus.

416 The endpoints of one side of a regular pentagon are $(-1,4)$ and $(2,3)$. What is the perimeter of the pentagon?
1) $\sqrt{10}$
2) $5\sqrt{10}$
3) $5\sqrt{2}$
4) $25\sqrt{2}$

417 After a reflection over a line, $\triangle A'B'C'$ is the image of $\triangle ABC$. Explain why triangle $ABC$ is congruent to triangle $\triangle A'B'C'$.

418 Which transformation would result in the perimeter of a triangle being different from the perimeter of its image?
1) $(x,y) \rightarrow (y,x)$
2) $(x,y) \rightarrow (x,-y)$
3) $(x,y) \rightarrow (4x, 4y)$
4) $(x,y) \rightarrow (x+2, y-5)$

419 If $\triangle ABC$ is dilated by a scale factor of 3, which statement is true of the image $\triangle A'B'C'$?
1) $3A'B' = AB$
2) $B'C' = 3BC$
3) $m\angle A' = 3(m\angle A)$
4) $3(m\angle C') = m\angle C$

420 Which equation represents a line that is perpendicular to the line represented by $2x - y = 7$?
1) $y = -\frac{1}{2}x + 6$
2) $y = \frac{1}{2}x + 6$
3) $y = -2x + 6$
4) $y = 2x + 6$
Francisco needs the three pieces of glass shown below to complete a stained glass window. The shapes, two triangles and a trapezoid, are measured in inches.

Glass can be purchased in rectangular sheets that are 12 inches wide. What is the minimum length of a sheet of glass, in inches, that Francisco must purchase in order to have enough to complete the window?
1) 20  
2) 25  
3) 29  
4) 34

A support wire reaches from the top of a pole to a clamp on the ground. The pole is perpendicular to the level ground and the clamp is 10 feet from the base of the pole. The support wire makes a 68° angle with the ground. Find the length of the support wire to the nearest foot.

Which information is not sufficient to prove that a parallelogram is a square?
1) The diagonals are both congruent and perpendicular.
2) The diagonals are congruent and one pair of adjacent sides are congruent.
3) The diagonals are perpendicular and one pair of adjacent sides are congruent.
4) The diagonals are perpendicular and one pair of adjacent sides are perpendicular.

A 15-foot ladder leans against a wall and makes an angle of 65° with the ground. What is the horizontal distance from the wall to the base of the ladder, to the nearest tenth of a foot?
1) 6.3  
2) 7.0  
3) 12.9  
4) 13.6

The equation of a circle is \(x^2 + 8x + y^2 - 12y = 144\). What are the coordinates of the center and the length of the radius of the circle?
1) center (4, -6) and radius 12  
2) center (-4, 6) and radius 12  
3) center (4, -6) and radius 14  
4) center (-4, 6) and radius 14
426 The table below shows the population and land area, in square miles, of four counties in New York State at the turn of the century.

<table>
<thead>
<tr>
<th>County</th>
<th>2000 Census Population</th>
<th>2000 Land Area (mi²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broome</td>
<td>200,536</td>
<td>706.82</td>
</tr>
<tr>
<td>Dutchess</td>
<td>280,150</td>
<td>801.59</td>
</tr>
<tr>
<td>Niagara</td>
<td>219,846</td>
<td>522.95</td>
</tr>
<tr>
<td>Saratoga</td>
<td>200,635</td>
<td>811.84</td>
</tr>
</tbody>
</table>

Which county had the greatest population density?
1) Broome 3) Niagara
2) Dutchess 4) Saratoga

427 In the diagram below of parallelogram $ABCD$, $AFGB$, $CF$ bisects $\angle DCB$, $DG$ bisects $\angle ADC$, and $CF$ and $DG$ intersect at $E$.

If $m\angle B = 75^\circ$, then the measure of $\angle EFA$ is
1) $142.5^\circ$
2) $127.5^\circ$
3) $52.5^\circ$
4) $37.5^\circ$

428 Write an equation of the line that is parallel to the line whose equation is $3y + 7 = 2x$ and passes through the point $(2,6)$.

429 After a dilation centered at the origin, the image of $CD$ is $C'D'$. If the coordinates of the endpoints of these segments are $C(6,-4)$, $D(2,-8)$, $C'(9,-6)$, and $D'(3,-12)$, the scale factor of the dilation is
1) $\frac{3}{2}$
2) $\frac{2}{3}$
3) $3$
4) $\frac{1}{3}$

430 A quadrilateral must be a parallelogram if
1) one pair of sides is parallel and one pair of angles is congruent
2) one pair of sides is congruent and one pair of angles is congruent
3) one pair of sides is both parallel and congruent
4) the diagonals are congruent
431 A walking path at a local park is modeled on the grid below, where the length of each grid square is 10 feet. The town needs to submit paperwork to pave the walking path. Determine and state, to the nearest square foot, the area of the walking path.

432 In parallelogram $PQRS$, $\overline{QP}$ is extended to point $T$ and $ST$ is drawn.

If $ST \cong SP$ and $m\angle R = 130^\circ$, what is $m\angle PST$?
1) $130^\circ$
2) $80^\circ$
3) $65^\circ$
4) $50^\circ$

433 The expression $\sin 57^\circ$ is equal to
1) $\tan 33^\circ$
2) $\cos 33^\circ$
3) $\tan 57^\circ$
4) $\cos 57^\circ$

434 Given: Quadrilateral $MATH$, $\overline{HM} \cong \overline{AT}$, $\overline{HT} \cong \overline{AM}$, $HE \perp MEA$, and $HA \perp AT$

Prove: $TA \cdot HA = HE \cdot TH$

435 The coordinates of the endpoints of $\overline{QS}$ are $Q(-9,8)$ and $S(9,-4)$. Point $R$ is on $\overline{QS}$ such that $QR:RS$ is in the ratio of $1:2$. What are the coordinates of point $R$?
1) $(0,2)$
2) $(3,0)$
3) $(-3,4)$
4) $(-6,6)$
436 Theresa has a rectangular pool 30 ft long, 15 ft wide, and 4 ft deep. Theresa fills her pool using city water at a rate of $3.95 per 100 gallons of water. Nancy has a circular pool with a diameter of 24 ft and a depth of 4 ft. Nancy fills her pool with a water delivery service at a rate of $200 per 6000 gallons. If Theresa and Nancy both fill their pools 6 inches from the top of the pool, determine and state who paid more to fill her pool. 

\[1\text{ft}^3 \text{ water} = 7.48 \text{ gallons}\]

437 Given circle \(O\) with radius \(OA\), use a compass and straightedge to construct an equilateral triangle inscribed in circle \(O\). [Leave all construction marks.]

438 In parallelogram \(ABCD\) shown below, \(m\angle DAC = 98^\circ\) and \(m\angle ACD = 36^\circ\).

What is the measure of angle \(B\)? Explain why.

439 In the diagram of equilateral triangle \(ABC\) shown below, \(E\) and \(F\) are the midpoints of \(AC\) and \(BC\), respectively.

\[
\text{If } EF = 2x + 8 \text{ and } AB = 7x - 2, \text{ what is the perimeter of trapezoid } ABFE? \\
1) 36 \\
2) 60 \\
3) 100 \\
4) 120
\]

440 An airplane took off at a constant angle of elevation. After the plane traveled for 25 miles, it reached an altitude of 5 miles, as modeled below.

To the nearest tenth of a degree, what was the angle of elevation?

441 If the altitudes of a triangle meet at one of the triangle's vertices, then the triangle is

1) a right triangle 
2) an acute triangle 
3) an obtuse triangle 
4) an equilateral triangle
442 Point $M$ divides $AB$ so that $AM:MB = 1:2$. If $A$ has coordinates $(-1, -3)$ and $B$ has coordinates $(8, 9)$, the coordinates of $M$ are

1) $(2, 1)$
2) $\left(\frac{5}{3}, 0\right)$
3) $(5, 5)$
4) $\left(\frac{23}{3}, 8\right)$

443 In the diagram below of circle $K$, secant $PLKE$ and tangent $PZ$ are drawn from external point $P$.

If $m\angle Z = 56^\circ$, determine and state the degree measure of angle $P$.

444 In rhombus $VENU$, diagonals $VN$ and $EU$ intersect at $S$. If $VN = 12$ and $EU = 16$, what is the perimeter of the rhombus?

1) 80
2) 40
3) 20
4) 10

445 In the diagram below of $\triangle ACD$, $DB$ is a median to $AC$, and $AB \cong DB$.

If $m\angle DAB = 32^\circ$, what is $m\angle BDC$?

1) $32^\circ$
2) $52^\circ$
3) $58^\circ$
4) $64^\circ$

446 In the diagram below, $\triangle ABC$ with sides 13, 15, and 16, is mapped onto $\triangle DEF$ after a clockwise rotation of $90^\circ$ about point $P$.

If $DE = 2x - 1$, what is the value of $x$?

1) 7
2) 7.5
3) 8
4) 8.5
447 In right triangle $ABC$ shown below, point $D$ is on $AB$ and point $E$ is on $CB$ such that $AC \parallel DE$.

If $AB = 15$, $BC = 12$, and $EC = 7$, what is the length of $BD$?
1) 8.75
2) 6.25
3) 5
4) 4

448 In the diagram below, chords $PQ$ and $RS$ of circle $O$ intersect at $T$.

Which relationship must always be true?
1) $RT = TQ$
2) $RT = TS$
3) $RT + TS = PT + TQ$
4) $RT \times TS = PT \times TQ$

449 A vendor is using an 8-ft by 8-ft tent for a craft fair. The legs of the tent are 9 ft tall and the top forms a square pyramid with a height of 3 ft.

What is the volume, in cubic feet, of space the tent occupies?
1) 256
2) 640
3) 672
4) 768

450 From a point on the ground one-half mile from the base of a historic monument, the angle of elevation to its top is $11.87^\circ$. To the nearest foot, what is the height of the monument?
1) 543
2) 555
3) 1086
4) 1110

451 What is the volume, in cubic centimeters, of a right square pyramid with base edges that are 64 cm long and a slant height of 40 cm?
1) 8192.0
2) 13,653.3
3) 32,768.0
4) 54,613.3
452 In the diagram below of triangle $ABC$, $\overline{AC}$ is extended through point $C$ to point $D$, and $BE$ is drawn to $\overline{AC}$.

Which equation is always true?
1) $m\angle 1 = m\angle 3 + m\angle 2$
2) $m\angle 5 = m\angle 3 - m\angle 2$
3) $m\angle 6 = m\angle 3 - m\angle 2$
4) $m\angle 7 = m\angle 3 + m\angle 2$

453 In the diagram below, circle $O$ has a radius of 10.

If $m\overline{AB} = 72^\circ$, find the area of shaded sector $AOB$, in terms of $\pi$.

454 Triangle $A'B'C'$ is the image of triangle $ABC$ after a dilation with a scale factor of $\frac{1}{2}$ and centered at point $A$. Is triangle $ABC$ congruent to triangle $A'B'C'$? Explain your answer.

455 Chelsea is sitting 8 feet from the foot of a tree. From where she is sitting, the angle of elevation of her line of sight to the top of the tree is $36^\circ$. If her line of sight starts 1.5 feet above ground, how tall is the tree, to the nearest foot?
1) 8
2) 7
3) 6
4) 4

456 A cargo trailer, pictured below, can be modeled by a rectangular prism and a triangular prism. Inside the trailer, the rectangular prism measures 6 feet wide and 10 feet long. The walls that form the triangular prism each measure 4 feet wide inside the trailer. The diagram below is of the floor, showing the inside measurements of the trailer.

If the inside height of the trailer is 6.5 feet, what is the total volume of the inside of the trailer, to the nearest cubic foot?
457 The line $-3x + 4y = 8$ is transformed by a dilation centered at the origin. Which linear equation could represent its image?

1) $y = \frac{4}{3}x + 8$
2) $y = \frac{3}{4}x + 8$
3) $y = -\frac{3}{4}x - 8$
4) $y = -\frac{4}{3}x - 8$

458 In the diagram below, $\triangle ABE \cong \triangle CBD$.

Prove: $\triangle AFD \cong \triangle CF E$

459 A 12-foot ladder leans against a building and reaches a window 10 feet above ground. What is the measure of the angle, to the nearest degree, that the ladder forms with the ground?

1) 34
2) 40
3) 50
4) 56

460 In rhombus $TIGE$, diagonals $\overline{TG}$ and $\overline{IE}$ intersect at $R$. The perimeter of $TIGE$ is 68, and $TG = 16$.

What is the length of diagonal $\overline{IE}$?
1) 15
2) 30
3) 34
4) 52

461 In the diagram below, $\overline{BC}$ connects points $B$ and $C$ on the congruent sides of isosceles triangle $ADE$, such that $\triangle ABC$ is isosceles with vertex angle $A$.

If $AB = 10$, $BD = 5$, and $DE = 12$, what is the length of $\overline{BC}$?
1) 6
2) 7
3) 8
4) 9
462 What are the coordinates of point \( C \) on the directed segment from \( A(−8, 4) \) to \( B(10, −2) \) that partitions the segment such that \( AC:CB \) is 2:1?
1) \( (1, 1) \)
2) \( (−2, 2) \)
3) \( (2, −2) \)
4) \( (4, 0) \)

463 A child-sized swimming pool can be modeled by a cylinder. The pool has a diameter of \( 6 \frac{1}{2} \) feet and a height of 12 inches. The pool is filled with water to \( \frac{2}{3} \) of its height. Determine and state the volume of the water in the pool, to the nearest cubic foot. One cubic foot equals 7.48 gallons of water. Determine and state, to the nearest gallon, the number of gallons of water in the pool.

464 Circle \( O \) with a radius of 9 is drawn below. The measure of central angle \( AOC \) is 120°.

What is the area of the shaded sector of circle \( O \)?
1) \( 6\pi \)
2) \( 12\pi \)
3) \( 27\pi \)
4) \( 54\pi \)

465 Riley plotted \( A(−1, 6), B(3, 8), C(6, −1), \) and \( D(1, 0) \) to form a quadrilateral. Prove that Riley's quadrilateral \( ABCD \) is a trapezoid. [The use of the set of axes on the next page is optional.] Riley defines an isosceles trapezoid as a trapezoid with congruent diagonals. Use Riley's definition to prove that \( ABCD \) is not an isosceles trapezoid.

466 The coordinates of the vertices of parallelogram \( CDEH \) are \( C(−5, 5), D(2, 5), E(−1, −1), \) and \( H(−8, −1) \). What are the coordinates of \( P \), the point of intersection of diagonals \( CE \) and \( DH \)?
1) \( (−2, 3) \)
2) \( (−2, 2) \)
3) \( (−3, 2) \)
4) \( (−3, −2) \)
467 As shown in the diagram below, the radius of a cone is 2.5 cm and its slant height is 6.5 cm.

How many cubic centimeters are in the volume of the cone?
1) \(12.5\pi\)
2) \(13.5\pi\)
3) \(30.0\pi\)
4) \(37.5\pi\)

468 A triangle has vertices \(A(-2,4), B(6,2),\) and \(C(1,-1)\). Prove that \(\Delta ABC\) is an isosceles right triangle. [The use of the set of axes below is optional.]

469 Which equation represents a line parallel to the line whose equation is \(-2x + 3y = -4\) and passes through the point \((1,3)\)?
1) \(y - 3 = -\frac{3}{2}(x - 1)\)
2) \(y - 3 = \frac{2}{3}(x - 1)\)
3) \(y + 3 = -\frac{3}{2}(x + 1)\)
4) \(y + 3 = \frac{2}{3}(x + 1)\)

470 Square \(MATH\) has a side length of 7 inches. Which three-dimensional object will be formed by continuously rotating square \(MATH\) around side \(AT\)?
1) a right cone with a base diameter of 7 inches
2) a right cylinder with a diameter of 7 inches
3) a right cone with a base radius of 7 inches
4) a right cylinder with a radius of 7 inches

471 If the line represented by \(y = -\frac{1}{4}x - 2\) is dilated by a scale factor of 4 centered at the origin, which statement about the image is true?
1) The slope is \(-\frac{1}{4}\) and the \(y\)-intercept is \(-8\).
2) The slope is \(-\frac{1}{4}\) and the \(y\)-intercept is \(-2\).
3) The slope is \(-1\) and the \(y\)-intercept is \(-8\).
4) The slope is \(-1\) and the \(y\)-intercept is \(-2\).
472 On the set of axes below, $\triangle ABC$ has vertices at $A(-2,0)$, $B(2,-4)$, $C(4,2)$, and $\triangle DEF$ has vertices at $D(4,0)$, $E(-4,8)$, $F(-8,-4)$.

Which sequence of transformations will map $\triangle ABC$ onto $\triangle DEF$?

1) a dilation of $\triangle ABC$ by a scale factor of 2 centered at point $A$
2) a dilation of $\triangle ABC$ by a scale factor of $\frac{1}{2}$ centered at point $A$
3) a dilation of $\triangle ABC$ by a scale factor of 2 centered at the origin, followed by a rotation of 180° about the origin
4) a dilation of $\triangle ABC$ by a scale factor of $\frac{1}{2}$ centered at the origin, followed by a rotation of 180° about the origin

473 The area of a sector of a circle with a radius measuring 15 cm is $75\pi$ cm². What is the measure of the central angle that forms the sector?

1) 72°
2) 120°
3) 144°
4) 180°

474 As shown in the diagram below, secants $PWR$ and $PTS$ are drawn to circle $O$ from external point $P$.

If $m\angle RPS = 35°$ and $m\angle RS = 121°$, determine and state $m\overarc{WT}$.

475 In the diagram of quadrilateral $NAVY$ below, $m\angle YNA = 30°$, $m\angle YAN = 38°$, $m\angle AVY = 94°$, and $m\angle VAY = 46°$.

Which segment has the shortest length?

1) $\overline{AY}$
2) $\overline{NY}$
3) $\overline{VA}$
4) $\overline{VY}$
476 As modeled in the diagram below, an access ramp starts on flat ground and ends at the beginning of the top step. Each step is 6 inches tall and 8 inches deep.

If the angle of elevation of the ramp is $4.76^\circ$, determine and state the length of the ramp, to the nearest tenth of a foot. Determine and state, to the nearest tenth of a foot, the horizontal distance, $d$, from the bottom of the stairs to the bottom of the ramp.

477 On the set of axes below, $\triangle ABC$, altitude $CG$, and median $CM$ are drawn.

Which expression represents the area of $\triangle ABC$?

1) $\frac{(BC)(AC)}{2}$
2) $\frac{(GC)(BC)}{2}$
3) $\frac{(CM)(AB)}{2}$
4) $\frac{(GC)(AB)}{2}$

478 In the diagram below of circle $O$, chords $JT$ and $ER$ intersect at $M$.

If $EM = 8$ and $RM = 15$, the lengths of $JM$ and $TM$ could be

1) 12 and 9.5
2) 14 and 8.5
3) 16 and 7.5
4) 18 and 6.5
479 Triangle $ABC$ is shown below. Using a compass and straightedge, construct the dilation of $\triangle ABC$ centered at $B$ with a scale factor of 2. [Leave all construction marks.]

Is the image of $\triangle ABC$ similar to the original triangle? Explain why.

480 In the diagram below of right triangle $KMI$, altitude $IG$ is drawn to hypotenuse $KM$.

If $KG = 9$ and $IG = 12$, the length of $IM$ is

1) 15
2) 16
3) 20
4) 25

481 The vertices of $\triangle ABC$ have coordinates $A(-2,-1)$, $B(10,-1)$, and $C(4,4)$. Determine and state the area of $\triangle ABC$. [The use of the set of axes below is optional.]

482 A large water basin is in the shape of a right cylinder. The inside of the basin has a diameter of $8 \frac{1}{4}$ feet and a height of 3 feet. Determine and state, to the nearest cubic foot, the number of cubic feet of water that it will take to fill the basin to a level of $\frac{1}{2}$ foot from the top.

483 Which statement about parallelograms is always true?

1) The diagonals are congruent.
2) The diagonals bisect each other.
3) The diagonals are perpendicular.
4) The diagonals bisect their respective angles.
484 Triangles \(JOE\) and \(SAM\) are drawn such that \(\angle E \cong \angle M\) and \(\overline{EJ} \cong \overline{MS}\). Which mapping would not always lead to \(\triangle JOE \cong \triangle SAM\)?

1) \(\angle J\) maps onto \(\angle S\)
2) \(\angle O\) maps onto \(\angle A\)
3) \(\overline{EO}\) maps onto \(\overline{MA}\)
4) \(\overline{JO}\) maps onto \(\overline{SA}\)

485 In \(\triangle ABC\) below, angle \(C\) is a right angle.

Which statement must be true?
1) \(\sin A = \cos B\)
2) \(\sin A = \tan B\)
3) \(\sin B = \tan A\)
4) \(\sin B = \cos B\)

486 A standard-size golf ball has a diameter of 1.680 inches. The material used to make the golf ball weighs 0.6523 ounce per cubic inch. What is the weight, to the nearest hundredth of an ounce, of one golf ball?

1) 1.10
2) 1.62
3) 2.48
4) 3.81

487 Given right triangle \(ABC\) with a right angle at \(C\), \(\angle B = 61^\circ\). Given right triangle \(RST\) with a right angle at \(T\), \(\angle R = 29^\circ\).

Which proportion in relation to \(\triangle ABC\) and \(\triangle RST\) is not correct?

1) \(\frac{AB}{RS} = \frac{RT}{AC}\)
2) \(\frac{BC}{ST} = \frac{AB}{RS}\)
3) \(\frac{BC}{ST} = \frac{AC}{RT}\)
4) \(\frac{AB}{AC} = \frac{RS}{RT}\)

488 On the set of axes below, \(\triangle ABC \cong \triangle STU\).

Describe a sequence of rigid motions that maps \(\triangle ABC\) onto \(\triangle STU\).
489 Which transformation carries the parallelogram below onto itself?

1) a reflection over \( y = x \)
2) a reflection over \( y = -x \)
3) a rotation of 90° counterclockwise about the origin
4) a rotation of 180° counterclockwise about the origin

490 Given points \( A, B, \) and \( C \), use a compass and straightedge to construct point \( D \) so that \( ABCD \) is a parallelogram. [Leave all construction marks.]

491 Triangles \( ABC \) and \( RST \) are graphed on the set of axes below.

Which sequence of rigid motions will prove \( \triangle ABC \cong \triangle RST \)?

1) a line reflection over \( y = x \)
2) a rotation of 180° centered at \((1,0)\)
3) a line reflection over the \( x \)-axis followed by a translation of 6 units right
4) a line reflection over the \( x \)-axis followed by a line reflection over \( y = 1 \)

492 What is an equation of the image of the line \( y = \frac{3}{2}x - 4 \) after a dilation of a scale factor of \( \frac{3}{4} \) centered at the origin?

1) \( y = \frac{9}{8}x - 4 \)
2) \( y = \frac{9}{8}x - 3 \)
3) \( y = \frac{3}{2}x - 4 \)
4) \( y = \frac{3}{2}x - 3 \)
493 What is an equation of a circle whose center is (1,4) and diameter is 10?
1) $x^2 - 2x + y^2 - 8y = 8$
2) $x^2 + 2x + y^2 + 8y = 8$
3) $x^2 - 2x + y^2 - 8y = 83$
4) $x^2 + 2x + y^2 + 8y = 83$

494 What is the volume of a hemisphere that has a diameter of 12.6 cm, to the nearest tenth of a cubic centimeter?
1) 523.7
2) 1047.4
3) 4189.6
4) 8379.2

495 After a dilation with center (0,0), the image of $DB$ is $D'B'$. If $DB = 4.5$ and $D'B' = 18$, the scale factor of this dilation is
1) $\frac{1}{5}$
2) 5
3) $\frac{1}{4}$
4) 4

496 What are the coordinates of the center and the length of the radius of the circle whose equation is $x^2 + y^2 = 8x - 6y + 39$?
1) center (−4,3) and radius 64
2) center (4,−3) and radius 64
3) center (−4,3) and radius 8
4) center (4,−3) and radius 8

497 In right triangle $PRT$, $\angle P = 90^\circ$, altitude $\overline{PQ}$ is drawn to hypotenuse $RT$, $RT = 17$, and $PR = 15$.

Determine and state, to the nearest tenth, the length of $RQ$.

498 A rhombus is graphed on the set of axes below.

Which transformation would carry the rhombus onto itself?
1) 180° rotation counterclockwise about the origin
2) reflection over the line $y = \frac{1}{2}x + 1$
3) reflection over the line $y = 0$
4) reflection over the line $x = 0$
499 On the set of axes below, $\triangle ABC \cong \triangle DEF$.

![Triangle ABC and DEF on coordinate plane]

Describe a sequence of rigid motions that maps $\triangle ABC$ onto $\triangle DEF$.

500 A countertop for a kitchen is modeled with the dimensions shown below. An 18-inch by 21-inch rectangle will be removed for the installation of the sink.

![Countertop diagram with sink removed]

What is the area of the top of the installed countertop, to the nearest square foot?
1) 26
2) 23
3) 22
4) 19

501 In right triangle $ABC$, $m\angle C = 90^\circ$ and $AC \neq BC$. Which trigonometric ratio is equivalent to $\sin B$?
1) $\cos A$
2) $\cos B$
3) $\tan A$
4) $\tan B$

502 On the set of axes below, $\triangle DEF$ has vertices at the coordinates $D(1,-1)$, $E(3,4)$, and $F(4,2)$, and point $G$ has coordinates $(3,1)$. Owen claims the median from point $E$ must pass through point $G$. Is Owen correct? Explain why.

![Triangle DEF with point G and median drawn]
503 In $\triangle ABC$ shown below, $\angle ACB$ is a right angle, $E$ is a point on $\overline{AC}$, and $\overline{ED}$ is drawn perpendicular to hypotenuse $\overline{AB}$.

If $AB = 9$, $BC = 6$, and $DE = 4$, what is the length of $AE$?
1) 5
2) 6
3) 7
4) 8

504 Nick wanted to determine the length of one blade of the windmill pictured below. He stood at a point on the ground 440 feet from the windmill's base. Using surveyor's tools, Nick measured the angle between the ground and the highest point reached by the top blade and found it was 38.8°. He also measured the angle between the ground and the lowest point of the top blade, and found it was 30°.

Determine and state a blade’s length, $x$, to the nearest foot.

505 Which three-dimensional figure will result when a rectangle 6 inches long and 5 inches wide is continuously rotated about the longer side?
1) a rectangular prism with a length of 6 inches, width of 6 inches, and height of 5 inches
2) a rectangular prism with a length of 6 inches, width of 5 inches, and height of 5 inches
3) a cylinder with a radius of 5 inches and a height of 6 inches
4) a cylinder with a radius of 6 inches and a height of 5 inches

506 What is an equation of a line that is perpendicular to the line whose equation is $2y + 3x = 1$?
1) $y = \frac{2}{3}x + \frac{5}{2}$
2) $y = \frac{3}{2}x + 2$
3) $y = -\frac{2}{3}x + 1$
4) $y = -\frac{3}{2}x + \frac{1}{2}$

507 In the diagram below, $\overline{AC}$ and $\overline{BD}$ intersect at $E$.

Which information is always sufficient to prove $\triangle ABE \cong \triangle CDE$?
1) $\overline{AB} \parallel \overline{CD}$
2) $\overline{AB} \cong \overline{CD}$ and $\overline{BE} \cong \overline{DE}$
3) $E$ is the midpoint of $\overline{AC}$.
4) $\overline{BD}$ and $\overline{AC}$ bisect each other.
508 Parallelogram $ABCD$ is adjacent to rhombus $DEFG$, as shown below, and $FC$ intersects $AGD$ at $H$.

If $\angle B = 118^\circ$ and $\angle AHC = 138^\circ$, determine and state $\angle GFH$.

509 In the diagram below of $\triangle ABC$, $D$ is a point on $BA$, $E$ is a point on $BC$, and $DE$ is drawn.

If $BD = 5$, $DA = 12$, and $BE = 7$, what is the length of $BC$ so that $AC \parallel DE$?

1) 23.8  
2) 16.8  
3) 15.6  
4) 8.6

510 In the diagram below of right triangle $ABC$, altitude $CD$ intersects hypotenuse $AB$ at $D$.

Which equation is always true?

1) $\frac{AD}{AC} = \frac{CD}{BC}$  
2) $\frac{AD}{CD} = \frac{BD}{CD}$  
3) $\frac{AC}{CD} = \frac{BC}{CD}$  
4) $\frac{AD}{AC} = \frac{AC}{BD}$

511 Using the construction below, state the degree measure of $\angle CAD$. Explain why.
512 On the set of axes below, \( AB \) is dilated by a scale factor of \( \frac{5}{2} \) centered at point \( P \).

Which statement is always true?
1) \( PA \cong AA' \)
2) \( AB \parallel A'B' \)
3) \( AB = A'B' \)
4) \( \frac{5}{2} (A'B') = AB \)

513 In the diagram of quadrilateral \( ABCD \) with diagonal \( AC \) shown below, segments \( GH \) and \( EF \) are drawn, \( AE \cong CG, BE \cong DG, AH \cong CF, \) and \( AD \cong CB \).

Prove: \( EF \cong GH \)

514 On the set of axes below, triangle \( ABC \) is graphed. Triangles \( A'B'C' \) and \( A''B''C'' \), the images of triangle \( ABC \), are graphed after a sequence of rigid motions.

Identify which sequence of rigid motions maps \( \triangle ABC \) onto \( \triangle A'B'C' \) and then maps \( \triangle A'B'C' \) onto \( \triangle A''B''C'' \).
1) a rotation followed by another rotation
2) a translation followed by a reflection
3) a reflection followed by a translation
4) a reflection followed by a rotation

515 A tent is in the shape of a right pyramid with a square floor. The square floor has side lengths of 8 feet. If the height of the tent at its center is 6 feet, what is the volume of the tent, in cubic feet?
1) 48
2) 128
3) 192
4) 384
516 On the set of axes below, $\triangle ABC$ is graphed with coordinates $A(-2,-1)$, $B(3,-1)$, and $C(-2,-4)$. Triangle $QRS$, the image of $\triangle ABC$, is graphed with coordinates $Q(-5,2)$, $R(-5,7)$, and $S(-8,2)$.

Describe a sequence of transformations that would map $\triangle ABC$ onto $\triangle QRS$.

517 In right triangle $RST$, altitude $TV$ is drawn to the hypotenuse $RS$. If $RV = 12$ and $RT = 18$, what is the length of $SV$?

1) $6\sqrt{5}$
2) 15
3) $6\sqrt{6}$
4) 27

518 If a rectangle is continuously rotated around one of its sides, what is the three-dimensional figure formed?

1) rectangular prism
2) cylinder
3) sphere
4) cone

519 In circle $O$ two secants, $\overline{ABP}$ and $\overline{CDP}$, are drawn to external point $P$. If $m\angle AC = 72^\circ$, and $m\angle BD = 34^\circ$, what is the measure of $\angle P$?

1) 19º
2) 38º
3) 53º
4) 106º

520 In the diagram below of circle $O$, points $K$, $A$, $T$, $I$, and $E$ are on the circle, $\overline{KAE}$ and $\overline{ITE}$ are drawn, $\overline{KE} \cong \overline{EI}$, and $\angle EKA \cong \angle EIT$.

Which statement about $\triangle KAE$ and $\triangle ITE$ is always true?

1) They are neither congruent nor similar.
2) They are similar but not congruent.
3) They are right triangles.
4) They are congruent.
521 The coordinates of the vertices of \( \triangle ABC \) are \( A(1,2), B(-5,3), \) and \( C(-6,-3) \). Prove that \( \triangle ABC \) is isosceles. State the coordinates of point \( D \) such that quadrilateral \( ABCD \) is a square. Prove that your quadrilateral \( ABCD \) is a square. [The use of the set of axes below is optional.]

522 In quadrilateral \( QRST \), diagonals \( QR \) and \( RT \) intersect at \( M \). Which statement would always prove quadrilateral \( QRST \) is a parallelogram?
1) \( \angle TQR \) and \( \angle QRS \) are supplementary.
2) \(QM \cong SM \) and \( QT \cong RS \)
3) \( QR \cong TS \) and \( QT \cong RS \)
4) \( QR \cong TS \) and \( QT \parallel RS \)

523 The figure below shows a rhombus with noncongruent diagonals.

Which transformation would not carry this rhombus onto itself?
1) a reflection over the shorter diagonal
2) a reflection over the longer diagonal
3) a clockwise rotation of 90° about the intersection of the diagonals
4) a counterclockwise rotation of 180° about the intersection of the diagonals

524 In the diagram below of right triangle \( ABC \), \( AC = 8 \), and \( AB = 17 \).

Which equation would determine the value of angle \( A \)?
1) \( \sin A = \frac{8}{17} \)
2) \( \tan A = \frac{8}{15} \)
3) \( \cos A = \frac{15}{17} \)
4) \( \tan A = \frac{15}{8} \)
525 Determine and state the area of triangle \( PQR \), whose vertices have coordinates \( P(-2, -5) \), \( Q(3, 5) \), and \( R(6, 1) \). [The use of the set of axes below is optional.]
Geometry Regents at Random Worksheets

Answer Section

1. ANS: 3
   \[4\sqrt{(-1-3)^2 + (5-1)^2} = 4\sqrt{20}\]
   PTS: 2   REF: 081703geo   NAT: G.GPE.B.7   TOP: Polygons in the Coordinate Plane

2. ANS:
   \[\frac{Q}{360}(\pi)(25^2) = (\pi)(25^2) - 500\pi\]
   \[Q = \frac{125\pi(360)}{625\pi} = 72\]
   PTS: 2   REF: 011828geo   NAT: G.C.B.5   TOP: Sectors

3. ANS: 3
   In (1) and (2), \(ABCD\) could be a rectangle with non-congruent sides. (4) is not possible
   PTS: 2   REF: 081714geo   NAT: G.CO.C.11   TOP: Special Quadrilaterals

4. ANS:
   C: \(V = \pi(26.7)^2(750) - \pi(24.2)^2(750) = 95,437.5\pi\)
   \[95,437.5\pi \text{ cm}^3 \left(\frac{2.7 \text{ g}}{\text{cm}^3}\right) \left(\frac{1 \text{ kg}}{1000 \text{ g}}\right) \left(\frac{\$0.38}{\text{kg}}\right) = \$307.62\]
   P: \(V = 40^2(750) - 35^2(750) = 281,250\)
   \[281,250 \text{ cm}^3 \left(\frac{2.7 \text{ g}}{\text{cm}^3}\right) \left(\frac{1 \text{ kg}}{1000 \text{ g}}\right) \left(\frac{\$0.38}{\text{kg}}\right) = \$288.56\]
   PTS: 6   REF: 011736geo   NAT: G.MG.A.2   TOP: Density

5. ANS: 3
   \[\frac{360^\circ}{5} = 72^\circ \ 216^\circ \text{ is a multiple of } 72^\circ\]
   PTS: 2   REF: 061819geo   NAT: G.CO.A.3   TOP: Mapping a Polygon onto Itself

6. ANS: 4
   \[x^2 + 4x + 4 + y^2 - 8y + 16 = -16 + 4 + 16\]
   \[(x + 2)^2 + (y - 4)^2 = 4\]
   PTS: 2   REF: 081821geo   NAT: G.GPE.A.1   TOP: Equations of Circles
   KEY: completing the square
7 ANS:
Yes. The triangles are congruent because of SSS \( \left( 5^2 + 12^2 = 13^2 \right) \). All congruent triangles are similar.

PTS: 2 REF: 061830geo NAT: G.SRT.B.5 TOP: Triangle Congruency

8 ANS: 2
\( x^2 = 3 \cdot 18 \)
\[ x = \sqrt{3 \cdot 3 \cdot 6} \]
\[ x = 3\sqrt{6} \]

PTS: 2 REF: 081712geo NAT: G.C.A.2 TOP: Chords, Secants and Tangents
KEY: secant and tangent drawn from common point, length

9 ANS: 1
\[ 360 - (82 + 104 + 121) = 53 \]

KEY: graph

10 ANS: 4 PTS: 2
REF: 081702geo NAT: G.CO.A.2 TOP: Identifying Transformations
KEY: basic

11 ANS: 4 PTS: 2
REF: 011706geo NAT: G.CO.A.2

12 ANS: 1
\[ 82.8 = \frac{1}{3} (4.6)(9)h \]
\[ h = 6 \]

PTS: 2 REF: 061810geo NAT: G.GMD.A.3 TOP: Volume
KEY: pyramids

13 ANS: 3
\[ \frac{s_r}{s_s} = \frac{6\theta}{4\theta} = 1.5 \]

KEY: arc length

14 ANS: 1 PTS: 2
REF: 011716geo NAT: G.CO.C.11
TOP: Special Quadrilaterals

15 ANS: 4
\[ \frac{6.6}{x} = \frac{4.2}{5.25} \]
\[ 4.2x = 34.65 \]
\[ x = 8.25 \]

PTS: 2 REF: 081705geo NAT: G.SRT.B.5 TOP: Similarity
KEY: basic
16 ANS: 2

\[ V = \frac{1}{3} \left( \frac{36}{4} \right)^2 \cdot 15 = 405 \]

PTS: 2 REF: 011822geo NAT: G.GMD.A.3 TOP: Volume
KEY: pyramids

17 ANS:

\[ \sqrt{(2.5-1)^2 + (-.5 - 1.5)^2} = \sqrt{2.25+4} = 2.5 \]

PTS: 2 REF: 081729geo NAT: G.SRT.A.1 TOP: Line Dilations

18 ANS:
Yes. \( \angle A \cong \angle X, \angle C \cong \angle Z, AC \cong XZ \) after a sequence of rigid motions which preserve distance and angle measure, so \( \triangle ABC \cong \triangle XYZ \) by ASA. \( \overline{BC} \cong \overline{YZ} \) by CPCTC.

PTS: 2 REF: 081730geo NAT: G.CO.B.7 TOP: Triangle Congruency

19 ANS:

\[ \cos W = \frac{6}{18} \]

\[ W \approx 71 \]

PTS: 2 REF: 011831geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find an Angle

20 ANS: 1

\[ 84 = \frac{1}{3} \cdot s^2 \cdot 7 \]

\[ 6 = s \]

PTS: 2 REF: 061716geo NAT: G.GMD.A.3 TOP: Volume
KEY: pyramids

21 ANS:

PTS: 2 REF: 081826geo NAT: G.CO.C.11 TOP: Parallelograms
22 ANS: 2

PTS: 2
REF: 011818geo
NAT: G.CO.C.9
TOP: Lines and Angles

23 ANS: 2
\begin{align*}
x^2 + y^2 - 6x + 2y &= 6 \\
x^2 - 6x + 9 + y^2 + 2y + 1 &= 6 + 9 + 1 \\
(x - 3)^2 + (y + 1)^2 &= 16
\end{align*}

PTS: 2
REF: 011812geo
NAT: G.GPE.A.1
TOP: Equations of Circles
KEY: completing the square

24 ANS: 1

Since a dilation preserves parallelism, the line \(4y = 3x + 7\) and its image \(3x - 4y = 9\) are parallel, with slopes of \(\frac{3}{4}\).

PTS: 2
REF: 081710geo
NAT: G.SRT.A.1
TOP: Line Dilations

25 ANS:

A dilation preserves slope, so the slopes of \(\overline{QR}\) and \(\overline{Q'R'}\) are equal. Because the slopes are equal, \(Q'R' \parallel QR\).

PTS: 4
REF: 011732geo
NAT: G.SRT.A.2
TOP: Dilations
KEY: grids

26 ANS: 1

Parallel chords intercept congruent arcs. \(\frac{180 - 130}{2} = 25\)

PTS: 2
REF: 081704geo
NAT: G.C.A.2
TOP: Chords, Secants and Tangents
KEY: parallel lines
27 ANS: 1
\[ x = -5 + \frac{1}{3}(4 - (-5)) = -5 + 3 = -2 \quad y = 2 + \frac{1}{3}(-10 - 2) = 2 - 4 = -2 \]

PTS: 2  REF: 011806geo  NAT: G.GPE.B.6  TOP: Directed Line Segments

28 ANS:
\[ 29.5 = 2\pi r \quad V = \frac{4}{3}\pi \cdot \left(\frac{29.5}{2\pi}\right)^3 \approx 434 \]
\[ r = \frac{29.5}{2\pi} \]

PTS: 2  REF: 061831geo  NAT: G.GMD.A.3  TOP: Volume

29 ANS: 1  PTS: 2  REF: 011703geo  NAT: G.SRT.B.5  TOP: Triangle Congruency

30 ANS: 2
\[ x^2 = 12(12 - 8) \]
\[ x^2 = 48 \]
\[ x = 4\sqrt{3} \]

PTS: 2  REF: 011823geo  NAT: G.SRT.B.5  TOP: Similarity

31 ANS: 3  PTS: 2  REF: 011714geo  NAT: G.SRT.C.6  TOP: Trigonometric Ratios

32 ANS: 2  PTS: 2  REF: 061701geo  NAT: G.CO.A.5  TOP: Compositions of Transformations

33 ANS: 4
\[ 4\sqrt{(-1 - 2)^2 + (2 - 3)^2} = 4\sqrt{10} \]

PTS: 2  REF: 081808geo  NAT: G.GPE.B.7  TOP: Polygons in the Coordinate Plane

34 ANS:
Yes, as translations do not change angle measurements.


KEY: basic
35 ANS:

![Diagram of two lines A and B with a circle intersecting them.]  

PTS: 2  REF: 081825geo  NAT: G.CO.D.12  TOP: Constructions  
KEY: parallel and perpendicular lines

36 ANS:
\[
\frac{152 - 56}{2} = 48
\]

PTS: 2  REF: 011728geo  NAT: G.C.A.2  TOP: Chords, Secants and Tangents  
KEY: secant and tangent drawn from common point, angle

37 ANS:
No, The line \(4x + 3y = 24\) passes through the center of dilation, so the dilated line is not distinct.  
\[4x + 3y = 24\]  
\[3y = -4x + 24\]  
\[y = \frac{4}{3}x + 8\]

38 ANS:

![Diagram of a triangle ABC with a point G.]  

PTS: 2  REF: 081830geo  NAT: G.SRT.A.1  TOP: Line Dilations  
KEY: line bisector

39 ANS: 1
\[\cos x = \frac{12}{13}\]  
\[x \approx 23\]

40 ANS: 2
\[6 + 6\sqrt{3} + 6 + 6\sqrt{3} \approx 32.8\]

PTS: 2  REF: 011709geo  NAT: G.SRT.C.8  TOP: 30-60-90 Triangles
41 ANS:
\[ \tan 16.5 = \frac{x}{13.5} \quad 9 \times 16 \times 4.5 = 648 \quad 3752 - (35 \times 16 \times .5) = 3472 \]
\[ 13.5 \times 16 \times 4.5 = 972 \quad 3472 \times 7.48 \approx 25971 \]
\[ x \approx 4 \]
\[ 4 + 4.5 = 8.5 \quad \frac{1}{2} \times 13.5 \times 16 \times 4 = 432 \quad \frac{25971}{10.5} = 2473.4 \]
\[ 12.5 \times 16 \times 8.5 = \frac{1700}{3752} \quad \frac{2473.4}{60} \approx 41 \]

PTS: 6  REF: 081736geo  NAT: G.GMD.A.3  TOP: Volume
KEY: compositions

42 ANS:
\[ \frac{4\pi}{3} (2^3 - 1.5^3) \approx 19.4 \quad 19.4 \cdot 1.308 \cdot 8 \approx 203 \]

PTS: 4  REF: 081834geo  NAT: G.MG.A.2  TOP: Density

43 ANS: 2
\[ \cos B = \frac{17.6}{26} \]
\[ B \approx 47 \]

PTS: 2  REF: 061806geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find an Angle

44 ANS:
Yes. The bases of the cylinders have the same area and the cylinders have the same height.

PTS: 2  REF: 081725geo  NAT: G.GMD.A.1  TOP: Volume

45 ANS:
\( \triangle PAT \) is an isosceles triangle because sides \( \overline{AP} \) and \( \overline{AT} \) are congruent \( (\sqrt{3^2 + 11^2} = \sqrt{7^2 + 9^2} = \sqrt{130}) \). \( R(2,9) \). Quadrilateral \( PART \) is a parallelogram because the opposite sides are parallel since they have equal slopes

\[ (m_{AR} = \frac{4}{6} = \frac{2}{3}; \quad m_{PR} = \frac{4}{6} = \frac{2}{3}; \quad m_{PA} = -\frac{11}{3}; \quad m_{RT} = -\frac{11}{3}) \]

PTS: 6  REF: 011835geo  NAT: G.GPE.B.4  TOP: Quadrilaterals in the Coordinate Plane
KEY: grids

46 ANS: 3  PTS: 2  REF: 061816geo  NAT: G.GMD.B.4  TOP: Rotations of Two-Dimensional Objects
47. ANS: 4  
PTS: 2  
TOP: Special Quadrilaterals  
REF: 011819geo  
NAT: G.CO.C.11

\[ \frac{5}{7} = \frac{x}{x+5} \]
\[ 12 \frac{1}{2} + 5 = 17 \frac{1}{2} \]

\[ 5x + 25 = 7x \]
\[ 2x = 25 \]
\[ x = 12 \frac{1}{2} \]

PTS: 2  
REF: 061821geo  
NAT: G.SRT.B.5  
TOP: Side Splitter Theorem

48. ANS: 4

\[ x \]
\[ + 72 \]
\[ \frac{2}{2} = 58 \]
\[ x + 72 = 116 \]
\[ x = 44 \]

PTS: 2  
REF: 061817geo  
NAT: G.C.A.2  
TOP: Chords, Secants and Tangents  
KEY: intersecting chords, angle

50. ANS:

PTS: 2  
REF: 011731geo  
NAT: G.GPE.B.4  
TOP: Quadrilaterals in the Coordinate Plane  
KEY: grids

51. ANS:
Yes, because 28° and 62° angles are complementary. The sine of an angle equals the cosine of its complement.

PTS: 2  
REF: 011727geo  
NAT: G.SRT.C.7  
TOP: Cofunctions

52. ANS:
A dilation of 3 centered at A. A dilation preserves angle measure, so the triangles are similar.

PTS: 4  
REF: 011832geo  
NAT: G.SRT.A.2  
TOP: Dilations

53. ANS: 4  
PTS: 2  
REF: 081801geo  
NAT: G.CO.C.9  
TOP: Lines and Angles
54 ANS: 1
\[24x = 10^2\]
\[24x = 100\]
\[x \approx 4.2\]

PTS: 2  
REF: 061823geo  
NAT: G.SRT.B.5  
TOP: Similarity  
KEY: leg

55 ANS: 4  
PTS: 2  
REF: 061803geo  
NAT: G.CO.A.2  
TOP: Identifying Transformations  
KEY: graphics

56 ANS: 3  
\[\triangle CFB \sim \triangle CAD \quad \frac{CB}{CF} = \frac{CD}{CA}\]
\[\frac{x}{21.6} = \frac{7.2}{9.6}\]
\[x = 16.2\]

PTS: 2  
REF: 061804geo  
NAT: G.SRT.B.5  
TOP: Similarity  
KEY: basic

57 ANS: 1  
\[-8 + \frac{3}{8} (16 - 8) = -8 + \frac{3}{8} (24) = -8 + 9 = 1\]
\[-2 + \frac{3}{8} (6 - 2) = -2 + \frac{3}{8} (8) = -2 + 3 = 1\]

PTS: 2  
REF: 081717geo  
NAT: G.GPE.B.6  
TOP: Directed Line Segments

58 ANS: 2  
\[AB = 10\] since \(\triangle ABC\) is a 6-8-10 triangle.  
\[6^2 = 10x\]
\[3.6 = x\]

PTS: 2  
REF: 081820geo  
NAT: G.SRT.B.5  
TOP: Similarity  
KEY: leg

59 ANS: 3  
\[x(x - 6) = 4^2\]
\[x^2 - 6x - 16 = 0\]
\[(x - 8)(x + 2) = 0\]
\[x = 8\]

PTS: 2  
REF: 081807geo  
NAT: G.SRT.B.5  
TOP: Similarity  
KEY: altitude

60 ANS: 2  
PTS: 2  
REF: 011802geo  
NAT: G.CO.C.11  
TOP: Parallelograms

61 ANS: 4  
PTS: 2  
REF: 011704geo  
NAT: G.CO.C.10  
TOP: Midsegments
62 ANS: 

\[ \frac{\pi}{12} \approx 1.2 \]

PTS: 2  REF: 061725geo  NAT: G.CO.D.12  TOP: Constructions
KEY: parallel and perpendicular lines

63 ANS: 1

64 ANS: 
Rotate \( \triangle ABC \) clockwise about point \( C \) until \( DF \parallel AC \). Translate \( \triangle ABC \) along \( CF \) so that \( C \) maps onto \( F \).

PTS: 2  REF: 061730geo  NAT: G.CO.A.5  TOP: Compositions of Transformations
KEY: identify

65 ANS: 3  PTS: 2  REF: 061702geo  NAT: G.GPE.B.7  TOP: Polygons in the Coordinate Plane

66 ANS: 2

\[
(x - 5)^2 + (y - 2)^2 = 16
\]

\[
x^2 - 10x + 25 + y^2 - 4y + 4 = 16
\]

\[
x^2 - 10x + y^2 - 4y = -13
\]

PTS: 2  REF: 061820geo  NAT: G.GPE.A.1  TOP: Equations of Circles
KEY: write equation, given graph

67 ANS: 3
The \( x \)-axis and line \( x = 4 \) are lines of symmetry and \((4,0)\) is a point of symmetry.

PTS: 2  REF: 081706geo  NAT: G.CO.A.3  TOP: Mapping a Polygon onto Itself

68 ANS: 3

\[
6x - 40 + x + 20 = 180 - 3x \quad m\angle BAC = 180 - (80 + 40) = 60
\]

\[
10x = 200
\]

\[
x = 20
\]

PTS: 2  REF: 011809geo  NAT: G.CO.C.10  TOP: Exterior Angle Theorem
69 ANS: 2
\[2x + 7 + 4x - 7 = 90\]
\[6x = 90\]
\[x = 15\]

PTS: 2 REF: 081824geo NAT: G.SRT.C.7 TOP: Cofunctions

70 ANS:
\[\tan 72 = \frac{x}{400}\]
\[\sin 55 = \frac{400\tan 72}{y}\]
\[x = 400\tan 72\]
\[y = \frac{400\tan 72}{\sin 55} = 1503\]

PTS: 4 REF: 061833geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side
KEY: advanced

71 ANS:
\[x^2 - 6x + 9 + y^2 + 8y + 16 = 56 + 9 + 16\]
\[(3, -4); r = 9\]
\[(x - 3)^2 + (y + 4)^2 = 81\]

PTS: 2 REF: 081731geo NAT: G.GPE.A.1 TOP: Equations of Circles
KEY: completing the square

72 ANS: 2
\[m = \frac{3}{2}\]
\[m_\perp = -\frac{2}{3}\]

PTS: 2 REF: 061812geo NAT: G.GPE.B.5 TOP: Parallel and Perpendicular Lines
KEY: write equation of perpendicular line

73 ANS: 1
\[\tan x = \frac{1}{12}\]
\[x \approx 4.76\]

PTS: 2 REF: 081715geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find an Angle

74 ANS:
\[2 \left( \frac{36}{12} \times \frac{36}{12} \times \frac{4}{12} \right) \times 3.25 = 19.50\]

PTS: 2 REF: 081831geo NAT: G.GMD.A.3 TOP: Volume
KEY: prisms

75 ANS: 4 PTS: 2 REF: 011816geo NAT: G.C.A.2 TOP: Chords, Secants and Tangents
KEY: inscribed
76 ANS: 3
$6 \cdot 3^2 = 54$ $12 \cdot 3 = 36$

PTS: 2 REF: 081823geo NAT: G.SRT.A.2 TOP: Dilations

77 ANS: 4
$C = 12\pi \frac{120}{360} (12\pi) = \frac{1}{3} (12\pi)$

PTS: 2 REF: 061822geo NAT: G.C.B.5 TOP: Arc Length
KEY: arc length

78 ANS:
$500 \times 1015 \text{ cc} \times \frac{0.29 \text{ kg}}{\text{ cc}} \times \frac{7.95 \text{ g}}{\text{ cc}} \times \frac{1 \text{ kg}}{1000 \text{ g}} = $1170

PTS: 2 REF: 011829geo NAT: G.MG.A.2 TOP: Density

79 ANS: 2
$\triangle ACB \sim \triangle AED$

PTS: 2 REF: 061811geo NAT: G.SRT.B.5 TOP: Similarity
KEY: basic

80 ANS: 4
$\frac{1}{3.5} = \frac{x}{18-x}$
$3.5x = 18-x$
$4.5x = 18$
$x = 4$

PTS: 2 REF: 081707geo NAT: G.SRT.B.5 TOP: Side Splitter Theorem
81 ANS:

\[ m_{MH} = \frac{6}{10} = \frac{3}{5}, \quad m_{AT} = \frac{6}{10} = \frac{3}{5}, \quad m_{MA} = -\frac{5}{3}, \quad m_{HT} = -\frac{5}{3}; \quad \overrightarrow{MH} \parallel \overrightarrow{AT} \quad \text{and} \quad \overrightarrow{MA} \parallel \overrightarrow{HT}. \]

\( MATH \) is a parallelogram since both sides of opposite sides are parallel. \( m_{MA} = -\frac{5}{3}, \quad m_{AT} = \frac{3}{5} \). Since the slopes are negative reciprocals, \( \overrightarrow{MA} \perp \overrightarrow{AT} \) and \( \angle A \) is a right angle. \( MATH \) is a rectangle because it is a parallelogram with a right angle.

82 ANS: 4

\[ \frac{36}{45} \neq \frac{15}{18} \]

\[ \frac{4}{5} \neq \frac{5}{6} \]

83 ANS: 4

PTS: 2 REF: 081709geo NAT: G.SRT.A.3 TOP: Similarity Proofs

84 ANS: 4

The segment’s midpoint is the origin and slope is \(-2\). The slope of a perpendicular line is \(\frac{1}{2}\). \[ y = \frac{1}{2} x + 0 \]

\[ 2y = x \]

\[ 2y - x = 0 \]

85 ANS: 3

\[ \sqrt{(-5)^2 + 12^2} = \sqrt{169} \quad \sqrt{11^2 + (2\sqrt{12})^2} = \sqrt{121 + 48} = \sqrt{169} \]

86 ANS: 4

Parallellogram $ABCD$, $\overline{BF} \perp \overline{AFD}$, and $\overline{DE} \perp \overline{BEC}$ (given); $\overline{BC} \parallel \overline{AD}$ (opposite sides of a $\square$ are $\parallel$); $\overline{BE} \parallel \overline{FD}$ (parts of $\parallel$ lines are $\parallel$); $\overline{BF} \parallel \overline{DE}$ (two lines $\perp$ to the same line are $\parallel$); $BEDF$ is a $\square$ (a quadrilateral with both pairs of opposite sides $\parallel$ is a $\square$); $\angle DEB$ is a right $\angle$ ($\perp$ lines form right $\angle$s); $BEDF$ is a rectangle (a $\square$ with one right $\angle$ is a rectangle).

(1) AA; (3) SAS; (4) SSS. NYSED has stated that all students should be awarded credit regardless of their answer to this question.

$2 = \frac{1}{2}(-2) + b$

$3 = b$

$2.5 \times 1.25 \times (27 \times 12) + \frac{1}{2} \pi (1.25)^2 (27 \times 12) \approx 1808$

$20000 \text{ g} \left(\frac{1 \text{ ft}^3}{7.48 \text{ g}}\right) = 2673.8 \text{ ft}^3$ $2673.8 = \pi r^2 (34.5) \quad 9.9 + 1 = 10.9$

$r \approx 4.967$

$d \approx 9.9$

$\angle B = 180 - (82 + 26) = 72; \quad \angle DEC = 180 - 26 = 154; \quad \angle EDB = 360 - (154 + 26 + 72) = 108; \quad \angle BDF = \frac{108}{2} = 54; \quad \angle DFB = 180 - (54 + 72) = 54$
95 ANS:
Parallelogram $ABCD$ with diagonal $AC$ drawn (given). $\overline{AC} \cong \overline{AC}$ (reflexive property). $\overline{AD} \cong \overline{CB}$ and $\overline{BA} \cong \overline{DC}$ (opposite sides of a parallelogram are congruent). $\triangle ABC \cong \triangle CDA$ (SSS).

PTS: 2 REF: 011825geo NAT: G.SRT.B.5 TOP: Quadrilateral Proofs

96 ANS: 3
TOP: Cross-Sections of Three-Dimensional Objects

97 ANS: 2
$6 \cdot 6 = x(x - 5)$
$36 = x^2 - 5x$
$0 = x^2 - 5x - 36$
$0 = (x - 9)(x + 4)$
$x = 9$

PTS: 2 REF: 061708geo NAT: G.C.A.2 TOP: Chords, Secants and Tangents

98 ANS:
Reflection across the $y$-axis, then translation up 5.

PTS: 2 REF: 061827geo NAT: G.CO.A.5 TOP: Compositions of Transformations

99 ANS:
\[ \triangle ABC \sim \triangle AED \text{ by AA}. \] \[ \angle DAE \cong \angle CAB \text{ because they are the same } \angle. \]
\[ \angle DEA \cong \angle CBA \text{ because they are both right } \angle s. \]

PTS: 2 REF: 081829geo NAT: G.SRT.B.5 TOP: Similarity

100 ANS: 1
$\sin 32 = \frac{x}{6.2}$
$x \approx 3.3$

PTS: 2 REF: 081719geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side
101 ANS: 1
Distance and angle measure are preserved after a reflection and translation.

KEY: basic

102 ANS:
\[
\frac{134 + 102}{2} = 118
\]

PTS: 2 REF: 081827geo NAT: G.C.A.2 TOP: Chords, Secants and Tangents
KEY: intersecting chords, angle

103 ANS: 2
\[
8(x + 8) = 6(x + 18)
8x + 64 = 6x + 108
2x = 44
x = 22
\]

PTS: 2 REF: 011715geo NAT: G.C.A.2 TOP: Chords, Secants and Tangents
KEY: secants drawn from common point, length

104 ANS:
\[
\frac{40}{360} \cdot \pi (4.5)^2 = 2.25\pi
\]

PTS: 2 REF: 061726geo NAT: G.C.B.5 TOP: Sectors

105 ANS: 2
PTS: 2 REF: 011702geo NAT: G.SRT.A.2 TOP: Compositions of Transformations
KEY: grids

106 ANS:
The four small triangles are 8-15-17 triangles. \(4 \times 17 = 68\)

PTS: 2 REF: 081726geo NAT: G.CO.C.11 TOP: Special Quadrilaterals
107 ANS: 2

\[ m = \frac{3}{2} \quad \text{and} \quad 1 = -\frac{2}{3}(-6) + b \]

\[ m_t = -\frac{2}{3} \quad 1 = 4 + b \]

\[ -3 = b \]

PTS: 2  
REF: 061719geo  
NAT: G.GPE.B.5  
TOP: Parallel and Perpendicular Lines

KEY: write equation of perpendicular line

108 ANS: 4  
PTS: 2  
REF: 061813geo  
NAT: G.CO.C.11  
TOP: Special Quadrilaterals

109 ANS: 2  
The line \( y = -3x + 6 \) passes through the center of dilation, so the dilated line is not distinct.

PTS: 2  
REF: 061824geo  
NAT: G.SRT.A.1  
TOP: Line Dilations

110 ANS: 2  

\[ V = \frac{1}{3} \left( \frac{60}{12} \right)^2 \left( \frac{84}{12} \right) \approx 58 \]

PTS: 2  
REF: 081819geo  
NAT: G.GMD.A.3  
TOP: Volume

KEY: pyramids

111 ANS: 2  

\[ 12^2 = 9 \cdot 16 \]

\[ 144 = 144 \]

PTS: 2  
REF: 081718geo  
NAT: G.SRT.B.5  
TOP: Similarity

KEY: leg

112 ANS: 3  

\[ v = \pi r^2 h \]

(1) \( 6^2 \cdot 10 = 360 \)

(2) \( 10^2 \cdot 6 = 600 \)

(3) \( 5^2 \cdot 6 = 150 \)

(4) \( 3^2 \cdot 10 = 900 \)

PTS: 2  
REF: 081713geo  
NAT: G.GMD.B.4  
TOP: Rotations of Two-Dimensional Objects

113 ANS: 2  

\[ \frac{512 \pi}{3} \quad \frac{1}{2} \pi = \frac{4 \pi}{3} \]

PTS: 2  
REF: 081723geo  
NAT: G.C.B.5  
TOP: Sectors
114 ANS: 1
\[ x^2 + y^2 - 12y + 36 = -20 + 36 \]
\[ x^2 + (y - 6)^2 = 16 \]

PTS: 2   REF: 061712geo   NAT: G.GPE.A.1   TOP: Equations of Circles
KEY: completing the square

115 ANS:
\[ V = (\pi)(4^2)(9) + \left(\frac{1}{2}\right)\left(\frac{4}{3}\right)(\pi)(4^3) \approx 586 \]

PTS: 4   REF: 011833geo   NAT: G.GMD.A.3   TOP: Volume
KEY: compositions

116 ANS:
\[ r_{180^\circ} \text{ about } \left(\frac{1}{2}, \frac{1}{2}\right) \]

PTS: 2   REF: 081727geo   NAT: G.CO.A.5   TOP: Compositions of Transformations
KEY: identify

117 ANS:

Because \( AB \cong AC \), \( \triangle ABC \) has two congruent sides and is isosceles. Because \( AB \cong BC \) is not true, \( \triangle ABC \) has sides that are not congruent and \( \triangle ABC \) is not equilateral.

PTS: 4   REF: 061832geo   NAT: G.GPE.B.4   TOP: Triangles in the Coordinate Plane

118 ANS: 3
\[ \frac{24}{40} = \frac{15}{x} \]
\[ 24x = 600 \]
\[ x = 25 \]

PTS: 2   REF: 011813geo   NAT: G.SRT.B.5   TOP: Side Splitter Theorem

119 ANS: 2
\[ 4 \times 4 \times 6 - \pi(1)^2(6) \approx 77 \]

PTS: 2   REF: 011711geo   NAT: G.GMD.A.3   TOP: Volume
KEY: compositions
120 ANS: 3
\[
x = \frac{3}{6.3} = \frac{3}{5} \quad \frac{y}{9.4} = \frac{6.3}{6.3 + 3.78}
\]
x = 3.78 \quad y \approx 5.9

PTS: 2 \quad REF: 081816geo \quad NAT: G.SRT.B.5 \quad TOP: Side Splitter Theorem

121 ANS: 4 \quad PTS: 2 \quad REF: 061711geo \quad NAT: G.CO.C.11
TOP: Special Quadrilaterals

122 ANS:
Each triangular prism has the same base area. Therefore, each corresponding cross-section of the prisms will have the same area. Since the two prisms have the same height of 14, the two volumes must be the same.

PTS: 2 \quad REF: 061727geo \quad NAT: G.GMD.A.1 \quad TOP: Volume

123 ANS: 2
\[
\frac{30}{360} (5)^2 (\pi) \approx 6.5
\]

PTS: 2 \quad REF: 081818geo \quad NAT: G.C.B.5 \quad TOP: Sectors

124 ANS: 1
\[
x^2 + y^2 - 6y + 9 = -1 + 9
\]
\[
x^2 + (y - 3)^2 = 8
\]

PTS: 2 \quad REF: 011718geo \quad NAT: G.GPE.A.1 \quad TOP: Equations of Circles
KEY: completing the square

125 ANS: 4 \quad PTS: 2 \quad REF: 081803geo \quad NAT: G.GMD.B.4
TOP: Rotations of Two-Dimensional Objects

126 ANS: 1
\[
\sin 32 = \frac{O}{129.5}
\]
\[
O \approx 68.6
\]

PTS: 2 \quad REF: 011804geo \quad NAT: G.SRT.C.8 \quad TOP: Using Trigonometry to Find a Side

127 ANS: 2
\[
\frac{x}{x + 3} = \frac{14}{21} \quad 14 - 6 = 8
\]
\[
21x = 14x + 42
\]
\[
7x = 42
\]
\[
x = 6
\]

PTS: 2 \quad REF: 081812geo \quad NAT: G.SRT.B.5 \quad TOP: Side Splitter Theorem

128 ANS: 2 \quad PTS: 2 \quad REF: 061709geo \quad NAT: G.SRT.B.5
TOP: Triangle Proofs \quad KEY: statements
129 ANS: 1

\[ B: (4 - 3, 3 - 4) \rightarrow (1, -1) \rightarrow (2, -2) \rightarrow (2 + 3, -2 + 4) \]

\[ C: (2 - 3, 1 - 4) \rightarrow (-1, -3) \rightarrow (-2, -6) \rightarrow (-2 + 3, -6 + 4) \]

PTS: 2 \hspace{1cm} REF: 011713geo \hspace{1cm} NAT: G.SRT.A.1 \hspace{1cm} TOP: Line Dilations

130 ANS: 4 \hspace{1cm} PTS: 2 \hspace{1cm} REF: 011803geo \hspace{1cm} NAT: G.CO.A.2

TOP: Identifying Transformations \hspace{1cm} KEY: graphics

131 ANS:

If an altitude is drawn to the hypotenuse of a triangle, it divides the triangle into two right triangles similar to each other and the original triangle.

PTS: 2 \hspace{1cm} REF: 061729geo \hspace{1cm} NAT: G.SRT.B.5 \hspace{1cm} TOP: Similarity

KEY: altitude

132 ANS: 4 \hspace{1cm} PTS: 2 \hspace{1cm} REF: 011723geo \hspace{1cm} NAT: G.GMD.B.4

TOP: Cross-Sections of Three-Dimensional Objects

133 ANS: 4

\[ RS \text{ and } TV \text{ bisect each other at point } X; \overline{TR} \text{ and } \overline{SV} \text{ are drawn (given); } \overline{TX} \cong \overline{XV} \text{ and } \overline{RX} \cong \overline{XS} \text{ (segment bisectors create two congruent segments); } \angle TXR \cong \angle VXS \text{ (vertical angles are congruent); } \triangle TXR \cong \triangle VXS \text{ (SAS); } \angle T \cong \angle V \text{ (CPCTC); } TR \parallel SV \text{ (a transversal that creates congruent alternate interior angles cuts parallel lines).} \]

PTS: 4 \hspace{1cm} REF: 061733geo \hspace{1cm} NAT: G.SRT.B.5 \hspace{1cm} TOP: Triangle Proofs

KEY: proof

134 ANS: 4

\[ \sqrt[3]{\frac{3V_f}{4\pi}} - 3 \sqrt[3]{\frac{3V_p}{4\pi}} = 3 \sqrt[3]{\frac{3(294)}{4\pi}} - 3 \sqrt[3]{\frac{3(180)}{4\pi}} \approx 0.6 \]

PTS: 2 \hspace{1cm} REF: 081708geo \hspace{1cm} NAT: G.CO.C.11 \hspace{1cm} TOP: Interior and Exterior Angles of Polygons

135 ANS: 4

\[ M \text{ is a centroid, and cuts each median 2:1.} \]

PTS: 2 \hspace{1cm} REF: 061718geo \hspace{1cm} NAT: G.CO.C.10 \hspace{1cm} TOP: Centroid, Orthocenter, Incenter and Circumcenter
Quadrilateral $ABCD$, $AB \cong CD$, $AB \parallel CD$, and $BF$ and $DE$ are perpendicular to diagonal $AC$ at points $F$ and $E$ (given). $\angle AED$ and $\angle CFB$ are right angles (perpendicular lines form right angles). $\angle AED \cong \angle CFB$ (All right angles are congruent). $ABCD$ is a parallelogram (A quadrilateral with one pair of sides congruent and parallel is a parallelogram). $AD \parallel BC$ (Opposite sides of a parallelogram are parallel). $\triangle DAE \cong \triangle BCF$ (Parallel lines cut by a transversal form congruent alternate interior angles). $DA \cong BC$ (Opposite sides of a parallelogram are congruent). $\triangle ADE \cong \triangle CBF$ (AAS). $AE \cong CF$ (CPCTC).

$\frac{300}{360} \cdot 8^2 \pi = \frac{160\pi}{3}$

$10 \cdot 6 = 15x$

$x = 4$

$\cos 54 = \frac{4.5}{m}$

$m \approx 7.7$

$\tan 54 = \frac{h}{4.5}$

$h \approx 6.2$

$T_{0,-2} \circ r_{y-axis}$

$\angle BDA \cong \angle BDC$; CPCTC;

Reflexive; $\angle BDA \cong \angle BDC$; CPCTC;

If points $B$ and $D$ are equidistant from the endpoints of $AC$, then $B$ and $D$ are on the perpendicular bisector of $AC$. 

$\angle BDA \cong \angle BDC$; CPCTC;

$\triangle BDA \cong \triangle BDC$ (ASA).
\[ \tan \theta = \frac{2.4}{x} \]
\[ \frac{3}{7} = \frac{2.4}{x} \]
\[ x = 5.6 \]

PTS: 2  
REF: 011707geo  
NAT: G.SRT.C.8  
TOP: Using Trigonometry to Find a Side

\[ V = \frac{1}{3} \pi (4)^2 (6) = 32\pi \]

PTS: 2  
REF: 061718geo  
NAT: G.GMD.B.4  
TOP: Rotations of Two-Dimensional Objects

ANS: 4
\[ \frac{1}{2} (360 - 268) = 46 \]

PTS: 2  
KEY: inscribed  
REF: 061704geo  
NAT: G.C.A.2  
TOP: Chords, Secants and Tangents

ANS: 3
\[ \cos 40 = \frac{14}{x} \]
\[ x \approx 18 \]

PTS: 2  
REF: 011712geo  
NAT: G.SRT.C.8  
TOP: Using Trigonometry to Find a Side

ANS: 1
\[ 20 \cdot 12 \cdot 45 + \frac{1}{2} \pi (10)^2 (45) \approx 17869 \]

PTS: 2  
KEY: compositions  
REF: 061807geo  
NAT: G.GMD.A.3  
TOP: Volume

ANS: 4
\[ \frac{2}{4} = \frac{9 - x}{x} \]
\[ 36 - 4x = 2x \]
\[ x = 6 \]

PTS: 2  
REF: 061705geo  
NAT: G.SRT.B.5  
TOP: Side Splitter Theorem

ANS: 2  
PTS: 2  
REF: 011805geo  
NAT: G.GMD.B.4  
TOP: Cross-Sections of Three-Dimensional Objects
PTS: 2  REF: 011725geo  NAT: G.CO.D.12  TOP: Constructions
KEY: line bisector
154 ANS: 1
Illinois: $\frac{1283062}{231.1} \approx 55520$  Florida: $\frac{1880130}{350.6} \approx 53626$  New York: $\frac{19378102}{411.2} \approx 47126$  Pennsylvania:
$\frac{12702379}{283.9} \approx 44742$

PTS: 2  REF: 081720geo  NAT: G.MG.A.2  TOP: Density
155 ANS: 3  PTS: 2  REF: 011710geo  NAT: G.CO.A.5
TOP: Compositions of Transformations  KEY: identify
156 ANS: 4
$\frac{360^\circ}{10} = 36^\circ$  $252^\circ$ is a multiple of $36^\circ$

PTS: 2  REF: 081722geo  NAT: G.CO.A.3  TOP: Mapping a Polygon onto Itself
157 ANS: 3
$V = \frac{1}{3} \pi r^2 h$
$54.45 \pi = \frac{1}{3} \pi (3.3)^2 h$
$h = 15$

PTS: 2  REF: 011807geo  NAT: G.GMD.A.3  TOP: Volume
KEY: cones
158 ANS: 3  PTS: 2  REF: 061706geo  NAT: G.SRT.A.1
TOP: Line Dilations
159 ANS:
$A(-2,1) \rightarrow (-3,-1) \rightarrow (-6,-2) \rightarrow (-5,0), \ B(0,5) \rightarrow (-1,3) \rightarrow (-2,6) \rightarrow (-1,8),$
$C(4,-1) \rightarrow (3,-3) \rightarrow (6,-6) \rightarrow (7,-4)$

PTS: 2  REF: 061826geo  NAT: G.SRT.A.2  TOP: Dilations
160 ANS: 1  PTS: 2  REF: 061801geo  NAT: G.CO.B.6
TOP: Properties of Transformations  KEY: graphics
161 ANS: 3 PTS: 2 REF: 011815geo NAT: G.CO.A.3
TOP: Mapping a Polygon onto Itself

162 ANS: 1
2x + 4 + 46 = 90
2x = 40
x = 20

PTS: 2 REF: 061808geo NAT: G.SRT.C.7 TOP: Cofunctions

163 ANS: 1
−8 + \frac{3}{5}(7 − 8) = −8 + 9 = 1 \quad 7 + \frac{3}{5}(−13 − 7) = 7 − 12 = −5

PTS: 2 REF: 081815geo NAT: G.GPE.B.6 TOP: Directed Line Segments

164 ANS: 1 PTS: 2 REF: 011814geo NAT: G.SRT.A.1
TOP: Line Dilations

165 ANS:

PTS: 2 REF: 011826geo NAT: G.CO.D.13 TOP: Constructions

166 ANS: 4

PTS: 2 REF: 061717geo NAT: G.CO.C.10 TOP: Interior and Exterior Angles of Triangles

167 ANS: 4
Opposite angles of an inscribed quadrilateral are supplementary.

PTS: 2 REF: 011821geo NAT: G.C.A.3 TOP: Inscribed Quadrilaterals

168 ANS: 3 PTS: 2 REF: 061703geo NAT: G.SRT.C.7
TOP: Cofunctions

169 ANS: 2 PTS: 2 REF: 081701geo NAT: G.GMD.B.4
TOP: Cross-Sections of Three-Dimensional Objects
ID: A

170 ANS: 2  PTS: 2  REF: 061720geo  NAT: G.CO.C.11
TOP: Parallelograms

171 ANS: 4
\[
\sin 71 = \frac{x}{20}
\]
\[x = 20 \sin 71 \approx 19\]

PTS: 2  REF: 061721geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find a Side
KEY: without graphics

172 ANS:
\[\cos B \text{ increases because } \angle A \text{ and } \angle B \text{ are complementary and } \sin A = \cos B.\]

PTS: 2  REF: 011827geo  NAT: G.SRT.C.7  TOP: Cofunctions

173 ANS:
Circle \( O \), tangent \( EC \) to diameter \( AC \), chord \( BC \) \parallel secant \( ADE \), and chord \( AB \) (given); \( \angle B \) is a right angle (an angle inscribed in a semi-circle is a right angle); \( EC \perp OC \) (a radius drawn to a point of tangency is perpendicular to the tangent); \( \angle ECA \) is a right angle (perpendicular lines form right angles); \( \angle B \cong \angle ECA \) (all right angles are congruent); \( \angle BCA \cong \angle CAE \) (the transversal of parallel lines creates congruent alternate interior angles); \( \triangle ABC \sim \triangle ECA \) (AA); \( \frac{BC}{CA} = \frac{AB}{EC} \) (Corresponding sides of similar triangles are in proportion).

PTS: 4  REF: 081733geo  NAT: G.SRT.B.5  TOP: Circle Proofs

174 ANS: 4
\[40 - x + 3x = 90\]
\[2x = 50\]
\[x = 25\]

PTS: 2  REF: 081721geo  NAT: G.SRT.C.7  TOP: Cofunctions

175 ANS: 3  PTS: 2  REF: 061802geo  NAT: G.CO.C.9
TOP: Lines and Angles

176 ANS: 4


177 ANS: 1
\[3 + \frac{2}{5}(8 - 3) = 3 + \frac{2}{5}(5) = 3 + 2 = 5\]
\[5 + \frac{2}{5}(-5 - 5) = 5 + \frac{2}{5}(-10) = 5 - 4 = 1\]

PTS: 2  REF: 011720geo  NAT: G.GPE.B.6  TOP: Directed Line Segments

\[(12 \cdot 11) - \left( \frac{1}{2} (12 \cdot 4) + \frac{1}{2} (7 \cdot 9) + \frac{1}{2} (11 \cdot 3) \right) = 60\]

PTS: 2  REF: 061815geo  NAT: G.GPE.B.7  TOP: Polygons in the Coordinate Plane

\[
\sin 16.5 = \frac{8}{x} \\
x \approx 28.2
\]

PTS: 2  REF: 081806ai  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find a Side

\[
\tan 36 = \frac{x}{10} \\
\cos 36 = \frac{10}{y} \\
x \approx 7.3 \\
y \approx 12.3607
\]

PTS: 4  REF: 081833geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find a Side

\[
x^2 + x^2 = 58^2 \\
A = (\sqrt{1682} + 8)^2 \approx 2402.2
\]

\[
2x^2 = 3364 \\
x = \sqrt{1682}
\]

PTS: 4  REF: 081734geo  NAT: G.MG.A.3  TOP: Area of Polygons
The slope of $3x + 2y = 12$ is $-\frac{3}{2}$, which is the opposite reciprocal of $\frac{2}{3}$.

Reflections are rigid motions that preserve distance, so $\triangle ABC \cong \triangle DEF$.

$V = \pi (10)^2 (18) = 1800 \pi \text{ in}^3 \quad 1800 \pi \text{ in}^3 = \frac{1 \text{ ft}^3}{12^3 \text{ in}^3} = \frac{25}{24} \pi \text{ ft}^3 \quad \frac{25}{24} \pi (95.46)(0.85) \approx 266 \quad 266 + 270 = 536$

The line is on the center of dilation, so the line does not change. $p: 3x + 4y = 20$

NYSED accepts either (1) or (3) as a correct answer. Statement III is not true if $A, B, A'$ and $B'$ are collinear.
ANS: rotation 180° about the origin, translation 2 units down; rotation 180° about B, translation 6 units down and 6 units left; or reflection over x-axis, translation 2 units down, reflection over y-axis

\[
tan 15 = \frac{6250}{x} \quad \tan 52 = \frac{6250}{y}
\]
\[
23325.3 - 4883 = 18442 \quad \frac{18442 \text{ ft}}{1 \text{ min}} \left( \frac{1 \text{ mi}}{5280 \text{ ft}} \right) \left( \frac{60 \text{ min}}{1 \text{ h}} \right) \approx 210
\]
\[
x \approx 23325.3 \quad y \approx 4883
\]

ANS: 
\[
-4 + \frac{2}{5}(6 - 4) = -4 + \frac{2}{5}(10) = -4 + 4 = 0 \quad 5 + \frac{2}{5}(20 - 5) = 5 + \frac{2}{5}(15) = 5 + 6 = 11
\]

ANS: Isosceles trapezoid \(ABCD\), \(\angle CDE \cong \angle DCE\), \(AE \perp DE\), and \(BE \perp CE\) (given); \(AD \cong BC\) (congruent legs of isosceles trapezoid); \(\angle DEA\) and \(\angle CEB\) are right angles (perpendicular lines form right angles); \(\angle DEA \cong \angle CEB\) (all right angles are congruent); \(\angle CDA \cong \angle DCB\) (base angles of an isosceles trapezoid are congruent); \(\angle CDA - \angle CDE \cong \angle DCB - \angle DCE\) (subtraction postulate); \(\triangle ADE \cong \triangle BCE\) (AAS); \(\overline{EA} \cong \overline{EB}\) (CPCTC);
\[
\angle EDA \cong \angle ECB
\]
\(\triangle AEB\) is an isosceles triangle (an isosceles triangle has two congruent sides).

ANS: 
\[
m = \frac{-4}{-6} = \frac{2}{3}
\]
\[
m_{\perp} = \frac{-3}{2}
\]

ANS: \(GI\) is parallel to \(NT\), and \(IN\) intersects at \(A\) (given); \(\angle I \cong \angle N\), \(\angle G \cong \angle T\) (paralleling lines cut by a transversal form congruent alternate interior angles); \(\triangle GIA \sim \triangle TNA\) (AA).

ANS: NYSED has stated that all students should be awarded credit regardless of their answer to this question.
\[
\frac{64}{4} = 16 \quad 16^2 = 256 \quad 2w + 2(w + 2) = 64 \quad 15 \times 17 = 255 \quad 2w + 2(w + 4) = 64 \quad 14 \times 18 = 252 \quad 2w + 2(w + 6) = 64
\]

\[
\begin{align*}
w &= 15 & w &= 14 & w &= 13
\end{align*}
\]

\[13 \times 19 = 247\]

PTS: 2  REF: 011708geo  NAT: G.MG.A.3  TOP: Area of Polygons

ANS: 4
\[9 \cdot 3 = 27, \quad 27 \cdot 4 = 108\]

PTS: 2  REF: 061805geo  NAT: G.SRT.A.2  TOP: Dilations

ANS:
\[
\begin{align*}
\overline{PQ} & = \sqrt{(8 - 3)^2 + (3 - 2)^2} = \sqrt{50} \\
\overline{QR} & = \sqrt{(1 - 8)^2 + (4 - 3)^2} = \sqrt{50} \\
\overline{RS} & = \sqrt{(-4 - 1)^2 + (-1 - 4)^2} = \sqrt{50} \\
\overline{PS} & = \sqrt{(4 - 3)^2 + (-1 - 2)^2} = \sqrt{50}
\end{align*}
\]

\[
\begin{align*}
PQRS \text{ is a rhombus because all sides are congruent.} & \quad m_{\overline{PQ}} = \frac{8 - 3}{3 - 2} = \frac{5}{1} = 5 \\
 & \quad m_{\overline{QR}} = \frac{1 - 8}{4 - 3} = -7 \\
\text{Because the slopes of adjacent sides are not opposite reciprocals, they are not perpendicular} \\
\end{align*}
\]

\[PQRS \text{ is not a square.}\]

PTS: 6  REF: 061735geo  NAT: G.GPE.B.4  TOP: Quadrilaterals in the Coordinate Plane

KEY: grids

ANS: 3
\[
\frac{7 - 1}{0 - 2} = \frac{6}{-2} = -3 \quad \text{The diagonals of a rhombus are perpendicular.}
\]

PTS: 2  REF: 011719geo  NAT: G.GPE.B.4  TOP: Quadrilaterals in the Coordinate Plane

ANS:

PTS: 2  REF: 081728geo  NAT: G.CO.D.13  TOP: Constructions
\[ -4 + \frac{2}{5} (1 - 4) = -4 + \frac{2}{5} (5) = -4 + 2 = -2 \]
\[ -2 + \frac{2}{5} (8 - 2) = -2 + \frac{2}{5} (10) = -2 + 4 = 2 \]

PTS: 2  REF: 061814geo  NAT: G.GPE.B.6  TOP: Directed Line Segments

208 ANS:
\[ C = 2\pi r \]
\[ V = \frac{1}{3} \pi \cdot 5^2 \cdot 13 \approx 340 \]
\[ 31.416 = 2\pi r \]
\[ 5 \approx r \]

PTS: 4  REF: 011734geo  NAT: G.GMD.A.3  TOP: Volume

KEY: cones

209 ANS: 1
\[ \cos S = \frac{60}{65} \]
\[ S \approx 23 \]

PTS: 2  REF: 061713geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find an Angle

210 ANS: 4
\[ \frac{360^\circ}{10} = 36^\circ \]
\[ 252^\circ \] is a multiple of \( 36^\circ \)

PTS: 2  REF: 011733geo  NAT: G.CO.A.3  TOP: Mapping a Polygon onto Itself

211 ANS:

Right triangle because \( \angle CBF \) is inscribed in a semi-circle.

PTS: 4  REF: 011733geo  NAT: G.CO.D.13  TOP: Constructions
Circle $O$, secant $\overline{ACD}$, tangent $\overline{AB}$ (Given). Chords $\overline{BC}$ and $\overline{BD}$ are drawn (Auxiliary lines). $\angle A \cong \angle A$, $\overarc{BC} \cong \overarc{BC}$ (Reflexive property). $m\angle BDC = \frac{1}{2} m\overarc{BC}$ (The measure of an inscribed angle is half the measure of the intercepted arc). $m\angle CBA = \frac{1}{2} m\overarc{BC}$ (The measure of an angle formed by a tangent and a chord is half the measure of the intercepted arc). $\angle BDC \cong \angle CBA$ (Angles equal to half of the same arc are congruent). $\triangle ABC \sim \triangle ADB$ (AA). $\frac{AB}{AC} = \frac{AD}{AB}$ (Corresponding sides of similar triangles are proportional). $AC \cdot AD = AB^2$ (In a proportion, the product of the means equals the product of the extremes).

PTS: 6  REF: spr1413geo  NAT: G.SRT.B.5  TOP: Circle Proofs


**Geometry Regents at Random Worksheets**

**Answer Section**

213  ANS: 3

\[
\frac{AB}{BC} = \frac{DE}{EF}
\]

\[
\frac{9}{15} = \frac{6}{10}
\]

\[90 = 90\]

PTS: 2  REF: 061515geo  NAT: G.SRT.B.5  TOP: Similarity

KEY: basic

214  ANS:

Triangle \(X'Y'Z'\) is the image of \(\triangle XYZ\) after a rotation about point \(Z\) such that \(\overline{ZX}\) coincides with \(\overline{ZU}\). Since rotations preserve angle measure, \(\overline{ZY}\) coincides with \(\overline{ZV}\), and corresponding angles \(X\) and \(Y\), after the rotation, remain congruent, so \(\overline{XY} \parallel \overline{UV}\). Then, dilate \(\triangle X'Y'Z'\) by a scale factor of \(\frac{ZU}{ZX}\) with its center at point \(Z\). Since dilations preserve parallelism, \(\overline{XY}\) maps onto \(\overline{UV}\). Therefore, \(\triangle XYZ \sim \triangle UVZ\).

PTS: 2  REF: spr1406geo  NAT: G.SRT.A.2  TOP: Compositions of Transformations

KEY: grids

215  ANS: 2

PTS: 2  REF: 081814geo  NAT: G.C.A.2  TOP: Chords, Secants and Tangents

KEY: tangents drawn from common point, length

216  ANS: 2

\[
C = \pi d \quad V = \pi \left(\frac{2.25}{\pi}\right)^2 \cdot 8 \approx 12.8916 \quad W = 12.8916 \cdot 752 \approx 9694
\]

\[
4.5 = \pi d
\]

\[
\frac{4.5}{\pi} = d
\]

\[
\frac{2.25}{\pi} = r
\]

PTS: 2  REF: 081617geo  NAT: G.MG.A.2  TOP: Density
217 ANS: 2
\[ x^2 + y^2 + 6y + 9 = 7 + 9 \]
\[ x^2 + (y + 3)^2 = 16 \]

PTS: 2  REF: 061514geo  NAT: G.GPE.A.1  TOP: Equations of Circles
KEY: completing the square

218 ANS: 1  PTS: 2  REF: 081606geo  NAT: G.SRT.C.7
TOP: Cofunctions

219 ANS: 2
\[ x^2 = 4 \cdot 10 \]
\[ x = \sqrt{40} \]
\[ x = 2\sqrt{10} \]

PTS: 2  REF: 081610geo  NAT: G.SRT.B.5  TOP: Similarity
KEY: leg

220 ANS: 2  PTS: 2  REF: 061603geo  NAT: G.GPE.A.1
TOP: Equations of Circles  KEY: find center and radius | completing the square

221 ANS:
\[ \sin 70 = \frac{30}{L} \]
\[ L \approx 32 \]

PTS: 2  REF: 011629geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find a Side
KEY: graphics

222 ANS: 2  PTS: 2  REF: 011610geo  NAT: G.SRT.A.1
TOP: Line Dilations

223 ANS: 1
\[ \frac{f}{4} = \frac{15}{6} \]
\[ f = 10 \]

PTS: 2  REF: 061617geo  NAT: G.CO.C.9  TOP: Lines and Angles

224 ANS: 2
\[ s^2 + s^2 = 7^2 \]
\[ 2s^2 = 49 \]
\[ s^2 = 24.5 \]
\[ s \approx 4.9 \]

PTS: 2  REF: 081511geo  NAT: G.C.A.3  TOP: Inscribed Quadrilaterals
225 ANS:
\[4x - 0.7 = 2x + 0.1\]
\[\sin A\] is the ratio of the opposite side and the hypotenuse while \(\cos B\) is the ratio of the adjacent side and the hypotenuse. The side opposite angle \(A\) is the same side as the side adjacent to angle \(B\). Therefore, \(\sin A = \cos B\).

\[2x = 0.8\]
\[x = 0.4\]

PTS: 2  REF: fall1407geo  NAT: G.SRT.C.7  TOP: Cofunctions

226 ANS: 1  PTS: 2  REF: 011608geo  NAT: G.CO.A.5
TOP: Compositions of Transformations  KEY: identify

227 ANS:
\[
\frac{3}{8} \cdot 56 = 21
\]

PTS: 2  REF: 081625geo  NAT: G.C.A.2  TOP: Chords, Secants and Tangents
KEY: common tangents

228 ANS: 4  PTS: 2  REF: 061513geo  NAT: G.CO.C.11
TOP: Parallelograms

229 ANS:
\(\Delta MNO\) is congruent to \(\Delta PNO\) by SAS. Since \(\Delta MNO \cong \Delta PNO\), then \(\overline{MO} \cong \overline{PO}\) by CPCTC. So \(NO\) must divide \(\overline{MP}\) in half, and \(MO = 8\).

PTS: 2  REF: fall1405geo  NAT: G.CO.C.10  TOP: Medians, Altitudes and Bisectors

230 ANS:
\[\tan 7 = \frac{125}{x}\]
\[\tan 16 = \frac{125}{y}\]
\[1018 - 436 \approx 582\]
\[x \approx 1018\]
\[y \approx 436\]

PTS: 4  REF: 081532geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find a Side
KEY: advanced

231 ANS: 4
\[m = \frac{-1}{2}\]
\[-4 = 2(6) + b\]
\[m_\perp = 2\]
\[-4 = 12 + b\]
\[-16 = b\]

PTS: 2  REF: 011602geo  NAT: G.GPE.B.5  TOP: Parallel and Perpendicular Lines
KEY: write equation of perpendicular line

TOP: Chords, Secants and Tangents  KEY: inscribed

233 ANS: 4  PTS: 2  REF: 061501geo  NAT: G.GMD.B.4
TOP: Rotations of Two-Dimensional Objects
The measures of the angles of a triangle remain the same after all rotations because rotations are rigid motions which preserve angle measure.

\[ x^2 + 4x + 4 + y^2 - 6y + 9 = 12 + 4 + 9 \]
\[ (x + 2)^2 + (y - 3)^2 = 25 \]

\[ A = \frac{1}{2} ab \quad 3 - 6 = -3 = x \]
\[ 24 = \frac{1}{2} a(8) \quad \frac{4 + 12}{2} = 8 = y \]
\[ a = 6 \]

\[ \tan 47 = \frac{x}{8.5} \quad \text{Cone: } V = \frac{1}{3} \pi (8.5)^2 (9.115) \approx 689.6 \quad \text{Cylinder: } V = \pi (8.5)^2 (25) \approx 5674.5 \quad \text{Hemisphere: } \]
\[ x \approx 9.115 \]
\[ V = \frac{1}{2} \left( \frac{4}{3} \pi (8.5)^3 \right) \approx 1286.3 \quad 689.6 + 5674.5 + 1286.3 \approx 7650 \quad \text{No, because } 7650 \cdot 62.4 = 477,360 \]
\[ 477,360 \div 0.85 = 405,756, \text{ which is greater than 400,000.} \]
239 ANS: 4

\[ V = \pi \left( \frac{6.7}{2} \right)^2 (4 \cdot 6.7) \approx 945 \]

PTS: 2 REF: 081620geo NAT: G.GMD.A.3 TOP: Volume
KEY: cylinders

240 ANS:

\[ M = 180 - (47 + 57) = 76 \text{ Rotations do not change angle measurements.} \]

PTS: 2 REF: 081629geo NAT: G.CO.B.6 TOP: Properties of Transformations

241 ANS:

The transformation is a rotation, which is a rigid motion.

PTS: 2 REF: 081530geo NAT: G.CO.B.7 TOP: Triangle Congruency

242 ANS: 3

1) \( \frac{12}{9} = \frac{4}{3} \) 2) AA 3) \( \frac{32}{16} \neq \frac{8}{2} \) 4) SAS

PTS: 2 REF: 061605geo NAT: G.SRT.B.5 TOP: Similarity
KEY: basic

243 ANS:

No, the weight of the bricks is greater than 900 kg.  
\[ 500 \times (5.1 \text{ cm} \times 10.2 \text{ cm} \times 20.3 \text{ cm}) = 528,003 \text{ cm}^3. \]

\[ \frac{528,003 \text{ cm}^3 \times \frac{1 \text{ m}^3}{1000000 \text{ cm}^3}}{1920 \text{ kg/m}^3 \times 0.528003 \text{ m}^3} \approx 1013 \text{ kg}. \]

PTS: 2 REF: fall1406geo NAT: G.MG.A.2 TOP: Density

244 ANS: 4 PTS: 2 REF: 061608geo NAT: G.SRT.A.2
TOP: Compositions of Transformations KEY: grids

245 ANS: 3

\[ \frac{x}{360} \cdot 3^2 \pi = 2\pi \quad 180 - 80 = 100 \]

\[ x = 80 \quad \frac{180 - 100}{2} = 40 \]

PTS: 2 REF: 011612geo NAT: G.C.B.5 TOP: Sectors
Quadrilateral $ABCD$ with diagonals $\overline{AC}$ and $\overline{BD}$ that bisect each other, and $\angle 1 \cong \angle 2$ (given); quadrilateral $ABCD$ is a parallelogram (the diagonals of a parallelogram bisect each other); $\overline{AB} \parallel \overline{CD}$ (opposite sides of a parallelogram are parallel); $\angle 1 \cong \angle 3$ and $\angle 2 \cong \angle 4$ (alternate interior angles are congruent); $\angle 2 \cong \angle 3$ and $\angle 3 \cong \angle 4$ (substitution); $\triangle ACD$ is an isosceles triangle (the base angles of an isosceles triangle are congruent); $\overline{AD} \cong \overline{DC}$ (the sides of an isosceles triangle are congruent); quadrilateral $ABCD$ is a rhombus (a rhombus has consecutive congruent sides); $\overline{AE} \perp \overline{BE}$ (the diagonals of a rhombus are perpendicular); $\angle BEA$ is a right angle (perpendicular lines form a right angle); $\triangle AEB$ is a right triangle (a right triangle has a right angle).
252 ANS: 1
\[ m_{\overline{TA}} = -1 \quad y = mx + b \]
\[ m_{\overline{EM}} = 1 \quad 1 = 1(2) + b \]
\[ -1 = b \]

PTS: 2 REF: 081614geo NAT: G.GPE.B.4 TOP: Quadrilaterals in the Coordinate Plane
KEY: general

253 ANS: 1
\[ \frac{360^\circ}{45^\circ} = 8 \]

PTS: 2 REF: 061510geo NAT: G.CO.A.3 TOP: Mapping a Polygon onto Itself

254 ANS: 4 PTS: 2 REF: 061615geo NAT: G.SRT.C.6 TOP: Trigonometric Ratios

255 ANS:
\[ \sin 75 = \frac{15}{x} \]
\[ x = \frac{15}{\sin 75} \]
\[ x \approx 15.5 \]

PTS: 2 REF: 081631geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side
KEY: graphics

256 ANS: 3
\[ \frac{4}{3} \pi \left( \frac{9.5}{2} \right)^3 \approx 55 \]
\[ \frac{4}{3} \pi \left( \frac{2.5}{2} \right)^3 \approx 55 \]

PTS: 2 REF: 011614geo NAT: G.GMD.A.3 TOP: Volume
KEY: spheres

257 ANS: 4
\[ 2592276 = \frac{1}{3} \cdot s^2 \cdot 146.5 \]
\[ 230 \approx s \]

PTS: 2 REF: 081521geo NAT: G.GMD.A.3 TOP: Volume
KEY: pyramids
The line \( y = 2x - 4 \) does not pass through the center of dilation, so the dilated line will be distinct from \( y = 2x - 4 \). Since a dilation preserves parallelism, the line \( y = 2x - 4 \) and its image will be parallel, with slopes of 2. To obtain the \( y \)-intercept of the dilated line, the scale factor of the dilation, \( \frac{3}{2} \), can be applied to the \( y \)-intercept, \((0, -4)\). Therefore, \( \left(0, -4 \cdot \frac{3}{2}\right) \rightarrow (0, -6) \). So the equation of the dilated line is \( y = 2x - 6 \).

The line \( y = 3x - 1 \) passes through the center of dilation, so the dilated line is not distinct.

Quadrilateral \( ABCD \) is a parallelogram with diagonals \( \overline{AC} \) and \( \overline{BD} \) intersecting at \( E \) (Given). \( \overline{AD} \cong \overline{BC} \) (Opposite sides of a parallelogram are congruent). \( \angle AED \cong \angle CEB \) (Vertical angles are congruent). \( \overline{BC} \parallel \overline{DA} \) (Definition of parallelogram). \( \angle DBC \cong \angle BDA \) (Alternate interior angles are congruent). \( \triangle AED \cong \triangle CEB \) (AAS). 180° rotation of \( \triangle AED \) around point \( E \).

\[
\frac{137.8}{6^3} \approx 0.638 \text{ Ash}
\]

Similar triangles are required to model and solve a proportion.

\[
\frac{x + 5}{1.5} = \frac{x}{1} \quad \frac{1}{3} \pi (1.5)^2 (15) - \frac{1}{3} \pi (1)^2 (10) \approx 24.9
\]

\[
x + 5 = 1.5x
\]
\[
5 = .5x
\]
\[
10 = x
\]
\[
10 + 5 = 15
\]
264 ANS:
\[ m_{TS} = \frac{-10}{6} = -\frac{5}{3} \quad m_{SR} = \frac{3}{5} \]
Since the slopes of \(TS\) and \(SR\) are opposite reciprocals, they are perpendicular and form a right angle. \(\triangle RST\) is a right triangle because \(\angle S\) is a right angle. \(P(0,9)\)
\[ m_{RP} = \frac{-10}{6} = -\frac{5}{3} \quad m_{PT} = \frac{3}{5} \]
Since the slopes of all four adjacent sides (\(TS\) and \(SR\), \(SR\) and \(RP\), \(PT\) and \(TS\), \(RP\) and \(PT\)) are opposite reciprocals, they are perpendicular and form right angles. Quadrilateral \(RSTP\) is a rectangle because it has four right angles.

PTS: 6 REF: 061536geo NAT: G.GPE.B.4 TOP: Quadrilaterals in the Coordinate Plane KEY: grids

265 ANS: 2 PTS: 2 REF: 081501geo NAT: G.CO.C.11 TOP: Special Quadrilaterals


267 ANS: 2
The given line \(h\), \(2x + y = 1\), does not pass through the center of dilation, the origin, because the \(y\)-intercept is at \((0,1)\). The slope of the dilated line, \(m\), will remain the same as the slope of line \(h\), \(-2\). All points on line \(h\), such as \((0,1)\), the \(y\)-intercept, are dilated by a scale factor of 4; therefore, the \(y\)-intercept of the dilated line is \((0,4)\) because the center of dilation is the origin, resulting in the dilated line represented by the equation \(y = -2x + 4\).

PTS: 2 REF: spr1403geo NAT: G.SRT.A.1 TOP: Line Dilations

268 ANS:
The acute angles in a right triangle are always complementary. The sine of any acute angle is equal to the cosine of its complement.

\[ \tan 34^\circ = \frac{T}{20} \]

\[ T \approx 13.5 \]

\[ \sqrt{45} = 3\sqrt{5} \quad a = \frac{1}{2} \left( 3\sqrt{5} \right) \left( 6\sqrt{5} \right) = \frac{1}{2} (18)(5) = 45 \]

\[ \sqrt{180} = 6\sqrt{5} \]
Compose a Transformation.

Translate \(\triangle ABC\) along \(\overrightarrow{CF}\) such that point \(C\) maps onto point \(F\), resulting in image \(\triangle A'B'C\). Then reflect \(\triangle A'B'C\) over \(\overrightarrow{DF}\) such that \(\triangle A'B'C\) maps onto \(\triangle DEF\).

Alternate Method:

Reflect \(\triangle ABC\) over the perpendicular bisector of \(\overrightarrow{EB}\) such that \(\triangle ABC\) maps onto \(\triangle DEF\).

\[x \approx 1051.3 \quad y \approx 77.4\]
\[ \overline{LA} \cong \overline{DN}, \overline{CA} \cong \overline{CN}, \text{ and } \overline{DAC} \perp \overline{LCN} \text{ (Given).} \] \[ \angle LCA \text{ and } \angle DCN \text{ are right angles (Definition of perpendicular lines).} \] \[ \triangle LAC \text{ and } \triangle DNC \text{ are right triangles (Definition of a right triangle).} \] \[ \triangle LAC \cong \triangle DNC \text{ (HL).} \] \[ \triangle LAC \text{ will map onto } \triangle DNC \text{ after rotating } \triangle LAC \text{ counterclockwise 90º about point } C \text{ such that point } L \text{ maps onto point } D. \]

**PTS: 4**

**REF:** spr1408geo

**NAT:** G.CO.B.8

**TOP:** Triangle Congruency

**ANS:** 4

\[ \sin 70 = \frac{x}{20} \]

\[ x \approx 18.8 \]

**PTS: 2**

**REF:** 061611geo

**NAT:** G.SRT.C.8

**TOP:** Using Trigonometry to Find a Side

**KEY:** without graphics

**ANS:** 1

\[ 180 - (68 \cdot 2) \]

**PTS: 2**

**REF:** 081624geo

**NAT:** G.CO.C.11

**TOP:** Interior and Exterior Angles of Polygons

**ANS:**

\[ V = \frac{1}{3} \cdot 6^2 \cdot 12 = 144 \]

**PTS: 2**

**REF:** 011607geo

**NAT:** G.GMD.A.3

**TOP:** Volume

**KEY:** pyramids

**ANS:**

\[ 180 - 2(30) = 120 \]

**PTS: 2**

**REF:** 011626geo

**NAT:** G.C.A.2

**TOP:** Chords, Secants and Tangents

**KEY:** parallel lines
(2) Euclid’s Parallel Postulate; (3) Alternate interior angles formed by parallel lines and a transversal are congruent; (4) Angles forming a line are supplementary; (5) Substitution

\[
\frac{360}{6} = 60
\]

\[
\text{ANS: } \tan x = \frac{10}{4}
\]

\[
x \approx 68
\]

\[
\text{ANS: } \sqrt{20^2 - 10^2} \approx 17.3
\]

\[
\text{ANS: } \theta = \frac{s}{r} = \frac{2\pi}{10} = \frac{\pi}{5}
\]

The length of \(A'C\) is twice \(AC\).
\[ V = 12 \cdot 8.5 \cdot 4 = 408 \]
\[ W = 408 \cdot 0.25 = 102 \]

\[ -5 + \frac{3}{5} (5 - 5) - 4 + \frac{3}{5} (1 - 4) \]
\[ -5 + \frac{3}{5} (10) - 4 + \frac{3}{5} (5) \]
\[ -5 + 6 - 4 + 3 \]
\[ 1 - 1 \]

Circle \( A \) can be mapped onto circle \( B \) by first translating circle \( A \) along vector \( \overrightarrow{AB} \) such that \( A \) maps onto \( B \), and then dilating circle \( A \), centered at \( A \), by a scale factor of \( \frac{5}{3} \). Since there exists a sequence of transformations that maps circle \( A \) onto circle \( B \), circle \( A \) is similar to circle \( B \).

\[ \frac{3.75}{5} = \frac{4.5}{6} \]
\[ AB \] is parallel to \( CD \) because \( AB \) divides the sides proportionately.
\[ 39.375 = 39.375 \]

\[ \frac{12}{4} = \frac{x}{5} \]
\[ 15 - 4 = 11 \]
\[ x = 15 \]
$14 \times 16 \times 10 = 2240 \quad 2240 - 1680 = 0.25$
It is given that point $D$ is the image of point $A$ after a reflection in line $CH$. It is given that $CH$ is the perpendicular bisector of $BCE$ at point $C$. Since a bisector divides a segment into two congruent segments at its midpoint, $BC \cong EC$. Point $E$ is the image of point $B$ after a reflection over the line $CH$, since points $B$ and $E$ are equidistant from point $C$ and it is given that $CH$ is perpendicular to $BE$. Point $C$ is on $CH$, and therefore, point $C$ maps to itself after the reflection over $CH$. Since all three vertices of triangle $ABC$ map to all three vertices of triangle $DEC$ under the same line reflection, then $\triangle ABC \cong \triangle DEC$ because a line reflection is a rigid motion and triangles are congruent when one can be mapped onto the other using a sequence of rigid motions.

\[
\frac{4}{6} = \frac{3}{4.5} = \frac{2}{3}
\]

\[
\frac{120}{230} = \frac{x}{315}
\]

\[x = 164\]
323 ANS:
\[
\tan 52.8 = \frac{h}{x} \quad \Rightarrow \quad x \tan 52.8 = x \tan 49.3 + 8 \tan 49.3
\]
\[
\tan 52.8 \approx \frac{h}{9} \quad 11.86 + 1.7 \approx 13.6
\]
\[
h = x \tan 52.8 \quad \Rightarrow \quad x \tan 52.8 - x \tan 49.3 = 8 \tan 49.3
\]
\[
(x \tan 52.8 - x \tan 49.3) = 8 \tan 49.3
\]
\[
x \approx 11.86
\]
\[
\tan 34.9 = \frac{h}{x+8}
\]
\[
h = (x+8) \tan 34.9
\]
\[
x \approx 9
\]

PTS: 6  REF: 011636geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find a Side

KEY: advanced

324 ANS: 2
\[
\frac{12}{4} = \frac{36}{x}
\]
\[
12x = 144
\]
\[
x = 12
\]

PTS: 2  REF: 061621geo  NAT: G.SRT.B.5  TOP: Side Splitter Theorem

325 ANS:
Since linear angles are supplementary, \( m \angle GIH = 65^\circ \). Since \( \overline{GH} \cong \overline{HI} \), \( m \angle GHI = 50^\circ \) \((180 - (65 + 65))\). Since \( \angle EGB \cong \angle GHI \), the corresponding angles formed by the transversal and lines are congruent and \( AB \parallel CD \).

PTS: 4  REF: 061532geo  NAT: G.CO.C.9  TOP: Lines and Angles

326 ANS: 2
Segments drawn from the center of the regular pentagon bisect each angle of the pentagon, and create five isosceles triangles as shown in the diagram below. Since each exterior angle equals the angles formed by the segments drawn from the center of the regular pentagon, the minimum degrees necessary to carry a regular polygon onto itself are equal to the measure of an exterior angle of the regular polygon.

\[
V = \frac{1}{3} \pi \left( \frac{3}{2} \right)^2 \cdot 8 \approx 18.85 \cdot 100 = 1885 \quad 1885 \cdot 0.52 \cdot 0.10 = 98.02 \quad 1.95(100) - (37.83 + 98.02) = 59.15
\]

PTS: 6  REF: 081536geo  NAT: G.MG.A.2  TOP: Density
328 ANS:
\[
\frac{1.65}{4.15} = \frac{x}{16.6}
\]
\[
4.15x = 27.39
\]
\[
x = 6.6
\]

PTS: 2  REF: 061531geo  NAT: G.SRT.B.5  TOP: Similarity
KEY: basic

329 ANS: 4  PTS: 2  REF: 081503geo  NAT: G.GMD.B.4  TOP: Rotations of Two-Dimensional Objects

330 ANS:
\[
\frac{2}{5}(16-1) = 6  \quad \frac{2}{5}(14-4) = 4  \quad (1+6,4+4) = (7,8)
\]

PTS: 2  REF: 081531geo  NAT: G.GPE.B.6  TOP: Directed Line Segments

331 ANS: 1
\[
\frac{1}{2} \left( \frac{4}{3} \right) \pi \cdot 5^3 \cdot 62.4 \approx 16,336
\]

PTS: 2  REF: 061620geo  NAT: G.MG.A.2  TOP: Density

332 ANS: 3
\[
r = \sqrt{(7-3)^2 + (1-2)^2} = \sqrt{16+9} = 5
\]

PTS: 2  REF: 061503geo  NAT: G.GPE.B.4  TOP: Circles in the Coordinate Plane

333 ANS:
\[
\tan 3.47 = \frac{M}{6336}
\]
\[
M \approx 384
\]
\[
4960 + 384 = 5344
\]
\[
\tan 0.64 = \frac{A}{20,493}
\]
\[
A \approx 229
\]
\[
5344 - 229 = 5115
\]

PTS: 6  REF: fall1413geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find a Side
KEY: advanced
334 ANS:
Yes. \[(x - 1)^2 + (y + 2)^2 = 4^2\]
\[(3.4 - 1)^2 + (1.2 + 2)^2 = 16\]
\[5.76 + 10.24 = 16\]
16 = 16

PTS: 2 REF: 081630geo NAT: G.GPE.B.4 TOP: Circles in the Coordinate Plane

335 ANS: 1
\[m = \frac{-2}{3}\]
\[1 = \left(\frac{-2}{3}\right)6 + b\]
\[1 = -4 + b\]
\[5 = b\]

PTS: 2 REF: 081510geo NAT: G.GPE.B.5 TOP: Parallel and Perpendicular Lines
KEY: write equation of parallel line

336 ANS: 4
\[
\frac{-2 - 1}{-1 - 3} = \frac{3 - 2}{0 - 5} = \frac{1}{-5} = \frac{3 - 1}{0 - 3} = \frac{2}{3} = \frac{2 - 2}{5 - 1} = \frac{4}{6} = \frac{2}{3}
\]

PTS: 2 REF: 081522geo NAT: G.GPE.B.4 TOP: Quadrilaterals in the Coordinate Plane
KEY: general

337 ANS:
Parallelogram \(ABCD\), diagonals \(\overline{AC}\) and \(\overline{BD}\) intersect at \(E\) (given). \(\overline{DC} \parallel \overline{AB}; \overline{DA} \parallel \overline{CB}\) (opposite sides of a parallelogram are parallel). \(\angle ACD \cong \angle CAB\) (alternate interior angles formed by parallel lines and a transversal are congruent).


338 ANS: 3
1) only proves AA;  2) need congruent legs for HL;  3) SAS;  4) only proves product of altitude and base is equal

PTS: 2 REF: 061607geo NAT: G.SRT.B.5 TOP: Triangle Proofs
KEY: statements

339 ANS: 4
\[\frac{2}{6} = \frac{5}{15}\]

PTS: 2 REF: 081517geo NAT: G.SRT.B.5 TOP: Side Splitter Theorem

340 ANS: 1
1) opposite sides;  2) adjacent sides;  3) perpendicular diagonals;  4) diagonal bisects angle

PTS: 2 REF: 061609geo NAT: G.CO.C.11 TOP: Special Quadrilaterals
\[
\cos A = \frac{9}{14}
\]
\[A \approx 50^\circ\]

**342** ANS: 3  
\[
\frac{60}{360} \cdot 8^2 \pi = \frac{1}{6} \cdot 64\pi = \frac{32\pi}{3}
\]

**343** ANS:

\[
-6 + \frac{2}{5}(4 - -6) -5 + \frac{2}{5}(0 - -5) (-2,-3)
\]

\[
-6 + \frac{2}{5}(10) -5 + \frac{2}{5}(5)
\]

\[-6 + 4 -5 + 2\]

\[-2 -3\]

**344** ANS: 2  
**345** ANS:

Circle \(O\), chords \(AB\) and \(CD\) intersect at \(E\) (Given); Chords \(CB\) and \(AD\) are drawn (auxiliary lines drawn); \(\angle CEB \cong \angle AED\) (vertical angles); \(\angle C \cong \angle A\) (Inscribed angles that intercept the same arc are congruent); \(\triangle BCE \sim \triangle DAE\) (AA); \(\frac{AE}{CE} = \frac{ED}{EB}\) (Corresponding sides of similar triangles are proportional); \(AE \cdot EB = CE \cdot ED\) (The product of the means equals the product of the extremes).

**346** ANS: 3  
**347** ANS:

\[73 + R = 90\] Equal cofunctions are complementary.

\[R = 17\]

**348** ANS: 3  
**349** ANS:

\[\text{Circle } O, \text{ chords } AB \text{ and } CD \text{ intersect at } E \text{ (Given); Chords } CB \text{ and } AD \text{ are drawn (auxiliary lines drawn); } \angle CEB \cong \angle AED \text{ (vertical angles); } \angle C \cong \angle A \text{ (Inscribed angles that intercept the same arc are congruent); } \triangle BCE \sim \triangle DAE \text{ (AA); } \frac{AE}{CE} = \frac{ED}{EB} \text{ (Corresponding sides of similar triangles are proportional); } AE \cdot EB = CE \cdot ED \text{ (The product of the means equals the product of the extremes).}\]
348 ANS:

![Diagram of a circle with lines drawn to form a regular pentagon inside.]

PTS: 2   REF: 061525geo   NAT: G.CO.D.13   TOP: Constructions

349 ANS: 1

\[
\frac{1000}{20\pi} \approx 15.9
\]

PTS: 2   REF: 011623geo   NAT: G.GMD.A.1   TOP: Circumference

350 ANS: 3   PTS: 2   REF: 061601geo   NAT: G.GMD.B.4   TOP: Rotations of Two-Dimensional Objects

351 ANS:

\[
\begin{align*}
\frac{40000}{\pi \left( \frac{51}{2} \right)^2} & \approx 19.6 \\
\frac{72000}{\pi \left( \frac{75}{2} \right)^2} & \approx 16.3
\end{align*}
\]

Dish A

PTS: 2   REF: 011630geo   NAT: G.MG.A.2   TOP: Density

352 ANS: 1

\[
m = \left( \frac{-11 + 5}{2}, \frac{5 + 7}{2} \right) = (-3, 1)
\]

\[
m = \left( \frac{5 - 7}{-11 - 5} \right) = \frac{12}{-16} = \frac{3}{4}
\]

\[
m_1 = \frac{4}{3}
\]

PTS: 2   REF: 061612geo   NAT: G.GPE.B.5   TOP: Parallel and Perpendicular Lines

KEY: perpendicular bisector

353 ANS: 1   PTS: 2   REF: 081504geo   NAT: G.SRT.C.7   TOP: Cofunctions

354 ANS:

\[
\left( \frac{180 - 20}{2} \right) \times \pi(6)^2 = \frac{80}{360} \times 36\pi = 8\pi
\]


355 ANS: 1   PTS: 2   REF: 081505geo   NAT: G.CO.A.3   TOP: Mapping a Polygon onto Itself

356 ANS:

Each quarter in both stacks has the same base area. Therefore, each corresponding cross-section of the stacks will have the same area. Since the two stacks of quarters have the same height of 23 quarters, the two volumes must be the same.

PTS: 2   REF: spr1405geo   NAT: G.GMD.A.1   TOP: Volume
ANS: Parallelogram $ABCD$, $EFG$, and diagonal $DFB$ (given); $\angle DFE \cong \angle BFG$ (vertical angles); $AD \parallel CB$ (opposite sides of a parallelogram are parallel); $\angle EDF \cong \angle GBF$ (alternate interior angles are congruent); $\triangle DEF \sim \triangle BGF$ (AA).

PTS: 4  REF: 061633geo  NAT: G.SRT.A.3  TOP: Similarity Proofs
358 ANS: 2
$\frac{4}{3} \pi \cdot 4^3 + 0.075 \approx 20$

PTS: 2  REF: 011619geo  NAT: G.MG.A.2  TOP: Density

ANS:
$\frac{6}{14} = \frac{9}{21}$ SAS
$126 = 126$

PTS: 2  REF: 081529geo  NAT: G.SRT.B.5  TOP: Similarity
KEY: basic

360 ANS: 4
$x = -6 + \frac{1}{6} (6 - -6) = -6 + 2 = -4$
$y = -2 + \frac{1}{6} (7 - -2) = -2 + \frac{9}{6} = -\frac{1}{2}$

PTS: 2  REF: 081618geo  NAT: G.GPE.B.6  TOP: Directed Line Segments

TOP: Rotations of Two-Dimensional Objects

362 ANS: 2
$SA = 6 \cdot 12^2 = 864$
$\frac{864}{450} = 1.92$

PTS: 2  REF: 061519geo  NAT: G.MG.A.3  TOP: Surface Area

363 ANS: 2

PTS: 2  REF: 061619geo  NAT: G.CO.C.10  TOP: Triangle Proofs

364 ANS: 1
The other statements are true only if $AD \perp BC$.

PTS: 2  REF: 081623geo  NAT: G.C.A.2  TOP: Chords, Secants and Tangents
KEY: inscribed
Translations preserve distance. If point $D$ is mapped onto point $A$, point $F$ would map onto point $C$. $\triangle DEF \cong \triangle ABC$ as $\overline{AC} \cong \overline{DF}$ and points are collinear on line $\ell$ and a reflection preserves distance.

$$h^2 = 30 \cdot 12$$
$$h^2 = 360$$
$$h = 6\sqrt{10}$$

$(x - 2)^2 + (y + 4)^2 = 9$
371 ANS: 
\[ M\left( \frac{4+0}{2}, \frac{6-1}{2} \right) = M\left( 2, \frac{5}{2} \right) \]
\[ m = \frac{6-1}{4-0} = \frac{7}{4} \quad m_1 = \frac{-4}{7} \quad y - 2.5 = \frac{-4}{7} (x - 2) \]
The diagonals, $MT$ and $AH$, of rhombus $MATH$ are perpendicular bisectors of each other.

PTS: 4 REF: fall1411geo NAT: G.GPE.B.4 TOP: Quadrilaterals in the Coordinate Plane
KEY: grids

372 ANS: 
Parallelogram $ANDR$ with $AW$ and $DE$ bisecting $NWD$ and $REA$ at points $W$ and $E$ (Given). $AN \cong RD$, $AR \cong DN$ (Opposite sides of a parallelogram are congruent). $AE = \frac{1}{2} AR$, $WD = \frac{1}{2} DN$, so $AE \cong WD$ (Definition of bisect and division property of equality). $AR \parallel DN$ (Opposite sides of a parallelogram are parallel). $AWDE$ is a parallelogram (Definition of parallelogram). $RE = \frac{1}{2} AR$, $NW = \frac{1}{2} DN$, so $RE \cong NW$ (Definition of bisect and division property of equality). $ED \cong AW$ (Opposite sides of a parallelogram are congruent). $\triangle ANW \cong \triangle DRE$ (SSS).

PTS: 6 REF: 011635geo NAT: G.SRT.B.5 TOP: Quadrilateral Proofs

373 ANS: 
\[
\begin{align*}
x &= \frac{2}{3} (4 - 2) = 4 - 2 + 4 = 2 \\ y &= \frac{2}{3} (7 - 1) = 4 + 4 = 5
\end{align*}
\]

PTS: 2 REF: 011627geo NAT: G.GPE.B.6 TOP: Directed Line Segments

374 ANS: 
$l: y = 3x - 4$
$m: y = 3x - 8$

PTS: 2 REF: 011631geo NAT: G.SRT.A.1 TOP: Line Dilations
As the sum of the measures of the angles of a triangle is 180°, \( m\angle ABC + m\angle BCA + m\angle CAB = 180° \). Each interior angle of the triangle and its exterior angle form a linear pair. Linear pairs are supplementary, so \( m\angle ABC + m\angle FBC = 180° \), \( m\angle BCA + m\angle DCA = 180° \), and \( m\angle CAB + m\angle EAB = 180° \). By addition, the sum of these linear pairs is 540°. When the angle measures of the triangle are subtracted from this sum, the result is 360°, the sum of the exterior angles of the triangle.

\[
\frac{7}{12} \cdot 30 = 17.5
\]

\[
\frac{9}{5} = \frac{9.2}{x}
\]

\[
5.1 + 9.2 = 14.3
\]

\[
9x = 46
\]

\[
x \approx 5.1
\]

\[
\frac{x}{10} = \frac{6}{4}
\]

\[
\overline{CD} = 15 - 4 = 11
\]

\[
x = 15
\]
380 ANS: 4
\[
\frac{1}{2} = \frac{x + 3}{3x - 1} \quad GR = 3(7) - 1 = 20
\]
\[3x - 1 = 2x + 6\]
\[x = 7\]

PTS: 2 REF: 011620geo NAT: G.SRT.B.5 TOP: Similarity
KEY: basic

381 ANS:
\[
\frac{\pi \cdot 11.25^2 \cdot 33.5}{231} \approx 57.7
\]

PTS: 4 REF: 061632geo NAT: G.GMD.A.3 TOP: Volume
KEY: cylinders

382 ANS: 1
\[
m_{RT} = \frac{5 - 3}{4 - 2} = \frac{8}{6} = \frac{4}{3} \quad m_{ST} = \frac{5 - 2}{4 - 8} = \frac{3}{-4} = -\frac{3}{4}
\]
Slopes are opposite reciprocals, so lines form a right angle.

PTS: 2 REF: 011618geo NAT: G.GPE.B.4 TOP: Triangles in the Coordinate Plane

383 ANS:

Since the square is inscribed, each vertex of the square is on the circle and the diagonals of the square are diameters of the circle. Therefore, each angle of the square is an inscribed angle in the circle that intercepts the circle at the endpoints of the diameters. Each angle of the square, which is an inscribed angle, measures 90 degrees. Therefore, the measure of the arc intercepted by two adjacent sides of the square is 180 degrees because it is twice the measure of its inscribed angle.

PTS: 4 REF: fall1412geo NAT: G.CO.D.13 TOP: Constructions
Since the midpoint of $AB$ is $(3,-2)$, the center must be either $(5,-2)$ or $(1,-2)$.

$$r = \sqrt{2^2 + 5^2} = \sqrt{29}$$

385 ANS: 2

$$\sqrt{3 \cdot 21} = \sqrt{63} = 3\sqrt{7}$$

386 ANS:

$$x = \sqrt{.55^2 -.25^2} \approx 0.49 \text{ No, } .49^2 = .25 < .9604 + .25 < 1.5$$

$$y = .9604$$

387 ANS: 4

$$\sqrt{(32-8)^2 + (28-4)^2} = \sqrt{576 + 1024} = \sqrt{1600} = 40$$

388 ANS: 4

The slope of $BC$ is $\frac{2}{5}$. Altitude is perpendicular, so its slope is $-\frac{5}{2}$.

389 ANS: 4

$$x^2 + 6x + 9 + y^2 - 4y + 4 = 23 + 9 + 4$$

$$(x + 3)^2 + (y - 2)^2 = 36$$

390 ANS: 4

PTS: 2

REF: 081506geo  NAT: G.SRT.A.2  TOP: Dilations
\[ \sin x = \frac{4.5}{11.75} \]
\[ x \approx 23 \]

PTS: 2  
REF: 061528geo  
NAT: G.SRT.C.8  
TOP: Using Trigonometry to Find an Angle

\[ 4 + \frac{4}{9}(22 - 4) + 2 + \frac{4}{9}(2 - 2) = (12, 2) \]

\[ 4 + \frac{4}{9}(18) + 2 + \frac{4}{9}(0) \]
\[ 4 + 8 = 2 + 0 \]
\[ 12 + 2 \]

PTS: 2  
REF: 061626geo  
NAT: G.GPE.B.6  
TOP: Directed Line Segments

ANS: 2  
PTS: 2  
REF: 081619geo  
NAT: G.C.B.5  
TOP: Sectors

ANS: 1
The man’s height, 69 inches, is opposite to the angle of elevation, and the shadow length, 102 inches, is adjacent to the angle of elevation. Therefore, tangent must be used to find the angle of elevation. 
\[ \tan x = \frac{69}{102} \]
\[ x \approx 34.1 \]

PTS: 2  
REF: fall1401geo  
NAT: G.SRT.C.8  
TOP: Using Trigonometry to Find an Angle

ANS: Yes. The sequence of transformations consists of a reflection and a translation, which are isometries which preserve distance and congruency.

PTS: 2  
REF: 011628geo  
NAT: G.CO.B.7  
TOP: Triangle Congruency

\[ V = \frac{1}{3} \pi \left( \frac{8.3}{2} \right)^2 (10.2) + \frac{1}{2} \cdot \frac{4}{3} \pi \left( \frac{8.3}{2} \right)^3 \approx 183.961 + 149.693 \approx 333.65 \text{ cm}^3 \]
\[ 333.65 \times 50 = 16682.7 \text{ cm}^3 \]
\[ 16682.7 \times 0.697 = 11627.8 \text{ g} \]
\[ 11.6278 \times 3.83 = 44.53 \]

PTS: 6  
REF: 081636geo  
NAT: G.MG.A.2  
TOP: Density
397 ANS:

The line \(3y = -2x + 8\) does not pass through the center of dilation, so the dilated line will be distinct from \(3y = -2x + 8\). Since a dilation preserves parallelism, the line \(3y = -2x + 8\) and its image \(2x + 3y = 5\) are parallel, with slopes of \(\frac{2}{3}\).

398 ANS: 1

\[ \frac{\pi}{4} = A \]
\[ \frac{13\pi}{8} = B \cdot 6.5 \]

399 ANS:

\[ s = \theta \cdot r \quad s = \theta \cdot r \quad \text{Yes, both angles are equal.} \]

\[ \frac{\pi}{4} = A \]
\[ \frac{13\pi}{8} = B \cdot 6.5 \]

400 ANS: 3

\[ \frac{60}{360} \cdot 6\pi = 6\pi \]

401 ANS: 4

PTS: 2  REF: 081518geo  NAT: G.C.B.5  TOP: Sectors

402 ANS: 3  PTS: 2  REF: 081613geo  NAT: G.GMD.B.4  TOP: Cross-Sections of Three-Dimensional Objects
\[\triangle XYZ, \overline{XY} \cong \overline{ZY}, \text{ and } \overline{YW} \text{ bisects } \angle XYZ \text{ (Given).} \]

\[\triangle XYZ \text{ is isosceles} \text{ (Definition of isosceles triangle).} \]

\[\overline{YW} \text{ is an altitude of } \triangle XYZ \text{ (The angle bisector of the vertex of an isosceles triangle is also the altitude of that triangle).} \]

\[\overline{YW} \perp \overline{XZ} \text{ (Definition of altitude).} \]

\[\angle YWZ \text{ is a right angle (Definition of perpendicular lines).} \]
ANS:
The slopes of perpendicular line are opposite reciprocals. Since the lines are perpendicular, they form right angles and a right triangle. 

\[ m_{BC} = -\frac{3}{2} \]

\[ -1 = \frac{2}{3} (-3) + b \quad \text{or} \quad -4 = \frac{2}{3} (-1) + b \]

\[ m_{\perp} = \frac{2}{3} \]

\[ -1 = -2 + b \]

\[ 1 = b \]

\[ -\frac{12}{3} = \frac{-2}{3} + b \]

\[ 3 = \frac{2}{3} x + 1 \]

\[ \frac{10}{3} = b \]

\[ 2 = \frac{2}{3} x \]

\[ 3 = \frac{2}{3} x - \frac{10}{3} \]

\[ 3 = x \quad 3 = 2x - 10 \]

\[ 9 = 2x \]

\[ 19 = 2x \]

\[ 9.5 = x \]

409 ANS: 2

\[ \frac{1.1}{1.2 \text{ oz}} \left( \frac{16 \text{ oz}}{1 \text{ lb}} \right) = \frac{13.31}{1 \text{ lb}} \left( \frac{1 \text{ g}}{3.7851} \right) \approx 3.5 \frac{\text{g}}{1 \text{ lb}} \]

410 ANS: 2

411 ANS:
Opposite angles in a parallelogram are congruent, so \( \angle O = 118^\circ \). The interior angles of a triangle equal 180°. 

\[ 180 - (118 + 22) = 40. \]
A dilation of $\frac{5}{2}$ about the origin. Dilations preserve angle measure, so the triangles are similar by AA.

$$\text{ANS:}$$

$$\tan x = \frac{12}{75}, \quad \tan y = \frac{72}{75}$$

$$43.83 - 9.09 \approx 34.7$$

$$x \approx 9.09, \quad y \approx 43.83$$

Parallelogram $ABCD$, $BE \perp CED$, $DF \perp BFC$, $CE \cong CF$ (given). $\angle BEC \cong \angle DFC$ (perpendicular lines form right angles, which are congruent). $\angle FCD \cong \angle BCE$ (reflexive property). $\triangle BEC \cong \triangle DFC$ (ASA). $BC \cong CD$ (CPCTC). $ABCD$ is a rhombus (a parallelogram with consecutive congruent sides is a rhombus).

$$\sqrt{(-1-2)^2 + (4-3)^2} = \sqrt{10}$$

Reflections are rigid motions that preserve distance.

$$\text{ANS:}$$

$$\text{ANS:}$$

$$\text{ANS:}$$

$$\text{ANS:}$$

$$m = \frac{-4}{-2} = 2$$

$$m_{\perp} = \frac{-1}{2}$$

$$\text{KEY:}$$ identify perpendicular lines
Geometry Regents at Random Worksheets
Answer Section

421 ANS: 1 PTS: 2 REF: 011918geo NAT: G.MG.A.3 TOP: Compositions of Polygons and Circles

422 ANS:
\[ \cos 68 = \frac{10}{x} \]

\[ x \approx 27 \]

PTS: 2 REF: 061927geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side

423 ANS: 3 PTS: 2 REF: 061924geo NAT: G.CO.C.11 TOP: Special Quadrilaterals

424 ANS: 1
\[ \cos 65 = \frac{x}{15} \]

\[ x \approx 6.3 \]

PTS: 2 REF: 081924geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side

425 ANS: 4
\[ x^2 + 8x + 16 + y^2 - 12y + 36 = 144 + 16 + 36 \]
\[ (x + 4)^2 + (y - 6)^2 = 196 \]

PTS: 2 REF: 061920geo NAT: G.GPE.A.1 TOP: Equations of Circles KEY: completing the square

426 ANS: 3
Broome: \( \frac{200536}{706.82} \approx 284 \) Dutchess: \( \frac{280150}{801.59} \approx 349 \) Niagara: \( \frac{219846}{522.95} \approx 420 \) Saratoga: \( \frac{200635}{811.84} \approx 247 \)

PTS: 2 REF: 061902geo NAT: G.MG.A.2 TOP: Density

427 ANS: 2

428 ANS:
\[3y + 7 = 2x \quad y - 6 = \frac{2}{3}(x - 2)\]
\[3y = 2x - 7\]
\[y = \frac{2}{3}x - \frac{7}{3}\]

PTS: 2 REF: 011925geo NAT: G.GPE.B.5 TOP: Parallel and Perpendicular Lines
KEY: write equation of parallel line

429 ANS: 1
\[\frac{9}{6} = \frac{3}{2}\]

PTS: 2 REF: 061905geo NAT: G.SRT.A.1 TOP: Line Dilations

430 ANS: 3 PTS: 2 REF: 061912geo NAT: G.CO.C.11 TOP: Parallelograms

431 ANS:
\[2 \times (90 \times 10) + (\pi)(30^2) - (\pi)(20^2) \approx 3371\]

PTS: 2 REF: 011931geo NAT: G.MG.A.3 TOP: Compositions of Polygons and Circles
KEY: area

432 ANS: 2


433 ANS: 2
\[90 - 57 = 33\]

PTS: 2 REF: 061909geo NAT: G.SRT.C.7 TOP: Cofunctions

434 ANS:
Quadrilateral \(MATH, \overline{HM} \cong \overline{AT}, \overline{HT} \cong \overline{AM}, \overline{HE} \perp \overline{MEA},\) and \(\overline{HA} \perp \overline{AT}\) (given); \(\angle HEA \cong \angle TAH\) are right angles (perpendicular lines form right angles); \(\angle HEA \cong \angle TAH\) (all right angles are congruent); \(MATH\) is a parallelogram (a quadrilateral with two pairs of congruent opposite sides is a parallelogram); \(\overrightarrow{MA} \parallel \overrightarrow{TH}\) (opposite sides of a parallelogram are parallel); \(\angle THA \cong \angle EAH\) (alternate interior angles of parallel lines and a transversal are congruent); \(\triangle HEA \sim \triangle TAH\) (AA); \(\frac{HA}{TH} = \frac{HE}{TA}\) (corresponding sides of similar triangles are in proportion); \(TA \cdot HA = HE \cdot TH\) (product of means equals product of extremes).

PTS: 6 REF: 061935geo NAT: G.SRT.B.5 TOP: Quadrilateral Proofs
435 ANS: 3
\[-9 + \frac{1}{3}(9 - 9) = -9 + \frac{1}{3}(18) = -9 + 6 = -3 \quad 8 + \frac{1}{3}(-4 - 8) = 8 + \frac{1}{3}(-12) = 8 - 4 = 4\]

PTS: 2 REF: 081903geo NAT: G.GPE.B.6 TOP: Directed Line Segments

436 ANS:
Theresa. \((30 \times 15 \times (4 - 0.5)) \text{ ft}^3 \times \frac{7.48 \text{ g}}{1 \text{ ft}^3} \times \frac{\$3.95}{100 \text{ g}} = \$465.35\), \((\pi \times 12^2 \times (4 - 0.5)) \text{ ft}^3 \times \frac{7.48 \text{ g}}{1 \text{ ft}^3} \times \frac{\$200}{6000 \text{ g}} = \$394.79\)

PTS: 4 REF: 011933geo NAT: G.GMD.A.3 TOP: Volume

KEY: cylinders

437 ANS:
\[
\begin{align*}
\angle D &= 46^\circ \text{ because the angles of a triangle equal } 180^\circ. \\
\angle B &= 46^\circ \text{ because opposite angles of a parallelogram are congruent.}
\end{align*}
\]

PTS: 2 REF: 061931geo NAT: G.CO.D.13 TOP: Constructions

438 ANS:
\[2(x + 8) = 7x - 2 \quad AB = 7(6) - 2 = 40. \text{ Since } \overline{EF} \text{ is a midsegment, } EF = \frac{40}{2} = 20. \text{ Since } \triangle ABC \text{ is equilateral,}
\]
\[4x + 16 = 7x - 2 \]
\[18 = 3x \]
\[6 = x \]
\[AE = BF = \frac{40}{2} = 20. \quad 40 + 20 + 20 + 20 = 100\]


439 ANS: 3
\[
\sin^{-1}\left(\frac{5}{25}\right) \approx 11.5
\]

PTS: 2 REF: 081926geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find an Angle

440 ANS: 1 PTS: 2 REF: 081904geo NAT: G.CO.C.10 TOP: Centroid, Orthocenter, Incenter and Circumcenter
442 ANS: 1
\[-1 + \frac{1}{3} (8 - 1) = -1 + \frac{1}{3} (9) = -1 + 3 = 2 \quad -3 + \frac{1}{3} (9 - 3) = -3 + \frac{1}{3} (12) = -3 + 4 = 1\]

PTS: 2 REF: 011915geo NAT: G.GPE.B.6 TOP: Directed Line Segments

\[\frac{124 - 56}{2} = 34\]

PTS: 2 REF: 081930geo NAT: G.C.A.2 TOP: Chords, Secants and Tangents

KEY: secant and tangent drawn from common point, angle

444 ANS: 2
\[\sqrt{8^2 + 6^2} = 10 \text{ for one side}\]

PTS: 2 REF: 011907geo NAT: G.CO.C.11 TOP: Special Quadrilaterals

445 ANS: 3

\[
\begin{array}{c}
\text{A} \\
\text{B} \\
\text{C} \\
\text{D}
\end{array}
\]

PTS: 2 REF: 081905geo NAT: G.CO.C.10 TOP: Exterior Angle Theorem

446 ANS: 4
\[2x - 1 = 16\]
\[x = 8.5\]


KEY: graphics

447 ANS: 2
\[\frac{x}{15} = \frac{5}{12}\]
\[x = 6.25\]

PTS: 2 REF: 011906geo NAT: G.SRT.B.5 TOP: Side Splitter Theorem


KEY: intersecting chords, length

449 ANS: 2
\[8 \times 8 \times 9 + \frac{1}{3} (8 \times 8 \times 3) = 640\]

PTS: 2 REF: 011909geo NAT: G.GMD.A.3 TOP: Volume

KEY: compositions
\[ \tan 11.87 = \frac{x}{0.5(5280)} \]
\[ x \approx 555 \]

\[ \sqrt{40^2 - \left( \frac{64}{2} \right)^2} = 24 \quad V = \frac{1}{3} (64)^2 \cdot 24 = 32768 \]

\[ \frac{72}{360} (\pi) \left( 10^2 \right) = 20\pi \]

No, because dilations do not preserve distance.

\[ \tan 36 = \frac{x}{8} \quad 5.8 + 1.5 \approx 7 \]
\[ x \approx 5.8 \]

\[ \left( 10 \times 6 \right) + \sqrt{7(7-6)(7-4)(7-4)} \right) (6.5) \approx 442 \]

The slope of \(-3x + 4y = 8\) is \(\frac{3}{4}\).
\[ \triangle ABE \cong \triangle CBD \text{ (given)}; \angle A \cong \angle C \text{ (CPCTC)}; \angle AFD \cong \angle CFE \text{ (vertical angles are congruent)}; \overline{AB} \cong \overline{CB}, \overline{DB} \cong \overline{EB} \text{ (CPCTC)}; \overline{AD} \cong \overline{CE} \text{ (segment subtraction)}; \triangle AFD \cong \triangle CFE \text{ (AAS)} \]

\[ \sin x = \frac{10}{12} \approx 0.833 \]

\[ x \approx 56 \]

\[ ER = \sqrt{17^2 - 8^2} = 15 \]

\[ \frac{10}{x} = \frac{15}{12} \]

\[ x = 8 \]

\[ -8 + \frac{2}{3}(10 - 8) = -8 + \frac{2}{3}(18) = -8 + 12 = 4 \]
\[ 4 + \frac{2}{3}(-2 - 4) = 4 + \frac{2}{3}(-6) = 4 - 4 = 0 \]

\[ V = \frac{2}{3} \pi \left( \frac{6.5}{2} \right)^2 (1) \approx 22 \cdot 7.48 \approx 165 \]

\[ \left( \frac{360 - 120}{360} \right)(\pi)(9^2) = 54\pi \]

\[ \text{PTS: 4} \quad \text{REF: 081933geo} \quad \text{NAT: G.SRT.B.5} \quad \text{TOP: Triangle Proofs} \]

\[ \text{PTS: 4} \quad \text{REF: 061922geo} \quad \text{NAT: G.SRT.C.8} \quad \text{TOP: Using Trigonometry to Find an Angle} \]

\[ \text{PTS: 2} \quad \text{REF: 061917geo} \quad \text{NAT: G.CO.C.11} \quad \text{TOP: Special Quadrilaterals} \]

\[ \text{PTS: 2} \quad \text{REF: 081917geo} \quad \text{NAT: G.SRT.B.5} \quad \text{TOP: Similarity} \]

\[ \text{PTS: 2} \quad \text{REF: 061919geo} \quad \text{NAT: G.GPE.B.6} \quad \text{TOP: Directed Line Segments} \]

\[ \text{PTS: 4} \quad \text{REF: 061933geo} \quad \text{NAT: G.GMD.A.3} \quad \text{TOP: Volume} \]

\[ \text{PTS: 2} \quad \text{REF: 081912geo} \quad \text{NAT: G.C.B.5} \quad \text{TOP: Sectors} \]
\[ m_{\overline{AD}} = \frac{0 - 6}{1 - (-1)} = -3 \quad \overline{AD} \parallel \overline{BC} \text{ because their slopes are equal.} \quad ABCD \text{ is a trapezoid} \]

\[ m_{\overline{BC}} = \frac{-1 - 8}{6 - 3} = -3 \]

because it has a pair of parallel sides. \( AC = \sqrt{(-1 - 6)^2 + (6 - 1)^2} = \sqrt{98} \quad ABCD \text{ is not an isosceles trapezoid} \]

\[ BD = \sqrt{(8 - 0)^2 + (3 - 1)^2} = \sqrt{68} \]

because its diagonals are not congruent.

\[ M_x = \frac{-5 + 1}{2} = \frac{6}{2} = 3 \quad M_y = \frac{5 + 1}{2} = \frac{4}{2} = 2. \]

\[ h = \sqrt{6.5^2 - 2.5^2} = 6, \quad V = \frac{1}{3} \pi (2.5)^2 6 = 12.5\pi \]

\[ h = \sqrt{6.5^2 - 2.5^2} = 6, \quad V = \frac{1}{3} \pi (2.5)^2 6 = 12.5\pi \]
Triangle with vertices $A(-2,4), B(6,2)$, and $C(1,-1)$ (given); $m_{AC} = \frac{5}{3}, m_{BC} = \frac{3}{5}$, definition of slope; Because the slopes of the legs of the triangle are opposite reciprocals, the legs are perpendicular (definition of perpendicular); $\angle C$ is a right angle (definition of right angle); $\triangle ABC$ is a right triangle (if a triangle has a right angle, it is a right triangle); $AC \simeq BC = \sqrt{34}$ (distance formula); $\triangle ABC$ is an isosceles triangle (an isosceles triangle has two congruent sides).

**PTS: 4**  
**REF:** 011932geo  
**NAT:** G.GPE.B.4  
**TOP:** Triangles in the Coordinate Plane

**ANS:** 2

$m = \frac{-2}{3} = \frac{2}{3}$

**PTS: 2**  
**REF:** 061916geo  
**NAT:** G.GPE.B.5  
**TOP:** Parallel and Perpendicular Lines

**KEY:** write equation of parallel line

**ANS:** 4  
**PTS: 2**  
**REF:** 081911geo  
**NAT:** G.GMD.B.4  
**TOP:** Rotations of Two-Dimensional Objects

**ANS:** 1

A dilation by a scale factor of 4 centered at the origin preserves parallelism and $(0,-2) \rightarrow (0,-8)$.

**PTS: 2**  
**REF:** 081910geo  
**NAT:** G.SRT.A.1  
**TOP:** Line Dilations

**ANS:** 3  
**PTS: 2**  
**REF:** 011903geo  
**NAT:** G.CO.A.5  
**TOP:** Compositions of Transformations

**KEY:** identify

**ANS:** 2

$x = 120$

**PTS: 2**  
**REF:** 011914geo  
**NAT:** G.C.B.5  
**TOP:** Sectors

**ANS:**

$\frac{121-x}{2} = 35$

$121 - x = 70$

$x = 51$

**PTS: 2**  
**REF:** 011927geo  
**NAT:** G.C.A.2  
**TOP:** Chords, Secants and Tangents

**KEY:** secants drawn from common point, angle
475 ANS: 3

\( \angle N \) is the smallest angle in \( \triangle NYA \), so side \( \overline{AY} \) is the shortest side of \( \triangle NYA \). \( \angle VYA \) is the smallest angle in \( \triangle VYA \), so side \( \overline{VA} \) is the shortest side of both triangles.

PTS: 2 REF: 011919geo NAT: G.CO.C.10 TOP: Angle Side Relationship

476 ANS:

\[
\sin 4.76 = \frac{1.5}{x} \quad \tan 4.76 = \frac{1.5}{x} \quad 18 - \frac{16}{12} \approx 16.7
\]

\[x \approx 18.1 \quad x \approx 18\]

PTS: 4 REF: 011934geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side

477 ANS: 4 PTS: 2 REF: 011921geo NAT: G.GPE.B.4

TOP: Triangles in the Coordinate Plane

478 ANS: 3

\[8 \cdot 15 = 16 \cdot 7.5\]

PTS: 2 REF: 061913geo NAT: G.C.A.2 TOP: Chords, Secants and Tangents

KEY: intersecting chords, length

479 ANS:

Yes, because a dilation preserves angle measure.

PTS: 4 REF: 081932geo NAT: G.CO.D.12 TOP: Constructions

KEY: congruent and similar figures

480 ANS: 3

\[12^2 = 9 \cdot GM \quad IM^2 = 16 \cdot 25\]

\[GM = 16 \quad IM = 20\]

PTS: 2 REF: 011910geo NAT: G.SRT.B.5 TOP: Similarity

KEY: leg

481 ANS:

\[\frac{1}{2} (5)(12) = 30\]

PTS: 2 REF: 081928geo NAT: G.GPE.B.7 TOP: Polygons in the Coordinate Plane
482 ANS: 
\[
\left( \frac{2.5}{3} \right)^2 \left( \frac{8.25}{2} \right)^2 \approx 134
\]

PTS: 2 REF: 081931geo NAT: G.GMD.A.3 TOP: Volume
KEY: cylinders

483 ANS: 2 PTS: 2 REF: 011912geo NAT: G.CO.C.11
TOP: Parallelograms

484 ANS: 4
d) is SSA

PTS: 2 REF: 061914geo NAT: G.CO.B.7 TOP: Triangle Congruency

485 ANS: 1 PTS: 2 REF: 081919geo NAT: G.SRT.C.7
TOP: Cofunctions

486 ANS: 2
\[
\frac{4}{3} \pi \times \left( \frac{1.68}{2} \right)^3 \times 0.6523 \approx 1.62
\]

PTS: 2 REF: 081914geo NAT: G.MG.A.2 TOP: Density

487 ANS: 1 \[\triangle ABC \sim \triangle RST\]

PTS: 2 REF: 011908geo NAT: G.SRT.B.5 TOP: Similarity
KEY: basic

488 ANS:
\[R_{90^\circ} \text{ or } T_{2,-6} \circ R_{(4,2),90^\circ} \text{ or } R_{270^\circ} \circ r_{x-axis} \circ r_{y-axis}\]

PTS: 2 REF: 061929geo NAT: G.CO.A.5 TOP: Compositions of Transformations
KEY: identify

489 ANS: 4 PTS: 2 REF: 061904geo NAT: G.CO.A.3
TOP: Mapping a Polygon onto Itself

490 ANS:

PTS: 2 REF: 011929geo NAT: G.CO.D.12 TOP: Constructions
KEY: equilateral triangles

491 ANS: 2 PTS: 2 REF: 081909geo NAT: G.CO.A.5
TOP: Compositions of Transformations KEY: identify
The line $y = \frac{3}{2}x - 4$ does not pass through the center of dilation, so the dilated line will be distinct from $y = \frac{3}{2}x - 4$. Since a dilation preserves parallelism, the line $y = \frac{3}{2}x - 4$ and its image will be parallel, with slopes of $\frac{3}{2}$. To obtain the $y$-intercept of the dilated line, the scale factor of the dilation, $\frac{3}{4}$, can be applied to the $y$-intercept, $(0, -4)$. Therefore, $\left(0, \frac{3}{4} \cdot -4 + \frac{3}{4}\right) \rightarrow (0, -3)$. So the equation of the dilated line is $y = \frac{3}{2}x - 3$.

\[
(x - 1)^2 + (y - 4)^2 = \left(\frac{10}{2}\right)^2
\]
\[
x^2 - 2x + 1 + y^2 - 8y + 16 = 25
\]
\[
x^2 - 2x + y^2 - 8y = 8
\]

\[
\left(\frac{x}{4.5}\right)^3 \approx 523.7
\]

\[
\left(\frac{x - 4}{6}\right)^2 + \left(\frac{y + 3}{6}\right)^2 = 64
\]
497 ANS:
\[17x = 15^2\]
\[17x = 225\]
\[x \approx 13.2\]

PTS: 2
REF: 061930geo
NAT: G.SRT.B.5
TOP: Similarity
KEY: leg

498 ANS: 4
PTS: 2
REF: 081923geo
NAT: G.CO.A.3
TOP: Mapping a Polygon onto Itself

499 ANS:
\[r_x = 2 \circ r_y\]

PTS: 2
REF: 081927geo
NAT: G.CO.A.5
TOP: Compositions of Transformations
KEY: identify

500 ANS: 4
\[(8 \times 2) + (3 \times 2) - \left(\frac{18}{12} \times \frac{21}{12}\right) \approx 19\]

PTS: 2
REF: 081917geo
NAT: G.MG.A.3
TOP: Compositions of Polygons and Circles
KEY: area

501 ANS: 1
PTS: 2
REF: 011922geo
NAT: G.SRT.C.7
TOP: Cofunctions

502 ANS:
No. The midpoint of \(\overline{DF}\) is \(\left(\frac{1+4}{2}, \frac{-1+2}{2}\right) = (2.5,0.5)\). A median from point \(E\) must pass through the midpoint.

PTS: 2
REF: 011930geo
NAT: G.GPE.B.4
TOP: Triangles in the Coordinate Plane

503 ANS: 2
\[\frac{4}{x} = \frac{6}{9}\]
\[x = 6\]

PTS: 2
REF: 061915geo
NAT: G.SRT.B.5
TOP: Similarity
KEY: basic

504 ANS:
\[\tan 30 = \frac{y}{440}\]
\[\tan 38.8 = \frac{h}{440}\]
\[353.8 - 254 \approx 100\]

\[y \approx 254\]
\[h \approx 353.8\]

PTS: 4
REF: 061934geo
NAT: G.SRT.C.8
TOP: Using Trigonometry to Find a Side
KEY: advanced

505 ANS: 3
PTS: 2
REF: 011911geo
NAT: G.GMD.B.4
TOP: Rotations of Two-Dimensional Objects
\[ m = \frac{-A}{B} = \frac{-3}{2} \quad \text{or} \quad m_{\perp} = \frac{2}{3} \]

506 ANS: 1

PTS: 2  
REF: 081908geo  NAT: G.GPE.B.5  TOP: Parallel and Perpendicular Lines  
KEY: identify perpendicular lines

507 ANS: 4

PTS: 2  
REF: 061908geo  NAT: G.SRT.B.5  TOP: Triangle Proofs  
KEY: statements

508 ANS:

\[ 20^\circ \]

PTS: 2  
REF: 011926geo  NAT: G.CO.C.11  TOP: Interior and Exterior Angles of Polygons

509 ANS: 1

\[ 5x = 12 \cdot 7 \quad 16.8 + 7 = 23.8 \]

\[ 5x = 84 \]

\[ x = 16.8 \]

PTS: 2  
REF: 061911geo  NAT: G.SRT.B.5  TOP: Side Splitter Theorem

510 ANS: 1

PTS: 2  
REF: 081916geo  NAT: G.SRT.B.5  TOP: Similarity  
KEY: leg

511 ANS:

30° \( \triangle CAD \) is an equilateral triangle, so \( \angle CAB = 60^\circ \). Since \( \overrightarrow{AD} \) is an angle bisector, \( \angle CAB = 30^\circ \).

PTS: 2  
REF: 081929geo  NAT: G.CO.D.12  TOP: Constructions  
KEY: equilateral triangles

512 ANS: 2

PTS: 2  
REF: 081901geo  NAT: G.SRT.A.1  TOP: Line Dilations
ANS:

Quadrilateral $ABCD$ with diagonal $\overline{AC}$, segments $GH$, $AE \cong CG$, $BE \cong DG$, $AH \cong CF$, and $AD \cong CB$ (given); $HF \cong HF$, $AC \cong AC$ (reflexive property); $AH + HF \cong CF + HF$, $AE + BE \cong CG + DG$ (segment addition); $\triangle ABC \cong \triangle CDA$ (SSS); $\angle EAF \cong \angle GCH$ (CPCTC); $\triangle AEF \cong \triangle CGH$ (SAS); $EF \cong GH$ (CPCTC).

PTS: 6  REF: 011935geo  NAT: G.SRT.B.5  TOP: Quadrilateral Proofs

TOP: Compositions of Transformations  KEY: identify  

ANS: 2

$V = \frac{1}{3} (8)^2 \cdot 6 = 128$

PTS: 2  REF: 061906geo  NAT: G.GMD.A.3  TOP: Volume  KEY: pyramids

ANS:

$R_{(-5.2),90^\circ} \circ T_{-3.1} \circ r_{x-axis}$

PTS: 2  REF: 011928geo  NAT: G.CO.A.5  TOP: Compositions of Transformations  KEY: identify

ANS: 2

$18^2 = 12(x + 12)$

$324 = 12(x + 12)$$

$27 = x + 12$$

$x = 15$

PTS: 2  REF: 081920geo  NAT: G.SRT.B.5  TOP: Similarity  KEY: leg

ANS: 2  PTS: 2  REF: 061903geo  NAT: G.GMD.B.4  TOP: Rotations of Two-Dimensional Objects

ANS: 1

$\frac{72 - 34}{2} = 19$

PTS: 2  REF: 061918geo  NAT: G.C.A.2  TOP: Chords, Secants and Tangents  KEY: secants drawn from common point, angle
ANS: \[ AB = \sqrt{(-5 - 1)^2 + (3 - 2)^2} = \sqrt{37}, \quad BC = \sqrt{(-5 - 6)^2 + (3 - 3)^2} = \sqrt{37} \] (because \( AB = BC \), \( \triangle ABC \) is isosceles). \( AD = \sqrt{(1 - 0)^2 + (2 - 4)^2} = \sqrt{37}, \quad CD = \sqrt{(-6 - 0)^2 + (-3 - 4)^2} = \sqrt{37} \), \[
m_{AB} = \frac{3 - 2}{-5 - 1} = -\frac{1}{6}, \quad m_{CD} = \frac{3 - 3}{-5 - 6} = 6\]

(\( ABCD \) is a square because all four sides are congruent, consecutive sides are perpendicular since slopes are opposite reciprocals and so \( \angle B \) is a right angle).

ANS: 3

PTS: 2

REF: 081913geo

NAT: G.CO.C.11

TOP: Special Quadrilaterals

ANS: 3

PTS: 2

REF: 011904geo

NAT: G.CO.A.3

TOP: Mapping a Polygon onto Itself

ANS: 4

\[ \tan A = \frac{\text{opposite}}{\text{adjacent}} = \frac{15}{8} \]

PTS: 2

REF: 011917geo

NAT: G.SRT.C.8

TOP: Using Trigonometry to Find an Angle

ANS:

\[ \frac{1}{2}(5)(10) = 25 \]

PTS: 2

REF: 061926geo

NAT: G.GPE.B.7

TOP: Polygons in the Coordinate Plane