Geometry Regents at Random Worksheets

1. In the diagram of ΔRST below, m∠T = 90°, RS = 65, and ST = 60.

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

2. Given: Parallelogram ABCD with diagonal AC drawn

   Prove: ΔABC ≅ ΔCDA

3. 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

4. In the diagram below of circle O, chord CD is parallel to diameter AOB and mCD = 130.

   What is mAC?
   1) 25
   2) 50
   3) 65
   4) 115

5. In the diagram below, ∠GRS ≅ ∠ART, GR = 36, SR = 45, AR = 15, and RT = 18.

   Which triangle similarity statement is correct?
   1) ΔGRS ~ ΔART by AA.
   2) ΔGRS ~ ΔART by SAS.
   3) ΔGRS ~ ΔART by SSS.
   4) ΔGRS is not similar to ΔART.
6. 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 $NM = 10$

7. 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

8. In the diagram below, $m\angle ABC = 268^\circ$.

What is the number of degrees in the measure of $\angle ABC$?
1) 134°
2) 92°
3) 68°
4) 46°

9. 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) $\frac{AB}{AC}$
10. 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 $M'N'$, the image of $MN$?
1) $y = -3x + 12$
2) $y = -3x + 6$
3) $y = -6x + 12$
4) $y = -6x + 6$

11. 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.

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

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

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

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

14. A circle whose center is the origin passes through the point $(-5,12)$. Which point also lies on this circle?
1) $(10,3)$
2) $(-12,13)$
3) $(11,2\sqrt{12})$
4) $(-8,5\sqrt{21})$

15. 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
16. 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

17. 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) $y + 8 = -\frac{2}{3}(x + 6)$

18. 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

19. Directed line segment $DE$ has endpoints $D(−4,−2)$ and $E(1,8)$. Point $F$ divides $\overline{DE}$ such that $DF:FE$ is 2:3. What are the coordinates of $F$?  
1) $(-3.0)$  
2) $(-2.2)$  
3) $(-1.4)$  
4) $(2.4)$

20. In the diagram below, $\overline{AD}$ intersects $\overline{BE}$ at $C$, and $AB \parallel DE$. If $CD = 6.6 \text{ cm}$, $DE = 3.4 \text{ cm}$, $CE = 4.2 \text{ cm}$, and $BC = 5.25 \text{ cm}$, what is the length of $\overline{AC}$, to the nearest hundredth of a centimeter?  
1) 2.70  
2) 3.34  
3) 5.28  
4) 8.25

21. 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
22 In triangle $SRK$ below, medians $\overline{SC}$, $\overline{KE}$, and $\overline{RL}$ intersect at $M$.

Which statement must always be true?

1) $3(MC) = SC$
2) $MC = \frac{1}{3}(SM)$
3) $RM = 2MC$
4) $SM = KM$

23 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) $\frac{160\pi}{3}$

24 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.

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

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) $\overline{AN} \parallel \overline{SC}$

26 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
27  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 $A'B'C'D'$.

28  In the diagram below of $\Delta ABC$, $D$, $E$, and $F$ are the midpoints of $AB$, $BC$, and $CA$, respectively.

What is the ratio of the area of $\Delta CFE$ to the area of $\Delta CAB$?
1) 1:1  
2) 1:2  
3) 1:3  
4) 1:4

29  In the diagram below of right triangle $AED$, $BC \parallel DE$.

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) $\frac{DE}{BC} = \frac{DB}{AB}$

30  Triangle $QRS$ is graphed on the set of axes below.

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

32 A man was parasailing above a lake at an angle of elevation of $32^\circ$ from a boat, as modeled in the diagram below.

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

33 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

34 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 $CD$.

35 Determine and state the coordinates of the center and the length of the radius of a circle whose equation is $x^2 + y^2 - 6x = 56 - 8y$.
36 In quadrilateral $ABCD$, $AB \cong CD$, $AB \parallel CD$, and $BF$ and $DE$ are perpendicular to diagonal $AC$ at points $F$ and $E$.

Prove: $AE \cong CF$

37 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

38 Given: $RS$ and $TV$ bisect each other at point $X$

$TR$ and $SV$ are drawn

Prove: $TR \parallel SV$

39 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.

40 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.

41 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.
42 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

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

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 \( C'(3,0) \)

44 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) \( m\angle ACB \cong \frac{1}{2} m\angle DAB \)

45 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) \( y + 9 = \frac{2}{3} (x + 6) \)
46 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) $m\overarc{BC} = m\angle BMC$
4) $m\overarc{AB} = \frac{1}{2} m\angle ACB$

47 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 $M'A'T'H'$.

48 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

49 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 $y = 70$
50 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.]

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

52 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

53 In the accompanying diagram of right triangle $ABC$, altitude $BD$ is drawn to hypotenuse $AC$.

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) $\frac{AB}{BC} = \frac{BD}{AC}$

54 Which transformation would not carry a square onto itself?
1) a reflection over one of its diagonals
2) a $90^\circ$ rotation clockwise about its center
3) a $180^\circ$ rotation about one of its vertices
4) a reflection over the perpendicular bisector of one side
55 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

56 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

57 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) \( 4\sqrt{40} \)

58 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/cm\(^3\). If the machinist makes 500 of these parts, what is the cost of the steel, to the nearest dollar?

59 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

60 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.
61 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 ft$^3$=7.48 gallons]

62 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.]

63 In the diagram below, $AB \parallel DFC$, $EDA \parallel CBG$, and $EFB$ and $AG$ 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) $\triangle DEF \sim \triangle AEB$
64 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 $\triangle ABC$ and $\triangle DEF$ on the set of axes below. Determine and state the single transformation where $\triangle DEF$ is the image of $\triangle ABC$. Use your transformation to explain why $\triangle ABC \cong \triangle DEF$.

65 In the diagram below, $\overline{AEFB} \parallel \overline{CGD}$, and $\overline{GE}$ and $\overline{GF}$ are drawn.

If $m\angle EFG = 32^\circ$ and $m\angle AEG = 137^\circ$, what is $m\angle EGF$?
1) $11^\circ$
2) $43^\circ$
3) $75^\circ$
4) $105^\circ$

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 Using a compass and straightedge, construct the line of reflection over which triangle $RST$ reflects onto triangle $R'S'T'$. [Leave all construction marks.]
68 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 \textit{not} an equilateral triangle. [The use of the set of axes below is optional.]

69 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

70 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) \(4x + 3y = 9\)

71 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/cm³, 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?

72 Triangle \(ABC\) and triangle \(ADE\) are graphed on the set of axes below. Describe a transformation that maps triangle \(ABC\) onto triangle \(ADE\). Explain why this transformation makes triangle \(ADE\) similar to triangle \(ABC\).
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.]

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

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.

A regular decagon is rotated $n$ degrees about its center, carrying the decagon onto itself. The value of $n$ could be
1) $10^\circ$
2) $150^\circ$
3) $225^\circ$
4) $252^\circ$
Geometry Regents Exam Questions at Random Worksheet # 17

78 In the diagram shown below, $\overline{PA}$ 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 $\overline{PA}$?

1) $3\sqrt{5}$
2) $3\sqrt{6}$
3) 3
4) 9

79 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.]

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

If $\angle A = 82^\circ$, $\angle B = 104^\circ$, and $\angle L = 121^\circ$, the measure of $\angle M$ is

1) $53^\circ$
2) $82^\circ$
3) $104^\circ$
4) $121^\circ$

81 In the diagram below, $\overline{AB} || \overline{DEF}$, $\overline{AE}$ and $\overline{BD}$ intersect at $C$, $\angle B = 43^\circ$, and $\angle CEF = 152^\circ$.

Which statement is true?

1) $\angle D = 28^\circ$
2) $\angle A = 43^\circ$
3) $\angle ACD = 71^\circ$
4) $\angle BCE = 109^\circ$
82 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) $\angle HDS \cong \angle NDS$

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

84 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 $BC$?
1) 
2) 
3) 
4) 

85 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) $3\cdot\frac{3}{4}$
2) 5
3) 15
4) $24\cdot\frac{3}{4}$
86 The 2010 U.S. Census populations and population densities are shown in the table below.

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

87 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.]

88 After a counterclockwise rotation about point X, scalene triangle ABC maps onto ΔRST, as shown in the diagram below.

Which statement must be true?

1) ∠A ≅ ∠R
2) ∠A ≅ ∠S
3) CB ≅ TR
4) CA ≅ TS
89. Point \( Q \) is on \( MN \) 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) \((6,0)\)

90. 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 \( y = x \)

91. 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

92. 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 \( BD \).
93 What is an equation of the perpendicular bisector of the line segment shown in the diagram below?

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

94 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

95 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) \( 40\sqrt{13} \)

96 In the diagram below of \( \triangle PQR \), \( ST \) is drawn parallel to \( PR \), \( PS = 2 \), \( SQ = 5 \), and \( TR = 5 \).

What is the length of \( QR \)?
1) 7
2) \( 2 \)
3) \( 12 \frac{1}{2} \)
4) \( 17 \frac{1}{2} \)
97. 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.]

98. 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 $PQRS$.

99. 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 $(5,5)$

100. 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
101 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.

102 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 $BC = 8.7$

103 In the diagram below, $GI$ is parallel to $NT$, and $IN$ intersects $GT$ at $A$.

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

104 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

105 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
106 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) $\sin B$

107 In triangle $ABC$, points $D$ and $E$ are on sides $\overline{AB}$ and $\overline{BC}$, 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

108 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

109 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.

110 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) $(x,y) \rightarrow (x + 2,y + 3)$

111 In the diagram below of right triangle $ABC$, altitude $BD$ is drawn to hypotenuse $AC$.

If $BD = 4$, $AD = x - 6$, and $CD = x$, what is the length of $CD$?

1) 5
2) 2
3) 8
4) 11
112 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° about the origin followed by a translation
4) a counterclockwise rotation of 90° about the origin followed by a translation

113 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

114 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) $(3,-6)$

115 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

116 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.

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

\[ \text{C} \]
\[ \text{A} \]
\[ \text{D} \]
\[ \text{B} \]
118 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° 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

119 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.

120 Circle \( O \) is centered at the origin. In the diagram below, a quarter of circle \( O \) is graphed.

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

122 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
123 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

124 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°

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

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

126 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 = $ area of $\triangle DEF$
4) perimeter of $\triangle ABC = $ perimeter of $\triangle DEF$

127 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.
128 In the diagram below, $AF$, and $DB$ intersect at $C$, and $AD$ and $FBE$ 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

129 Triangle $ABC$ and triangle $DEF$ are drawn below.

If $AB \cong DE$, $AC \cong DF$, and $\angle A \cong \angle D$, write a sequence of transformations that maps triangle $ABC$ onto triangle $DEF$.

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

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

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

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

132 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]

133 In the diagram below, secants $RST$ and $RQP$, 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 $RQ$?

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

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

What is the length of $\overline{AE}$, to the nearest tenth?
1) 14.0
2) 5.1
3) 3.3
4) 4.0

136 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 ($M$).
137 In parallelogram $ABCD$ shown below, the bisectors of $\angle ABC$ and $\angle DCB$ meet at $E$, a point on $AD$.

If $m\angle A = 68^\circ$, determine and state $m\angle BEC$.

138 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.

139 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

140 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

141 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 $m\angle BAC = 50^\circ$, find $m\angle XAC$.

142 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.
143 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

144 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.

[The use of the set of axes below is optional.]

145 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.

146 Given: $\triangle ABC, \overline{AEC}, \overline{BDE}$ 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>$1 \triangle ABC, \overline{AEC}, \overline{BDE}$ with $\angle ABE \cong \angle CBE$, and $\angle ADE \cong \angle CDE$</td>
<td>$1$ Given</td>
</tr>
<tr>
<td>$2 \overline{BD} \cong \overline{BD}$</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>$6 \overline{AD} \cong \overline{CD}, \overline{AB} \cong \overline{CB}$</td>
<td>$6$</td>
</tr>
<tr>
<td>$7 \overline{BDE}$ is the perpendicular bisector of $\overline{AC}$</td>
<td>$7$</td>
</tr>
</tbody>
</table>
147 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 \( n \).

Which single transformation would carry Figure 1 onto Figure 3?
1) a dilation
2) a rotation
3) a reflection
4) a translation

148 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 \( = \sqrt{35} \)

149 In a right triangle, \( \sin(40 - x)^\circ = \cos(3x)^\circ \). What is the value of \( x \)?
1) 10
2) 15
3) 20
4) 25

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

What is \( m \angle BAC \)?
1) 20\(^\circ\)
2) 40\(^\circ\)
3) 60\(^\circ\)
4) 80\(^\circ\)

151 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
152 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

153 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.]

154 If $\sin(2x + 7)^\circ = \cos(4x - 7)^\circ$, what is the value of $x$? 
1) 7  
2) 15  
3) 21  
4) 30

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

156 Given the right triangle in the diagram below, what is the value of $x$, to the nearest foot?

157 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.
158 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) $(1,-6)$

159 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) $y = -2x + 3$

160 In $\triangle ABC$, $\overline{BD}$ is the perpendicular bisector of $\overline{AD}$. 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

161 In the diagram below of parallelogram $ROCK$, $m\angle C$ is $70^\circ$ and $m\angle ROS$ is $65^\circ$.

What is $m\angle KSO$?
1) $45^\circ$
2) $110^\circ$
3) $115^\circ$
4) $135^\circ$

162 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) $\frac{64\pi}{3}$
163 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

164 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.

165 In quadrilateral \( \text{BLUE} \) shown below, \( \overline{BE} \cong \overline{UL} \).

Which information would be sufficient to prove quadrilateral \( \text{BLUE} \) is a parallelogram?
1) \( \overline{BL} \parallel \overline{EU} \)
2) \( \overline{LU} \parallel \overline{BE} \)
3) \( \overline{BE} \cong \overline{BL} \)
4) \( \overline{LU} \cong \overline{EU} \)

166 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 \( \overline{FS} \) is 400 feet. The angle formed by path \( \overline{TF} \) and path \( \overline{FS} \) is 72°. The angle formed by path \( \overline{TC} \) and path \( \overline{CS} \) is 55°.

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

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

169 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 $AB$ 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 $AC$, to the nearest inch.

170 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

171 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

172 Given: Parallelogram $ABCD$, $BF \perp AFD$, and $DE \perp BEC$

Prove: $BEDF$ is a rectangle

173 Using a compass and straightedge, construct a regular hexagon inscribed in circle $O$. [Leave all construction marks.]
174 In the circle below, $\overline{AB}$ is a chord. Using a compass and straightedge, construct a diameter of the circle. [Leave all construction marks.]

175 In the diagram below of circle $O$, chord $\overline{DF}$ bisects chord $\overline{BC}$ at $E$.

If $BC = 12$ and $FE$ is 5 more than $DE$, then $FE$ is
1) 13
2) 9
3) 6
4) 4

176 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 $\overline{AB}$?
1) $32\pi$
2) $48\pi$
3) $96\pi$
4) $144\pi$

177 As shown in the diagram below, $\overline{ABC} \parallel \overline{EFG}$ and $\overline{BF} \cong \overline{EF}$.

If $\angle CBF = 42.5^\circ$, then $\angle EBF$ is
1) $42.5^\circ$
2) $68.75^\circ$
3) $95^\circ$
4) $137.5^\circ$
178 In regular hexagon $ABCDEF$ shown below, $AD$, $BE$, and $CF$ all intersect at $G$.

When $\triangle ABG$ is reflected over $BG$ and then rotated $180^\circ$ about point $G$, $\triangle ABG$ is mapped onto

1) $\triangle FEG$
2) $\triangle AFG$
3) $\triangle CBG$
4) $\triangle DEG$

179 In the diagram below of circle $O$, chords $AB$ and $CD$ intersect at $E$.

If $m\overset{\frown}{AC} = 72^\circ$ and $m\angle AEC = 58^\circ$, how many degrees are in $m\overset{\frown}{DB}$?

1) $108^\circ$
2) $65^\circ$
3) $44^\circ$
4) $14^\circ$

180 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) $(6,4,2,8)$

181 Line segment $RW$ has endpoints $R(-4,5)$ and $W(6,20)$. Point $P$ is on $\overline{RW}$ such that $RP:PW$ is $2:3$. What are the coordinates of point $P$?

1) $(2,9)$
2) $(0,11)$
3) $(2,14)$
4) $(10,2)$

182 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) $59^\circ$
2) $62^\circ$
3) $118^\circ$
4) $121^\circ$
183 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.

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.

184 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) $AC$ onto $DF$, and $BC$ onto $EF$
3) $\angle C$ onto $\angle F$, and $BC$ onto $EF$
4) point $A$ onto point $D$, and $AB$ onto $DE$

185 The diagram below shows circle $O$ with radii $\overline{OA}$ and $\overline{OB}$. The measure of angle $AOB$ is $120^\circ$, 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) $\frac{1}{3}(12\pi)$

186 The diagram shows rectangle $ABCD$, with diagonal $BD$.

What is the perimeter of rectangle $ABCD$, to the nearest tenth?
1) 28.4
2) 32.8
3) 48.0
4) 62.4
187 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

188 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) $y = \frac{2}{3}x + 10$

189 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)

190 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
191 Quadrilaterals BIKE and GOLF are graphed on the set of axes below.

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

192 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) \[y = -\frac{2}{3}x + 4\]

193 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

194 Sue believes that the two cylinders shown in the diagram below have equal volumes.

Is Sue correct? Explain why.

195 In the diagram below, \(DE\), \(DF\), and \(EF\) 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) \(AB + AC\)
196 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.

197 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

198 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) 40º
2) 50º
3) 60º
4) 70º

199 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.
200 The regular polygon below is rotated about its center.

Which angle of rotation will carry the figure onto itself?
1) 60°
2) 108°
3) 216°
4) 540°

201 In the diagram below, $XS$ and $YR$ intersect at $Z$. Segments $XY$ and $RS$ are drawn perpendicular to $YR$ to form triangles $XYZ$ and $SRZ$.

Which statement is always true?
1) $(XY)(SR) = (XZ)(RZ)$
2) $\triangle XYZ \cong \triangle SRZ$
3) $XS \cong YR$
4) $\frac{XY}{SR} = \frac{YZ}{RZ}$

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

203 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) $4\sqrt{10}$

204 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°
205 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

206 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?

207 The coordinates of the endpoints of \( \overline{AB} \) are \( A(2,3) \) and \( B(5,-1) \). Determine the length of \( \overline{A'B'} \), 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.]

208 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
209 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.

210 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

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

The measure of angle \( DFB \) is

1) 36°  
2) 54°  
3) 72°  
4) 82°

212 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.
213 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.]

214 Lou has a solid clay brick in the shape of a rectangular prism with a length of 8 inches, a width of 3.5 inches, and a height of 2.25 inches. If the clay weighs 1.055 oz/in\(^3\), how much does Lou's brick weigh, to the nearest ounce?

1) 66
2) 64
3) 63
4) 60

215 The area of a sector of a circle with a radius measuring 15 cm is \( 75\pi \) cm\(^2\). What is the measure of the central angle that forms the sector?

1) 72°
2) 120°
3) 144°
4) 180°

216 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

217 Kayla was cutting right triangles from wood to use for an art project. Two of the right triangles she cut are shown below.

If \( \triangle ABC \sim \triangle DEF \), with right angles \( B \) and \( E \), \( BC = 15 \) cm, and \( AC = 17 \) cm, what is the measure of \( \angle F \), to the nearest degree?

1) 28°
2) 41°
3) 62°
4) 88°
218 In \( \triangle XYZ \), shown below, medians \( \overline{XE}, \overline{YF}, \) and \( \overline{ZD} \) intersect at \( C \).

If \( CE = 5 \), \( YF = 21 \), and \( XZ = 15 \), determine and state the perimeter of triangle \( CFX \).

219 In the diagram below, \( \triangle ABC \) with sides 13, 15, and 16, is mapped onto \( \triangle DEF \) after a clockwise rotation of 90° about point \( P \).

If \( DE = 2x - 1 \), what is the value of \( x \)?
1) 7
2) 7.5
3) 8
4) 8.5

220 In the diagram below of circle \( K \), secant \( \overline{PLKE} \) and tangent \( \overline{PZ} \) are drawn from external point \( P \).

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

221 In the diagram below of right triangle \( ABC \), altitude \( \overline{CD} \) intersects hypotenuse \( \overline{AB} \) 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) \( \frac{AD}{AC} = \frac{AC}{BD} \)
222. 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) \(37.5\pi\)

223. 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) \(37.5^\circ\)

224. 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.

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

225. Diego needs to install a support beam to hold up his new birdhouse, as modeled below. The base of the birdhouse is \(24\frac{1}{2}\) inches long. The support beam will form an angle of \(38^\circ\) with the vertical post. Determine and state the approximate length of the support beam, \(x\), to the nearest inch.
226 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) \( y = \frac{3}{2}x - 3 \)

227 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.

228 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

229 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

230 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
231 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 pieces](image)

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

232 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)

233 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

234 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).

235 In quadrilateral $ABCD$ below, $AB \parallel CD$, and $E, H,$ and $F$ are the midpoints of $AD, AC,$ and $BC$, respectively.

![Quadrilateral](image)

If $AB = 24$, $CD = 18$, and $AH = 10$, then $FH$ is

1) 9  
2) 10  
3) 12  
4) 21
236 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: $EF \cong GH$

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

Which segment has the shortest length?
1) $AY$
2) $NY$
3) $VA$
4) $VY$

238 Determine and state an equation of the line perpendicular to the line $5x - 4y = 10$ and passing through the point $(5, 12)$.

239 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

240 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
241 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) \((-3,-2)\)

242 In right triangle \( ABC \) shown below, point \( D \) is on \( AB \) and point \( E \) is on \( CB \) such that \( AC \parallel DE \).

[Diagram of triangle with points labeled]

If \( AB = 15 \), \( BC = 12 \), and \( EC = 7 \), what is the length of \( BD \)?

1) 8.75
2) 6.25
3) 5
4) 4

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

244 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.

[Diagram of cargo 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?

245 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.
246 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) $\frac{AB}{RT} = \frac{RS}{AC}$
2) $\frac{BC}{ST} = \frac{AB}{RS}$
3) $\frac{BC}{ST} = \frac{AC}{RT}$
4) $\frac{AB}{AC} = \frac{RS}{RT}$

247 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.

248 A cone has a volume of $108\pi$ and a base diameter of 12. What is the height of the cone?

1) 27
2) 9
3) 3
4) 4

249 In quadrilateral $QRST$, diagonals $\overline{QS}$ and $\overline{RT}$ intersect at $M$. Which statement would always prove quadrilateral $QRST$ is a parallelogram?

1) $\angle TQR$ and $\angle QRS$ are supplementary.
2) $\overline{QM} \cong \overline{SM}$ and $\overline{QT} \cong \overline{RS}$
3) $\overline{QR} \cong \overline{TS}$ and $\overline{QT} \cong \overline{RS}$
4) $\overline{QR} \parallel \overline{TS}$ and $\overline{QT} \parallel \overline{RS}$

250 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

251 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
252 In the diagram of equilateral triangle $ABC$ shown below, $E$ and $F$ are the midpoints of $AC$ and $BC$, respectively.

If $EF = 2x + 8$ and $AB = 7x - 2$, what is the perimeter of trapezoid $ABFE$?

1) 36  
2) 60  
3) 100  
4) 120

253 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) $\tan A = \frac{15}{8}$

254 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) $\frac{(GC)(AB)}{2}$

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

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


256 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 \(-2\).

257 On the set of axes below, rhombus \(ABCD\) has vertices whose coordinates are \(A(1,2), B(4,6), C(7,2),\) and \(D(4,-2)\).

What is the area of rhombus \(ABCD\)?

1) 20

2) 24

3) 25

4) 48

258 The expression \(\sin 57^\circ\) is equal to

1) \(\tan 33^\circ\)

2) \(\cos 33^\circ\)

3) \(\tan 57^\circ\)

4) \(\cos 57^\circ\)

259 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

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

1) 19º

2) 38º

3) 53º

4) 106º

261 In the diagram below, \(\triangle ABE \cong \triangle CBD\).

Prove: \(\triangle AFD \cong \triangle CFE\)
262 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°. 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 

263 The coordinates of the endpoints of $QS$ are $Q(-9,8)$ and $S(9,-4)$. Point $R$ is on $QS$ 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) 

264 In $\triangle ABC$ below, angle $C$ is a right angle.

\[ \begin{array}{c}
A \\
\text{5} \\
\text{13} \\
C \\
\text{12} \\
\text{B}
\end{array} \]

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

265 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.

266 In the diagram below, right triangle $PQR$ is transformed by a sequence of rigid motions that maps it onto right triangle $NML$.

Write a set of three congruency statements that would show $ASA$ congruency for these triangles.
267 In the diagram below of circle \( O \), points \( K, A, T, I, \) and \( E \) are on the circle, \( \triangle KAE \) and \( \triangle ITE \) are drawn, \( KE \cong EI \), 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.

268 Which figure(s) below can have a triangle as a two-dimensional cross section?
I. cone
II. cylinder
III. cube
IV. square pyramid
1) I, only
2) IV, only
3) I, II, and IV, only
4) I, III, and IV, only

269 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

270 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) \( y + 3 = \frac{2}{3} (x + 1) \)

271 In the diagram below of \( \triangle ABC \), \( D \) is a point on \( BA \), \( E \) is a point on \( BC \), and \( \overline{DE} \) is drawn.

If \( BD = 5 \), \( DA = 12 \), and \( BE = 7 \), what is the length of \( \overline{BC} \) so that \( AC \parallel DE \)?
1) 23.8
2) 16.8
3) 15.6
4) 8.6

272 For the acute angles in a right triangle, \( \sin(4x) = \cos(3x + 13) \). What is the number of degrees in the measure of the smaller angle?
1) 11°
2) 13°
3) 44°
4) 52°
273 As shown in the diagram below, secants $PWR$ and $PTS$ are drawn to circle $O$ from external point $P$.

If $m \angle RPS = 35^\circ$ and $mRS = 121^\circ$, determine and state $mWT$.

274 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

275 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) $\overline{PA} \cong \overline{AA'}$
2) $\overline{AB} \parallel \overline{A'B'}$
3) $\overline{AB} = \overline{A'B'}$
4) $\frac{5}{2}(\overline{A'B'}) = \overline{AB}$

276 In trapezoid $ABCD$ below, $\overline{AB} \parallel \overline{CD}$.

If $AE = 5.2$, $AC = 11.7$, and $CD = 10.5$, what is the length of $AB$, to the nearest tenth?
1) 4.7
2) 6.5
3) 8.4
4) 13.1
277 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 \( x = 0 \)

278 Rhombus \( ABCD \) can be mapped onto rhombus \( KLMN \) by a rotation about point \( P \), as shown below.

What is the measure of \( \angle KNM \) if the measure of \( \angle CAD = 35^\circ \)?
1) 35°
2) 55°
3) 70°
4) 110°

279 In parallelogram \( PQRS \), \( QP \) 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°
2) 80°
3) 65°
4) 50°

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

281 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
282 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.]

283 In the diagram below of circle \( O \), secant \( ABC \) and tangent \( AD \) are drawn.

If \( CA = 12.5 \) and \( CB = 4.5 \), determine and state the length of \( DA \).

284 Jaden is comparing two cones. The radius of the base of cone \( A \) is twice as large as the radius of the base of cone \( B \). The height of cone \( B \) is twice the height of cone \( A \). The volume of cone \( A \) is

1) twice the volume of cone \( B \)
2) four times the volume of cone \( B \)
3) equal to the volume of cone \( B \)
4) equal to half the volume of cone \( B \)

285 In the diagram below of \( \triangle RST \), \( L \) is a point on \( RS \), and \( M \) is a point on \( RT \), such that \( LM \parallel ST \).

If \( RL = 2, LS = 6, LM = 4, \) and \( ST = x + 2 \), what is the length of \( ST \)?

1) 10
2) 12
3) 14
4) 16

286 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
287 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.

288 David has just finished building his treehouse and still needs to buy a ladder to be attached to the ledge of the treehouse and anchored at a point on the ground, as modeled below. David is standing 1.3 meters from the stilt supporting the treehouse. This is the point on the ground where he has decided to anchor the ladder. The angle of elevation from his eye level to the bottom of the treehouse is $56^\circ$. David's eye level is 1.5 meters above the ground.

Determine and state the minimum length of a ladder, to the nearest tenth of a meter, that David will need to buy for his treehouse.
289 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

290 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 $y = 1$

291 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

292 In circle $B$ below, diameter $RT$, radius $BE$, and chord $RE$ are drawn.

If $\angle TRE = 15^\circ$ and $BE = 9$, then the area of sector $EBR$ is
1) $3.375\pi$
2) $6.75\pi$
3) $33.75\pi$
4) $37.125\pi$

293 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°. To the nearest foot, what is the height of the monument?
1) 543
2) 555
3) 1086
4) 1110
294  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.

![Walking Path Grid]

295  In triangle $MAH$ below, $MT$ is the perpendicular bisector of $AH$.

Which statement is not always true?
1) $\triangle MAH$ is isosceles.
2) $\triangle MAT$ is isosceles.
3) $MT$ bisects $\angle AMH$.
4) $\angle A$ and $\angle TMH$ are complementary.

296  A regular hexagon is rotated about its center. Which degree measure will carry the regular hexagon onto itself?
1) $45^\circ$
2) $90^\circ$
3) $120^\circ$
4) $135^\circ$

297  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

298  The line represented by $2y = x + 8$ is dilated by a scale factor of $k$ centered at the origin, such that the image of the line has an equation of $y - \frac{1}{2}x = 2$.

What is the scale factor?
1) $k = \frac{1}{2}$
2) $k = 2$
3) $k = \frac{1}{4}$
4) $k = 4$
299 On the set of axes below, \( \triangle ABC \cong \triangle DEF \).

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

300 Parallelogram \( ABCD \) is adjacent to rhombus \( DEFG \), as shown below, and \( FC \) intersects \( AGD \) at \( H \).

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

301 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

302 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.
303 In the diagram below, $\overline{FAD} \parallel \overline{EHC}$, and $\overline{ABH}$ and $\overline{BC}$ are drawn.

If $m\angle FAB = 48^\circ$ and $m\angle ECB = 18^\circ$, what is $m\angle ABC$?

1) 18°
2) 48°
3) 66°
4) 114°

304 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.

305 In the diagram below of right triangle $ABC$, altitude $BD$ is drawn.

Which ratio is always equivalent to $\cos A$?

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

306 On the set of axes below, $\triangle ABC \cong \triangle STU$.

Describe a sequence of rigid motions that maps $\triangle ABC$ onto $\triangle STU$. 
307 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

308 Given \( MT \) below, use a compass and straightedge to construct a 45° angle whose vertex is at point \( M \). [Leave all construction marks.]

309 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.

310 Point \( M \) divides \( \overline{AB} \) 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) \(\left(\frac{23}{3}, 8\right)\)

311 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
312 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 $68^\circ$ angle with the ground. Find the length of the support wire to the nearest foot.

313 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) $\tan B$

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

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

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

315 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) $x^2 + 2x + y^2 + 8y = 83$

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

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

317 Circle $O$ with a radius of 9 is drawn below. The measure of central angle $AOC$ is $120^\circ$.

What is the area of the shaded sector of circle $O$?

1) $6\pi$
2) $12\pi$
3) $27\pi$
4) $54\pi$

318 The endpoints of directed line segment $PQ$ have coordinates of $P(-7,-5)$ and $Q(5,3)$. What are the coordinates of point $A$, on $\overline{PQ}$, that divide $\overline{PQ}$ into a ratio of 1:3?

1) $A(-1,-1)$
2) $A(2,1)$
3) $A(3,2)$
4) $A(-4,-3)$
319 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

320 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) $RT \times TS = PT \times TQ$

321 A rectangular tabletop will be made of maple wood that weighs 43 pounds per cubic foot. The tabletop will have a length of eight feet, a width of three feet, and a thickness of one inch. Determine and state the weight of the tabletop, in pounds.

322 In rhombus $TIGE$, diagonals $TG$ and $IE$ intersect at $R$. The perimeter of $TIGE$ is 68, and $TG = 16$.

What is the length of diagonal $IE$?
1) 15
2) 30
3) 34
4) 52
323 On the set of axes below, pentagon $ABCD\overline{E}$ is congruent to $\overline{A''B''C''D''E''}$.

Which describes a sequence of rigid motions that maps $ABCD\overline{E}$ onto $\overline{A''B''C''D''E''}$?

1) a rotation of 90° counterclockwise about the origin followed by a reflection over the x-axis
2) a rotation of 90° counterclockwise about the origin followed by a translation down 7 units
3) a reflection over the y-axis followed by a reflection over the x-axis
4) a reflection over the x-axis followed by a rotation of 90° counterclockwise about the origin

324 What is an equation of a circle whose center is at (2,−4) and is tangent to the line $x = −2$?

1) $(x−2)^2 + (y+4)^2 = 4$
2) $(x−2)^2 + (y+4)^2 = 16$
3) $(x+2)^2 + (y−4)^2 = 4$
4) $(x+2)^2 + (y−4)^2 = 16$

325 In quadrilateral $ABCD$, $E$ and $F$ are points on $\overline{BC}$ and $\overline{AD}$, respectively, and $\overline{BD}$ and $\overline{EF}$ are drawn such that $\angle ABG \cong \angle CDG$, $\overline{AB} \cong \overline{CD}$, and $\overline{CE} \cong \overline{AF}$.

Prove: $\overline{FG} \cong \overline{EG}$

326 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

327 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.]
328 In right triangle $PRT$, $m \angle P = 90^\circ$, altitude $PQ$ is drawn to hypotenuse $RT$, $RT = 17$, and $PR = 15$. Determine and state, to the nearest tenth, the length of $RQ$.

329 In right triangle $RST$ below, altitude $SV$ is drawn to hypotenuse $RT$.

If $RV = 4.1$ and $TV = 10.2$, what is the length of $ST$, to the nearest tenth?

1) 6.5  
2) 7.7  
3) 11.0  
4) 12.1

330 Triangles $JOE$ and $SAM$ are drawn such that $\angle E \cong \angle M$ and $EJ \cong MS$. 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) $EO$ maps onto $MA$  
4) $JO$ maps onto $SA$

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

332 Quadrilateral $NATS$ has coordinates $N(-4,-3)$, $A(1,2)$, $T(8,1)$, and $S(3,-4)$. Prove quadrilateral $NATS$ is a rhombus. [The use of the set of axes below is optional.]
A manufacturer is designing a new container for their chocolate-covered almonds. Their original container was a cylinder with a height of 18 cm and a diameter of 14 cm. The new container can be modeled by a rectangular prism with a square base and will contain the same amount of chocolate-covered almonds.

If the new container's height is 16 cm, determine and state, to the nearest tenth of a centimeter, the side length of the new container if both containers contain the same amount of almonds. A store owner who sells the chocolate-covered almonds displays them on a shelf whose dimensions are 80 cm long and 60 cm wide. The shelf can only hold one layer of new containers when each new container sits on its square base. Determine and state the maximum number of new containers the store owner can fit on the shelf.

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?

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.

Using the construction below, state the degree measure of \( \angle CAD \). Explain why.
337. Triangle $PQR$ is shown on the set of axes below.

Which quadrant will contain point $R''$, the image of point $R$, after a 90° clockwise rotation centered at $(0,0)$ followed by a reflection over the $x$-axis?

1) I  
2) II  
3) III  
4) IV

338. 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.

339. In right triangle $RST$, altitude $TV$ is drawn to 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

340. 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 $BC$?

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

341. Triangle $JGR$ is similar to triangle $MST$. Which statement is not always true?

1) $\angle J \cong \angle M$  
2) $\angle G \cong \angle T$  
3) $\angle R \cong \angle T$  
4) $\angle G \cong \angle S$

342. 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.
343 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 \( \triangle QRS \).

344 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.

345 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

346 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.]
347 A triangle has vertices $A(-2,4)$, $B(6,2)$, and $C(1,-1)$. Prove that $\triangle ABC$ is an isosceles right triangle. [The use of the set of axes below is optional.]

348 In the diagram below of triangle $ABC$, $AC$ is extended through point $C$ to point $D$, and $BE$ is drawn to $AC$.

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 $180^\circ$ 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 $180^\circ$ about the origin

349 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.

350 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 equation is always true?
1) $\angle 1 = \angle 3 + \angle 2$
2) $\angle 5 = \angle 3 - \angle 2$
3) $\angle 6 = \angle 3 - \angle 2$
4) $\angle 7 = \angle 3 + \angle 2$
351 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]

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

352 In parallelogram $ABCD$, diagonals $AC$ and $BD$ intersect at $E$. Which statement proves $ABCD$ is a rectangle?
1) $AC \cong BD$
2) $AB \perp BD$
3) $AC \perp BD$
4) $AC$ bisects $\angle BCD$

353 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.

354 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) $\frac{1}{3}$

355 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

356 In $\triangle ABC$ shown below, $\angle ACB$ is a right angle, $E$ is a point on $AC$, and $ED$ is drawn perpendicular to hypotenuse $AB$.

![Right Triangle Diagram]

If $AB = 9$, $BC = 6$, and $DE = 4$, what is the length of $AE$?
1) 5
2) 6
3) 7
4) 8
357 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

358 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.

359 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

360 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.]

361 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

362 The endpoints of $\overline{DEF}$ are $D(1,4)$ and $F(16,14)$. Determine and state the coordinates of point $E$, if $DE:EF = 2:3$. 
363 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 \( m \).

364 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

365 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

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

367 Which regular polygon has a minimum rotation of 45° to carry the polygon onto itself?
1) octagon
2) decagon
3) hexagon
4) pentagon

368 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) \((1,-1)\)

369 Given: \( \triangle AEC \), \( \triangle DEF \), and \( FE \perp CE \)

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 \( E \)
370 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) $EA$ bisects angle $ZET$.
2) Triangle $EZT$ is equilateral.
3) $EA$ is a median of triangle $EZT$.
4) Angle $Z$ is congruent to angle $T$.

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

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 $AB = 17$

372 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?

373 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) $\frac{5}{\pi}$
374 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) \( y = 3x - 6 \)

375 On the set of axes below, rectangle \( ABCD \) can be proven congruent to rectangle \( KLMN \) using which transformation?

1) rotation
2) translation
3) reflection over the \( x \)-axis
4) reflection over the \( y \)-axis

376 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) \( (x,y) \rightarrow (x + 2,y - 5) \)

377 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

378 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
379 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.

380 A quadrilateral has vertices with coordinates (−3, 1), (0, 3), (5, 2), and (−1, −2). Which type of quadrilateral is this?
1) rhombus
2) rectangle
3) square
4) trapezoid

381 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.

382 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.
383 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.

384 In the diagram below, quadrilateral $ABCD$ is inscribed in circle $P$.

What is $m\angle ADC$?
1) 70°
2) 72°
3) 108°
4) 110°

385 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°. A short time later, at point $D$, the angle of elevation was 16°.

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

386 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

387 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 $\triangle A'B'C' \sim \triangle ABC$. 
388 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) \( \tan E = \frac{TM}{JM} \)

389 In the diagram below of circle \( O \), the area of the shaded sector \( LOM \) is \( 2\pi \) cm\(^2\).

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

1) 10°
2) 20°
3) 40°
4) 80°

390 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

391 Prove the sum of the exterior angles of a triangle is 360°.

392 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) \( \cos x \)

393 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.
394 In the diagram below, $\triangle DEF$ is the image of $\triangle ABC$ after a clockwise rotation of $180^\circ$ 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) $\frac{m\angle B}{m\angle E} = \frac{m\angle C}{m\angle F}$

395 Given: Parallelogram $ABCD$, $\overline{EFG}$, and diagonal $DFB$

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

396 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.

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

397 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 $m\angle EFD = 47^\circ$, 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.
398 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) $AB \equiv CD$ and $BC \equiv AD$
3) $AB \equiv CD$ and $AB \parallel CD$
4) $AB \equiv CD$ and $BC \parallel AD$

399 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

400 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 $m\angle AOB$.

401 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/m$^3$. The maximum capacity of the contractor's trailer is 900 kg. Can the trailer hold the weight of 500 bricks? Justify your answer.

402 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

403 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) $\angle CFG \equiv \angle FCB$
2) $\angle ABF \equiv \angle BFC$
3) $\angle EFB \equiv \angle CFB$
4) $\angle CBF \equiv \angle GFC$
404 Using the information given below, which set of triangles can \textit{not} be proven similar?

\begin{enumerate}
\item \begin{tikzpicture}
\draw (0,0) -- (2,3) -- (4,0) -- cycle;
\end{tikzpicture}
\item \begin{tikzpicture}
\draw (0,0) -- (2,3) -- (4,0) -- cycle;
\end{tikzpicture}
\item \begin{tikzpicture}
\draw (0,0) -- (2,3) -- (4,0) -- cycle;
\end{tikzpicture}
\item \begin{tikzpicture}
\draw (0,0) -- (2,3) -- (4,0) -- cycle;
\end{tikzpicture}
\end{enumerate}

405 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?

\begin{enumerate}
\item 236
\item 282
\item 564
\item 945
\end{enumerate}

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

\begin{figure}
\centering
\includegraphics[width=0.5\textwidth]{triangle.png}
\caption{Triangle $FGH$ inscribed in circle $O$.}
\end{figure}

What is the area of the sector formed by angle $FOH$?

\begin{enumerate}
\item $2\pi$
\item $\frac{3}{2}\pi$
\item $6\pi$
\item $24\pi$
\end{enumerate}

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

\begin{figure}
\centering
\includegraphics[width=0.5\textwidth]{triangle2.png}
\caption{Triangle $CHR$ with $O$ on $HR$ and $D$ on $CR$.}
\end{figure}

If $RD = 4$, $RO = 6$, and $OH = 4$, what is the length of $CD$?

\begin{enumerate}
\item $2 \frac{2}{3}$
\item $6 \frac{2}{3}$
\item 11
\item 15
\end{enumerate}
Given: \( \triangle ABC \)
Prove: \( m\angle 1 + m\angle 2 + m\angle 3 = 180^\circ \)

Fill in the missing reasons below.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) ( \triangle ABC )</td>
<td>(1) Given</td>
</tr>
<tr>
<td>(2) Through point ( C ), draw ( \overline{DCE} ) parallel to ( AB ).</td>
<td>(2)</td>
</tr>
<tr>
<td>(3) ( m\angle 1 = m\angle ACD, m\angle 3 = m\angle BCE )</td>
<td>(3)</td>
</tr>
<tr>
<td>(4) ( m\angle ACD + m\angle 2 + m\angle BCE = 180^\circ )</td>
<td>(4)</td>
</tr>
<tr>
<td>(5) ( m\angle 1 + m\angle 2 + m\angle 3 = 180^\circ )</td>
<td>(5)</td>
</tr>
</tbody>
</table>
409 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) \( \angle FDB \)

410 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.

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

412 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
413 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 \( \triangle XYZ \).

414 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

415 In \( \triangle CED \) as shown below, points \( A \) and \( B \) are located on sides \( \overline{CE} \) and \( \overline{ED} \), 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 \( CD \).

416 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
417 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 \( MN \)?

![Graph showing line MN and point P](image)

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

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

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

419 In the diagram of parallelogram \( ABCD \) below, \( BE \perp CED, DF \perp BFC, CE \cong CF \).

Prove \( ABCD \) is a rhombus.

420 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 \( \angle DCB \)

421 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
422 Using a straightedge and compass, construct a square inscribed in circle $O$ below. [Leave all construction marks.]

Determine the measure of the arc intercepted by two adjacent sides of the constructed square. Explain your reasoning.

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

424 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.

425 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 $y = 0$.

426 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) $y = 2x + 1$
427 Which transformation of \( \overline{OA} \) would result in an image parallel to \( \overline{OA} \)?

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

428 In the diagram below, \( \overline{DB} \) and \( \overline{AF} \) intersect at point \( C \), and \( \overline{AD} \) and \( \overline{FBE} \) are drawn.

429 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 \( A'C' \).

430 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) \( \sin \angle A = \cos \angle B \)

431 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

If \( AC = 6, DC = 4, FC = 15, \) \( m\angle D = 65^\circ \), and \( m\angle CBE = 115^\circ \), what is the length of \( CB \)?

1) 10  
2) 12  
3) 17  
4) 22.5
432 As shown in the diagram below, the angle of elevation from a point on the ground to the top of the tree is 34°.

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

434 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

435 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

436 The coordinates of vertices A and B of ΔABC are A(3,4) and B(3,12). If the area of ΔABC is 24 square units, what could be the coordinates of point C?
1) (3,6)
2) (8,−3)
3) (−3,8)
4) (6,3)

437 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
438 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.

439 Which point shown in the graph below is the image of point \( P \) after a counterclockwise rotation of 90° about the origin?

1) \( A \)
2) \( B \)
3) \( C \)
4) \( D \)

440 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

441 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) \( \frac{AB}{DE} = \frac{FE}{CB} \)
442 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

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

Which measurements are justified by this similarity?
1) $AD = 3$, $AB = 6$, $AE = 4$, and $AC = 12$
2) $AD = 5$, $AB = 8$, $AE = 7$, and $AC = 10$
3) $AD = 3$, $AB = 9$, $AE = 5$, and $AC = 10$
4) $AD = 2$, $AB = 6$, $AE = 5$, and $AC = 15$

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

445 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.

446 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 $\angle C \cong \angle F$

447 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

448 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
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) $\frac{CE}{ED} = \frac{EB}{EA}$
2) $\frac{AE}{BE} = \frac{AC}{BD}$
3) $\frac{EC}{AE} = \frac{BE}{ED}$
4) $\frac{ED}{EC} = \frac{AC}{BD}$

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

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

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

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 $CD$.

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
455  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.

Which statement is always true?
1) $2AB = AD$
2) $AD \perp DE$
3) $AC = CE$
4) $BC \parallel DE$

---

456  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) $3x - 2y = 5$

---

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

---

458  Given: Parallelogram $ANDR$ with $\overline{AW}$ and $\overline{DE}$ bisecting $\angle NWD$ and $\angle REA$ at points $W$ and $E$, respectively

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

459  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.

---

460  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
461 Describe a sequence of transformations that will map \( \triangle ABC \) onto \( \triangle DEF \) as shown below.

462 In \( \triangle RST \) shown below, altitude \( SU \) is drawn to \( RT \) 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) \( 6\sqrt{35} \)

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

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

464 Quadrilateral \( ABCD \) with diagonals \( AC \) and \( BD \) is shown in the diagram below.

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

465 Which transformation would not always produce an image that would be congruent to the original figure?
1) translation
2) dilation
3) rotation
4) reflection
466 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 $AE \cdot EB = CE \cdot ED$.

467 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) $y = 3x - 1$

468 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

469 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.

470 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

471 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

472 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: $\triangle ABC \cong \triangle DEC$

473 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.
474 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

475 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

476 In the diagram below, ABCD is a parallelogram, AB is extended through B to E, and CE is drawn.

If CE \cong BE and m\angle D = 112^\circ, what is m\angle E?
1) 44^\circ
2) 56^\circ
3) 68^\circ
4) 112^\circ

477 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

478 In parallelogram QRST shown below, diagonal TR is drawn, U and V are points on TS and QR, respectively, and UV intersects 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
479 In the diagram below, secant $\overline{ACD}$ and tangent $\overline{AB}$ 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. ($AC \cdot AD = AB^2$)

480 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

481 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.

482 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
483 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) $\frac{5}{\sqrt{21}}$

484 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 $\overline{AB}$ onto $\overline{DE}$, $\overline{BC}$ onto $\overline{EF}$, and $\overline{AC}$ onto $\overline{DF}$.
4) There is a sequence of rigid motions that maps point $A$ onto point $D$, $\overline{AB}$ onto $\overline{DE}$, and $\angle B$ onto $\angle E$.

485 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) $y = 2x - 16$

486 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.

487 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
488 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) \( y = -x - 3 \)

489 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

490 In the diagram of \( \triangle ABC \) shown below, use a compass and straightedge to construct the median to \( AB \). [Leave all construction marks.]
493 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>

494 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? SAS?
1) \( \angle CDB \cong \angle AEB \)
2) \( \angle AFD \cong \angle EFC \)
3) \( AD \cong CE \)
4) \( AE \cong CD \)

495 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

496 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
497 In the diagram below, $\overline{EF}$ intersects $\overline{AB}$ and $\overline{CD}$ at $G$ and $H$, respectively, and $\overline{GI}$ is drawn such that $GH \cong IH$.

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

498 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) $m \parallel n$

499 In the diagram below, $\triangle ABC$ and $\triangle XYZ$ are graphed.

Use the properties of rigid motions to explain why $\triangle ABC \cong \triangle XYZ$.

500 In the diagram of circle $A$ shown below, chords $\overline{CD}$ and $\overline{EF}$ intersect at $G$, and chords $\overline{CE}$ and $\overline{FD}$ 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) $\triangle CEG \sim \triangle FDG$
501 Given: \( \triangle XYZ, \overline{XY} \cong \overline{ZY} \), and \( \overline{YW} \) bisects \( \angle XYZ \)
Prove that \( \angle YWZ \) is a right angle.

502 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.

503 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.

504 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

505 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) \( \frac{EA}{EC} \)
506 In the diagram below, $AC \cong DF$ and points $A$, $C$, $D$, and $F$ are collinear on line $\ell$.

Let $\triangle D'E'F'$ 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 $\triangle D'E'F'$ after a reflection across line $\ell$. Suppose that $E''$ is located at $B$. Is $\triangle DEF$ congruent to $\triangle ABC$? Explain your answer.

507 In the diagram below, $FE \parallel AC$ at $B$, and $GE \parallel BD$ 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 $B$.

508 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.

509 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.
510 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

511 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.

512 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 g/cm³, and the cost, per kilogram, of ice is $3.83. Determine and state the cost of the ice needed to make 50 snow cones.

513 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) \(4\sqrt{2}\)
514 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.

515 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 $\triangle CEB$.

516 The coordinates of the endpoints of $\overline{AB}$ are $A(-6,-5)$ and $B(4,0)$. Point $P$ is on $\overline{AB}$. 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.]

517 In circle $O$ shown below, diameter $\overline{AC}$ is perpendicular to $\overline{CD}$ at point $C$, and chords $\overline{AB}$, $\overline{BC}$, $\overline{AE}$, and $\overline{CE}$ 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) $\angle CBA \cong \angle AEC$
518 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) \(25\sqrt{2}\)

519 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.

520 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) \(y = 2x + 6\)

521 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) \(3(m\angle C') = m\angle C\)

522 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 \(\overline{BC}\)?

1) \(\frac{2}{5}\) 
2) \(\frac{3}{2}\) 
3) \(-\frac{1}{2}\) 
4) \(-\frac{5}{2}\)

523 Explain why \(\cos(x) = \sin(90 - x)\) for \(x\) such that \(0 < x < 90\).
524 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.]

\[
\text{coordinates of point } J = \frac{2T + 1P}{2 + 1} = \frac{2(4, 7) + 1(-2, 1)}{3} = \left( \frac{2 \cdot 4 - 2}{3}, \frac{2 \cdot 7 + 1}{3} \right) = \left( \frac{6}{3}, \frac{15}{3} \right) = (2, 5)
\]

525 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) \((8.5)^3 - \frac{1}{3} \pi (4)^2 (8)\)

526 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

527 In the diagram of parallelogram \( FRED \) shown below, \( ED \) is extended to \( A \), and \( AF \) is drawn such that \( AF \parallel DF \).

If \( m\angle R = 124^\circ \), what is \( m\angle AFD \)?

1) \(124^\circ\)
2) \(112^\circ\)
3) \(68^\circ\)
4) \(56^\circ\)
528 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.

529 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 \( \triangle BOC \).

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

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

532 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.
533 In parallelogram $ABCD$ shown below, diagonals $\overline{AC}$ and $\overline{BD}$ intersect at $E$.

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

534 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.

535 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)

536 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
537 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.]

538 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° with the ground. Determine and state the length of the ladder to the nearest tenth of a foot.

539 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) $\sin A = \cos B$

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

Describe a sequence of similarity transformations that shows $\triangle XYZ$ is similar to $\triangle UVZ$. 
541 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) \( \frac{4}{3} \)

542 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°?
1) \( \frac{8\pi}{3} \)
2) \( \frac{16\pi}{3} \)
3) \( \frac{32\pi}{3} \)
4) \( \frac{64\pi}{3} \)

543 Using a compass and straightedge, construct an altitude of triangle \( ABC \) below. [Leave all construction marks.]

544 In the diagram below, radius \( OA \) 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.]
545 In the diagram below of circle $O$, diameter $\overline{AB}$ and radii $\overline{OC}$ and $\overline{OD}$ are drawn. The length of $\overline{AB}$ is 12 and the measure of $\angle COD$ is 20 degrees.

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

546 In the diagram below, $\overline{BC}$ 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.

547 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

548 Which figure can have the same cross section as a sphere?
1) 
2) 
3) 
4)
549 In the diagram of $\triangle LAC$ and $\triangle DNC$ below, $\overline{LA} \cong \overline{DN}$, $\overline{CA} \cong \overline{CN}$, and $\overline{DAC} \perp \overline{LCN}$.

a) Prove that $\triangle LAC \cong \triangle DNC$.

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

550 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

551 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 $\triangle ABC \cong \triangle DEF$.

552 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)

553 If the rectangle below is continuously rotated about side $w$, which solid figure is formed?

1) pyramid
2) rectangular prism
3) cone
4) cylinder
554 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 $x = 1$.

555 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

556 In circle $O$, diameter $\overline{AB}$, chord $\overline{BC}$, and radius $\overline{OC}$ are drawn, and the measure of arc $BC$ is $108^\circ$.

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

557 The diagram below shows parallelogram $LMNO$ with diagonal $\overline{LN}$, $m\angle M = 118^\circ$, and $m\angle LNO = 22^\circ$.

Explain why $m\angle NLO$ is 40 degrees.
558. The graph below shows \( \overline{AB} \), which is a chord of circle \( O \). The coordinates of the endpoints of \( \overline{AB} \) are \( A(3,3) \) and \( B(3,-7) \). The distance from the midpoint of \( \overline{AB} \) to the center of circle \( O \) is 2 units.

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) \( (x - 5)^2 + (y + 2)^2 = 25 \)

559. 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°

560. The image of \( \triangle ABC \) after a rotation of 90° clockwise about the origin is \( \triangle DEF \), as shown below.

Which statement is true?
1) \( \overline{BC} \cong \overline{DE} \)
2) \( \overline{AB} \cong \overline{DF} \)
3) \( \angle C \cong \angle E \)
4) \( \angle A \cong \angle D \)
Geometry Regents at Random Worksheets
Answer Section

1 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

2 ANS:
Parallelogram \(ABCD\) with diagonal \(\overline{AC}\) 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

3 ANS: 4 PTS: 2 REF: 081803geo NAT: G.GMD.B.4 TOP: Rotations of Two-Dimensional Objects

4 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

5 ANS: 4
\[
\frac{36}{45} \neq \frac{15}{18}
\]
\[
\frac{4}{5} \neq \frac{5}{6}
\]

PTS: 2 REF: 081709geo NAT: G.SRT.A.3 TOP: Similarity Proofs

6 ANS: 2
\[
12^2 = 9 \cdot 16
\]
\[144 = 144\]

PTS: 2 REF: 081718geo NAT: G.SRT.B.5 TOP: Similarity
KEY: leg

7 ANS: 1
\[
20 \cdot 12 \cdot 45 + \frac{1}{2} \pi (10)^2 (45) \approx 17869
\]

PTS: 2 REF: 061807geo NAT: G.GMD.A.3 TOP: Volume
KEY: compositions
8 ANS: 4
\[ \frac{1}{2} (360 - 268) = 46 \]

PTS: 2  REF: 061704geo  NAT: G.C.A.2  TOP: Chords, Secants and Tangents
KEY: inscribed

9 ANS: 3  PTS: 2  REF: 011714geo  NAT: G.SRT.C.6  TOP: Trigonometric Ratios

10 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

11 ANS:
Yes. The triangles are congruent because of SSS \( (5^2 + 12^2 = 13^2) \). All congruent triangles are similar.

PTS: 2  REF: 061830geo  NAT: G.SRT.B.5  TOP: Triangle Congruency

12 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

13 ANS: 2
\[ \frac{x}{x + 3} = \frac{14}{21} \]
\[ 14 - 6 = 8 \]
\[ 21x = 14x + 42 \]
\[ 7x = 42 \]
\[ x = 6 \]

PTS: 2  REF: 081812geo  NAT: G.SRT.B.5  TOP: Side Splitter Theorem

14 ANS: 3
\[ \sqrt{(-5)^2 + 12^2} = \sqrt{169} \]
\[ \sqrt{11^2 + (2\sqrt{12})^2} = \sqrt{121 + 48} = \sqrt{169} \]

PTS: 2  REF: 011722geo  NAT: G.GPE.B.4  TOP: Circles in the Coordinate Plane

15 ANS: 2  PTS: 2  REF: 081701geo  NAT: G.GMD.B.4  TOP: Cross-Sections of Three-Dimensional Objects

16 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
17 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

18 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

19 ANS: 2

\[ -4 + \frac{2}{5} (1 - 4) = -4 + \frac{2}{5} (5) = -4 + 2 = -2 \]

\[ -2 + \frac{2}{5} (8 - 2) = -2 + \frac{2}{5} (10) = -2 + 4 = 2 \]

PTS: 2 REF: 061814geo NAT: G.GPE.B.6 TOP: Directed Line Segments

20 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

21 ANS: 3

PTS: 2 REF: 061702geo NAT: G.GPE.B.7 TOP: Polygons in the Coordinate Plane

22 ANS: 1

\( M \) is a centroid, and cuts each median 2:1.

PTS: 2 REF: 061818geo NAT: G.CO.C.10 TOP: Centroid, Orthocenter, Incenter and Circumcenter

23 ANS: 4

\[ \frac{300}{360} \cdot 8^2 \pi = \frac{160\pi}{3} \]

PTS: 2 REF: 011721geo NAT: G.C.B.5 TOP: Sectors

24 ANS: Yes, as translations do not change angle measurements.

PTS: 2 REF: 061825geo NAT: G.CO.B.6 TOP: Properties of Transformations KEY: basic

25 ANS: 4

PTS: 2 REF: 081810geo NAT: G.SRT.B.5 TOP: Triangle Proofs KEY: statements
26 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

27 ANS:
rotation 180º about the origin, translation 2 units down; rotation 180º about \( B \), translation 6 units down and 6 units left; or reflection over \( x \)-axis, translation 2 units down, reflection over \( y \)-axis

PTS: 2 REF: 081828geo NAT: G.CO.A.5 TOP: Compositions of Transformations
KEY: identify

28 ANS: 4
TOP: Midsegments

29 ANS: 2
\( \triangle ACB \sim \triangle AED \)

PTS: 2 REF: 061811geo NAT: G.SRT.B.5 TOP: Similarity
KEY: basic

30 ANS:

A dilation preserves slope, so the slopes of \( \overline{QR} \) and \( \overline{Q'R'} \) are equal. Because the slopes are equal, \( Q'R' \parallel \overline{QR} \).

PTS: 4 REF: 011732geo NAT: G.SRT.A.2 TOP: Dilations
KEY: grids

31 ANS: 1
TOP: Dilations

32 ANS: 1
\[
\sin 32 = \frac{O}{129.5}
\]
\[O \approx 68.6\]

PTS: 2 REF: 011804geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side
33 ANS: 1
\[2x + 4 + 46 = 90\]
\[2x = 40\]
\[x = 20\]

PTS: 2  REF: 061808geo  NAT: G.SRT.C.7  TOP: Cofunctions

34 ANS: 3
\[\frac{s_L}{s_S} = \frac{6\theta}{4\theta} = 1.5\]

KEY: arc length

35 ANS:
\[x^2 - 6x + 9 + y^2 + 8y + 16 = 56 + 9 + 16\]
\[(x - 3)^2 + (y + 4)^2 = 81\]

PTS: 2  REF: 081731geo  NAT: G.GPE.A.1  TOP: Equations of Circles
KEY: completing the square

36 ANS:
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). \(\angle DAE \cong \angle BCF\) (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).

PTS: 6  REF: 011735geo  NAT: G.SRT.B.5  TOP: Quadrilateral Proofs

37 ANS: 1
\[V = \frac{1}{3} \pi \left( \frac{1.5}{2} \right)^2 \left( \frac{4}{2} \right) \approx 1.2\]

PTS: 2  REF: 011724geo  NAT: G.GMD.A.3  TOP: Volume
KEY: cones

38 ANS:
\(RS\) and \(TV\) bisect each other at point \(X\); \(TR\) and \(SV\) are drawn (given); \(TX \cong XV\) and \(RX \cong XS\) (segment bisectors create two congruent segments); \(\angle TXR \cong \angle VXS\) (vertical angles are congruent); \(\triangle TXR \cong \triangle VXS\) (SAS); \(\angle T \cong \angle V\) (CPCTC); \(TR \parallel SV\) (a transversal that creates congruent alternate interior angles cuts parallel lines).

PTS: 4  REF: 061733geo  NAT: G.SRT.B.5  TOP: Triangle Proofs
KEY: proof
39 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

40 ANS: Isosceles trapezoid $ABCD$, $\angle CDE \cong \angle DCE$, $\overline{AE} \perp \overline{DE}$, and $\overline{BE} \perp \overline{CE}$ (given); $\overline{AD} \cong \overline{BC}$ (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); $EA \cong EB$ (CPCTC);

$\angle EDA \cong \angle ECB$

$\triangle AEB$ is an isosceles triangle (an isosceles triangle has two congruent sides).


41 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

42 ANS: 3 PTS: 2 REF: 011710geo NAT: G.CO.A.5 TOP: Compositions of Transformations KEY: identify

43 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 REF: 011713geo NAT: G.SRT.A.1 TOP: Line Dilations


45 ANS: 1

$m = \frac{-4}{-6} = \frac{2}{3}$

$m_\perp = \frac{-3}{2}$

PTS: 2 REF: 011820geo NAT: G.GPE.B.5 TOP: Parallel and Perpendicular Lines KEY: write equation of perpendicular line


47 ANS: $R_{180^\circ}$ about $\left( \begin{array}{c} \frac{1}{2} \\ \frac{1}{2} \end{array} \right)$

PTS: 2 REF: 081727geo NAT: G.CO.A.5 TOP: Compositions of Transformations KEY: identify
48 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

49 ANS: 4
Opposite angles of an inscribed quadrilateral are supplementary.

PTS: 2 REF: 011821geo NAT: G.C.A.3 TOP: Inscribed Quadrilaterals

50 ANS:

\[
m_{\overline{MH}} = \frac{6}{10} = \frac{3}{5}, \quad m_{\overline{AT}} = \frac{6}{10} = \frac{3}{5}, \quad m_{\overline{MA}} = -\frac{5}{3}, \quad m_{\overline{HT}} = -\frac{5}{3}; \quad \overline{MH} \parallel \overline{AT} \text{ and } \overline{MA} \parallel \overline{HT}.
\]

\textit{MATH} is a parallelogram since both sides of opposite sides are parallel. \( m_{\overline{MA}} = -\frac{5}{3}, \quad m_{\overline{AT}} = \frac{3}{5}. \) Since the slopes are negative reciprocals, \( \overline{MA} \perp \overline{AT} \) and \( \angle A \) is a right angle. \( \textit{MATH} \) is a rectangle because it is a parallelogram with a right angle.

PTS: 6 REF: 081835geo NAT: G.GPE.B.4 TOP: Quadrilaterals in the Coordinate Plane
KEY: grids

51 ANS:
Circle \( O \), tangent \( \overline{EC} \) to diameter \( \overline{AC} \), chord \( \overline{BC} \parallel \text{secant } \overline{ADE} \), and chord \( \overline{AB} \) (given); \( \angle B \) is a right angle (an angle inscribed in a semi-circle is a right angle); \( \overline{EC} \perp \overline{OC} \) (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); \( \triangle BCA \cong \triangle CAE \) (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

52 ANS: 1
\[
\frac{64}{4} = 16 \quad 16^2 = 256 \quad 2w + 2(w + 2) = 64 \quad 15 \times 17 = 255 \quad 2w + 2(w + 4) = 64 \quad 14 \times 18 = 252 \quad 2w + 2(w + 6) = 64
\]
\[
w = 15 \quad w = 14 \quad w = 13
\]
\[
13 \times 19 = 247
\]

PTS: 2 REF: 011708geo NAT: G.MG.A.3 TOP: Area of Polygons
53  ANS: 2  
\[ AB = 10 \text{ since } \triangle ABC \text{ is a 6-8-10 triangle. } \quad 6^2 = 10x \]
\[ 3.6 = x \]

PTS: 2  REF: 081820geo  NAT: G.SRT.B.5  TOP: Similarity  
KEY: leg

54  ANS: 3  PTS: 2  REF: 011815geo  NAT: G.CO.A.3  TOP: Mapping a Polygon onto Itself

55  ANS: 3  
\[ 2.5 \times 1.25 \times (27 \times 12) + \frac{1}{2} \pi(1.25)^2(27 \times 12) \approx 1808 \]

PTS: 2  REF: 061723geo  NAT: G.GMD.A.3  TOP: Volume  
KEY: compositions

56  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

57  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

58  ANS:  
\[ 500 \times 1015 \text{ cc} \times \frac{0.29}{\text{kg}} \times \frac{7.95 \text{ g}}{\text{cc}} \times \frac{1 \text{ kg}}{1000 \text{ g}} = \$1170 \]

PTS: 2  REF: 011829geo  NAT: G.MG.A.2  TOP: Density

59  ANS: 3  
\[ v = \pi r^2 h \]
\[ (1) \quad 6^2 \cdot 10 = 360 \]
\[ 150\pi = \pi r^2 h \]
\[ (2) \quad 10^2 \cdot 6 = 600 \]
\[ 150 = r^2 h \]
\[ (3) \quad 5^2 \cdot 6 = 150 \]
\[ (4) \quad 3^2 \cdot 10 = 900 \]

PTS: 2  REF: 081713geo  NAT: G.GMD.B.4  TOP: Rotations of Two-Dimensional Objects
60 ANS: 
\[ \frac{Q}{360} \left( \pi \right) \left( 25^2 \right) = \left( \pi \right) \left( 25^2 \right) - 500\pi \]
\[ Q = \frac{125\pi(360)}{625\pi} \]
\[ Q = 72 \]
PTS: 2 REF: 011828geo NAT: G.C.B.5 TOP: Sectors

61 ANS: 
\[ \tan 16.5 = \frac{x}{13.5} \]
\[ x \approx 4 \]
\[ 9 \times 16 \times 4.5 = 648 \quad 3752 - (35 \times 16 \times 5) = 3472 \]
\[ 13.5 \times 16 \times 4.5 = 972 \quad 3472 \times 7.48 \approx 25971 \]
\[ 4 + 4.5 = 8.5 \]
\[ \frac{1}{2} \times 13.5 \times 16 \times 4 = 432 \quad \frac{25791}{10.5} \approx 2473.4 \]
\[ 12.5 \times 16 \times 8.5 = \frac{1700}{3752} \quad \frac{2473.4}{60} \approx 41 \]
PTS: 6 REF: 081736geo NAT: G.GMD.A.3 TOP: Volume
KEY: compositions

62 ANS: 
\[ \text{Diagram of a circle with points A and B, radius OA and OB.} \]
PTS: 2 REF: 011826geo NAT: G.CO.D.13 TOP: Constructions

63 ANS: 4

AA

PTS: 2 REF: 061809geo NAT: G.SRT.A.3 TOP: Similarity Proofs
Reflections are rigid motions that preserve distance, so $\triangle ABC \cong \triangle DEF$. 

$\begin{align*}
r_{x=-1} & \quad \text{Reflections are rigid motions that preserve distance, so $\triangle ABC \cong \triangle DEF$.}
\end{align*}$

KEY: graphics

65 ANS: 4 PTS: 2 REF: 081801geo NAT: G.CO.C.9 TOP: Lines and Angles

66 ANS: 2

\[
\begin{align*}
(x - 5)^2 + (y - 2)^2 &= 16 \\
(x - 10)^2 + (y - 4)^2 &= 16 \\
(x - 10)^2 + (y - 4)^2 &= -13
\end{align*}
\]

PTS: 2 REF: 061820geo NAT: G.GPE.A.1 TOP: Equations of Circles
KEY: write equation, given graph

67 ANS: 

PTS: 2 REF: 011725geo NAT: G.CO.D.12 TOP: Constructions
KEY: line bisector
Because $\overline{AB} \cong \overline{AC}$, $\triangle ABC$ has two congruent sides and is isosceles. Because $\overline{AB} \cong \overline{BC}$ 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

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

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
73 ANS:

\[ AB = \sqrt{2^2 + 3^2} = \sqrt{13} \]

PTS: 4 REF: 081732geo NAT: G.GPE.B.4 TOP: Triangles in the Coordinate Plane

74 ANS:

\[ \tan 52^\circ = \frac{6250}{y} \implies y \approx 4883 \]

\[ 23325.3 - 4883 = 18442 \times \frac{1 \text{ mi}}{5280 \text{ ft}} \times \frac{60 \text{ min}}{1 \text{ h}} \approx 210 \]

PTS: 6 REF: 061736geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side

75 ANS:

\[ T_{0,-2} \circ r_{y\text{-axis}} \]

PTS: 2 REF: 011726geo NAT: G.CO.A.5 TOP: Compositions of Transformations

KEY: line bisector

76 ANS:

\[ \tan 15^\circ = \frac{6250}{x} \]

\[ x \approx 23325.3 \]

\[ y \approx 4883 \]

PTS: 2 REF: 061829geo NAT: G.CO.D.12 TOP: Constructions

KEY: identify

77 ANS:

\[ \frac{360^\circ}{10} = 36^\circ \text{ 252}^\circ \text{ is a multiple of } 36^\circ \]

PTS: 2 REF: 081722geo NAT: G.CO.A.3 TOP: Mapping a Polygon onto Itsel
78 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

79 ANS:
\[ PQ \sqrt{(8 - 3)^2 + (3 - 2)^2} = \sqrt{50} \]
\[ QR \sqrt{(1 - 8)^2 + (4 - 3)^2} = \sqrt{50} \]
\[ RS \sqrt{(-4 - 1)^2 + (-1 - 4)^2} = \sqrt{50} \]
\[ PS \sqrt{(-4 - 3)^2 + (-1 - 2)^2} = \sqrt{50} \]

PQRS is a rhombus because all sides are congruent. \[ m_{PQ} = \frac{8 - 3}{3 - 2} = \frac{5}{1} = 1 \]
\[ m_{QR} = \frac{1 - 8}{4 - 3} = -7 \]
Because the slopes of adjacent sides are not opposite reciprocals, they are not perpendicular and do not form a right angle. Therefore PQRS is not a square.

PTS: 6 REF: 061735geo NAT: G.GPE.B.4 TOP: Quadrilaterals in the Coordinate Plane
KEY: grids

80 ANS: 1
\[ 360 - (82 + 104 + 121) = 53 \]

KEY: graph

81 ANS: 3 PTS: 2 REF: 061802geo NAT: G.CO.C.9 TOP: Lines and Angles

82 ANS: 2 PTS: 2 REF: 011802geo NAT: G.CO.C.11 TOP: Parallelograms


84 ANS: 3 PTS: 2 REF: 061816geo NAT: G.GMD.B.4 TOP: Rotations of Two-Dimensional Objects
85 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

86 ANS: 1
Illinois: \( \frac{12830632}{231.1} \approx 55520 \) Florida: \( \frac{18801310}{350.6} \approx 53626 \) 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

87 ANS:

88 ANS: 1
\[ \frac{8(x + 8)}{6(x + 18)} = \frac{8x + 64}{6x + 108} = \frac{2x = 44}{x = 22} \]

PTS: 2  REF: 011720geo  NAT: G.GPE.B.6  TOP: Directed Line Segments
KEY: graphics

89 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
KEY: graphics

90 ANS: 4
\[ 8(x + 8) = 6(x + 18) \]
\[ 8x + 64 = 6x + 108 \]
\[ 2x = 44 \]
\[ x = 22 \]

PTS: 2  REF: 011715geo  NAT: G.C.A.2  TOP: Chords, Secants and Tangents
KEY: secants drawn from common point, length
92 ANS: 4  PTS: 2  REF: 061813geo  NAT: G.CO.C.11
TOP: Special Quadrilaterals

93 ANS: 4
The segment’s midpoint is the origin and slope is $-2$. The slope of a perpendicular line is $\frac{1}{2}$. $y = \frac{1}{2}x + 0$

\[
2y = x \\
2y - x = 0
\]

PTS: 2  REF: 081724geo  NAT: G.GPE.B.5  TOP: Parallel and Perpendicular Lines
KEY: perpendicular bisector

94 ANS: 4
\[
\sin 16.5^\circ = \frac{8}{x} \\
x \approx 28.2
\]

PTS: 2  REF: 081806ai  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find a Side

95 ANS: 1
\[
(12 \cdot 11) - \left(\frac{1}{2} (12 \cdot 4) + \frac{1}{2} (7 \cdot 9) + \frac{1}{2} (11 \cdot 3)\right) = 60
\]

PTS: 2  REF: 061815geo  NAT: G.GPE.B.7  TOP: Polygons in the Coordinate Plane

96 ANS: 4
\[
\frac{5}{7} = \frac{x}{x+5} \\
12 \frac{1}{2} + 5 = 17 \frac{1}{2}
\]

\[
5x + 25 = 7x \\
2x = 25 \\
x = 12 \frac{1}{2}
\]

PTS: 2  REF: 061821geo  NAT: G.SRT.B.5  TOP: Side Splitter Theorem
\[ \Delta PAT \text{ is an isosceles triangle because sides } \overline{AP} \text{ and } \overline{AT} \text{ are congruent (} \sqrt{3^2 + 11^2} = \sqrt{7^2 + 9^2} = \sqrt{130}) \].

\( R(2, 9) \). Quadrilateral \( PART \) is a parallelogram because the opposite sides are parallel since they have equal slopes

\[
(m_{\overline{AR}} = \frac{4}{6} = \frac{2}{3};
\quad m_{\overline{PT}} = \frac{4}{6} = \frac{2}{3};
\quad m_{\overline{PA}} = \frac{-11}{3};
\quad m_{\overline{RT}} = \frac{-11}{3})
\]

\[ \text{PTS: 6} \quad \text{REF: } 011835\text{geo} \quad \text{NAT: G.GPE.B.4} \quad \text{TOP: Quadrilaterals in the Coordinate Plane} \]

\[ \text{KEY: grids} \]

\[ \text{98 ANS: The four small triangles are 8-15-17 triangles. } 4 \times 17 = 68 \]

\[ \text{PTS: 2} \quad \text{REF: } 081726\text{geo} \quad \text{NAT: G.CO.C.11} \quad \text{TOP: Special Quadrilaterals} \]

\[ \text{99 ANS: 3} \quad \text{PTS: 2} \quad \text{REF: } 081817\text{geo} \quad \text{NAT: G.CO.A.3} \]

\[ \text{TOP: Mapping a Polygon onto Itself} \]

\[ \text{100 ANS: 4} \quad \text{PTS: 2} \quad \text{REF: } 061711\text{geo} \quad \text{NAT: G.CO.C.11} \]

\[ \text{TOP: Special Quadrilaterals} \]

\[ \text{101 ANS: The line is on the center of dilation, so the line does not change. } p: 3x + 4y = 20 \]

\[ \text{PTS: 2} \quad \text{REF: } 061731\text{geo} \quad \text{NAT: G.SRT.A.1} \quad \text{TOP: Line Dilations} \]

\[ \text{102 ANS: 2} \]

\[ (1) \text{ AA; (3) SAS; (4) SSS. NYSED has stated that all students should be awarded credit regardless of their answer to this question.} \]

\[ \text{PTS: 2} \quad \text{REF: } 061724\text{geo} \quad \text{NAT: G.SRT.B.5} \quad \text{TOP: Similarity} \]

\[ \text{KEY: basic} \]

\[ \text{103 ANS: } \overline{GI} \text{ is parallel to } \overline{NT}, \text{ and } \overline{IN} \text{ intersects at } A \text{ (given); } \angle I \cong \angle N, \angle G \cong \angle T \text{ (paralleling lines cut by a transversal form congruent alternate interior angles); } \Delta GIA \sim \Delta TNA \text{ (AA).} \]

\[ \text{PTS: 2} \quad \text{REF: } 011729\text{geo} \quad \text{NAT: G.SRT.A.3} \quad \text{TOP: Similarity Proofs} \]
104 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

105 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

106 ANS: 3     PTS: 2     REF: 061703geo   NAT: G.SRT.C.7   TOP: Cofunctions

107 ANS: 3
\[ \begin{align*}
\frac{x}{6.3} &= 3 \\
y &= \frac{6.3 + 3.78}{5} \\
x &= 3.78 \\
y &\approx 5.9
\end{align*} \]

PTS: 2     REF: 081816geo   NAT: G.SRT.B.5   TOP: Side Splitter Theorem

108 ANS: 1     PTS: 2     REF: 061707geo   NAT: G.CO.A.3   TOP: Mapping a Polygon onto Itself


KEY: basic

111 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

112 ANS: 2     PTS: 2     REF: 061701geo   NAT: G.CO.A.5   TOP: Compositions of Transformations
KEY: identify

KEY: basic

114 ANS: 1
\[ -8 + \frac{3}{5}(7 - 8) = -8 + 9 = 1 \]
\[ 7 + \frac{3}{5}(-13 - 7) = 7 - 12 = -5 \]

PTS: 2     REF: 081815geo   NAT: G.GPE.B.6   TOP: Directed Line Segments
115 ANS: 3  PTS: 2  REF: 081805geo  NAT: G.GMD.B.4
TOP: Cross-Sections of Three-Dimensional Objects

116 ANS:

\[ C = 2\pi r \quad V = \frac{1}{3} \pi \cdot 5^2 \cdot 13 \approx 340 \]

\[ 31.416 = 2\pi r \]

\[ 5 \approx r \]

PTS: 4  REF: 011734geo  NAT: G.GMD.A.3  TOP: Volume
KEY: cones

117 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  REF: 061729geo  NAT: G.SRT.B.5  TOP: Similarity
KEY: altitude

118 ANS: 4  PTS: 2  REF: 011706geo  NAT: G.CO.A.2
TOP: Identifying Transformations
KEY: basic

119 ANS:

\[ \frac{4\pi}{3} (2^2 - 1.5^2) \approx 19.4 \quad 19.4 \cdot 1.308 \cdot 8 \approx 203 \]

PTS: 4  REF: 081834geo  NAT: G.MG.A.2  TOP: Density

120 ANS: 4  PTS: 2  REF: 011810geo  NAT: G.GMD.B.4
TOP: Rotations of Two-Dimensional Objects

121 ANS: 2

\[ x^2 + y^2 - 6x + 2y = 6 \]

\[ x^2 - 6x + 9 + y^2 + 2y + 1 = 6 + 9 + 1 \]

\[ (x - 3)^2 + (y + 1)^2 = 16 \]

PTS: 2  REF: 081814geo  NAT: G.C.A.2  TOP: Chords, Secants and Tangents
KEY: tangents drawn from common point, length

122 ANS: 2

\[ x^2 + y^2 - 6x + 2y = 6 \]

\[ x^2 - 6x + 9 + y^2 + 2y + 1 = 6 + 9 + 1 \]

\[ (x - 3)^2 + (y + 1)^2 = 16 \]

PTS: 2  REF: 011812geo  NAT: G.GPE.A.1  TOP: Equations of Circles
KEY: completing the square
123  ANS: 3
\[ 6 \cdot 3^2 = 54 \quad 12 \cdot 3 = 36 \]

PTS: 2  REF: 081823geo  NAT: G.SRT.A.2  TOP: Dilations

124  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

125  ANS: 2  PTS: 2  REF: 061709geo  NAT: G.SRT.B.5  TOP: Triangle Proofs  KEY: statements

126  ANS: 1  PTS: 2  REF: 011703geo  NAT: G.SRT.B.5  TOP: Triangle Congruency

127  ANS:
\[ V = \pi (10)^2 (18) = 1800 \pi \text{ in}^3 \]
\[ 1800 \pi \text{ in}^3 (\frac{1}{18^3 \text{ in}^3}) = \frac{25}{24} \pi \text{ ft}^3 \]
\[ \frac{25}{24} \pi (95.46)(0.85) \approx 266 + 266 + 270 = 536 \]

PTS: 4  REF: 061834geo  NAT: G.MG.A.2  TOP: Density

128  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

129  ANS:
Rotate \( \triangle ABC \) clockwise about point \( C \) until \( \overline{DF} \parallel \overline{AC} \). Translate \( \triangle ABC \) along \( \overline{CF} \) so that \( C \) maps onto \( F \).

PTS: 2  REF: 061730geo  NAT: G.CO.A.5  TOP: Compositions of Transformations  KEY: identify
130 ANS:

\[
\frac{134 + 102}{2} = 118
\]

PTS: 2  
REF: 081827geo  
NAT: G.C.A.2  
TOP: Chords, Secants and Tangents  
KEY: intersecting chords, angle

131 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

132 ANS:

\[
20000 \text{g} \left( \frac{1 \text{ft}^3}{7.48 \text{g}} \right) = 2673.8 \text{ft}^3  
2673.8 = \pi r^2 (34.5)  
9.9 + 1 = 10.9
\]

\[r \approx 4.967  
d \approx 9.9\]

PTS: 4  
REF: 061734geo  
NAT: G.GMD.A.3  
TOP: Volume  
KEY: cylinders

133 ANS:

\[10 \cdot 6 = 15x  
x = 4\]

PTS: 2  
REF: 061828geo  
NAT: G.C.A.2  
TOP: Chords, Secants and Tangents  
KEY: secants drawn from common point, length

134 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

135 ANS:

\[
\frac{1}{3.5} = \frac{x}{18-x}  
3.5x = 18 - x  
4.5x = 18  
x = 4\]

PTS: 2  
REF: 081707geo  
NAT: G.SRT.B.5  
TOP: Side Splitter Theorem
136 ANS:
\[
\cos 54 = \frac{4.5}{m} \quad \tan 54 = \frac{h}{4.5}
\]
\[
m \approx 7.7 \quad h \approx 6.2
\]
PTS: 4 REF: 011834geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side

137 ANS:
\[
\tan 54 = \frac{h}{4.5} \approx 6.2
\]
PTS: 2 REF: 081826geo NAT: G.CO.C.11 TOP: Parallelograms

138 ANS: 3 PTS: 2 REF: 061706geo NAT: G.SRT.A.1 TOP: Line Dilations

139 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

140 ANS: 2
\[
\tan \theta = \frac{2.4}{x}
\]
\[
\frac{3}{7} = \frac{2.4}{x}
\]
\[
x = 5.6
\]
PTS: 2 REF: 011707geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side

141 ANS:
\[
180 - 2(25) = 130
\]
PTS: 2 REF: 011730geo NAT: G.CO.C.10 TOP: Centroid, Orthocenter, Incenter and Circumcenter

142 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

KEY: spheres
143 ANS: 4
\[ 9 \cdot 3 = 27, \quad 27 \cdot 4 = 108 \]

PTS: 2  REF: 061805geo  NAT: G.SRT.A.2  TOP: Dilations

144 ANS:
No, The line \( 4x + 3y = 24 \) passes through the center of dilation, so the dilated line is not distinct.
\[ 4x + 3y = 24 \]
\[ 3y = -4x + 24 \]
\[ y = \frac{4}{3}x + 8 \]

PTS: 2  REF: 081830geo  NAT: G.SRT.A.1  TOP: Line Dilations

145 ANS:
\[ \frac{40}{360} \cdot \pi (4.5)^2 = 2.25\pi \]

PTS: 2  REF: 061726geo  NAT: G.C.B.5  TOP: Sectors

146 ANS:
2 Reflexive; 4 \( \angle BDA \equiv \angle BDC \); 6 CPCTC; 7 If points \( B \) and \( D \) are equidistant from the endpoints of \( \overline{AC} \), then \( B \) and \( D \) are on the perpendicular bisector of \( \overline{AC} \).

PTS: 4  REF: 081832geo  NAT: G.SRT.B.5  TOP: Triangle Proofs

147 ANS: 4  PTS: 2  REF: 061803geo  NAT: G.CO.A.2

TOP: Identifying Transformations  KEY: proof

148 ANS: 1
\[ x^2 + y^2 - 6y + 9 = -1 + 9 \]
\[ x^2 + (y - 3)^2 = 8 \]

PTS: 2  REF: 011718geo  NAT: G.GPE.A.1  TOP: Equations of Circles

KEY: completing the square

149 ANS: 4
\[ 40 - x + 3x = 90 \]
\[ 2x = 50 \]
\[ x = 25 \]

PTS: 2  REF: 081721geo  NAT: G.SRT.C.7  TOP: Cofunctions

150 ANS: 3
\[ 6x - 40 + x + 20 = 180 - 3x \]
\[ m\angle BAC = 180 - (80 + 40) = 60 \]
\[ 10x = 200 \]
\[ x = 20 \]

PTS: 2  REF: 011809geo  NAT: G.CO.C.10  TOP: Exterior Angle Theorem
151 ANS: 2  PTS: 2  REF: 011805geo  NAT: G.GMD.B.4  TOP: Cross-Sections of Three-Dimensional Objects

152 ANS: 4  PTS: 2  REF: 011705geo  NAT: G.CO.C.11  TOP: Special Quadrilaterals

153 ANS:

PTS: 2  REF: 061725geo  NAT: G.CO.D.12  TOP: Constructions
KEY: parallel and perpendicular lines

154 ANS: 2
2x + 7 + 4x − 7 = 90
6x = 90
x = 15

PTS: 2  REF: 081824geo  NAT: G.SRT.C.7  TOP: Cofunctions

155 ANS: 4
\frac{360°}{10} = 36°  252° is a multiple of 36°

PTS: 2  REF: 011717geo  NAT: G.CO.A.3  TOP: Mapping a Polygon onto Itself

156 ANS: 3
\cos 40 = \frac{14}{x}
x ≈ 18

PTS: 2  REF: 011712geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find a Side

157 ANS:
Yes. \angle A \cong \angle X, \angle C \cong \angle Z, \overline{AC} \cong \overline{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

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

PTS: 2  REF: 011806geo  NAT: G.GPE.B.6  TOP: Directed Line Segments
159  ANS: 3  
\[ y = mx + b \]
\[ 2 = \frac{1}{2} (-2) + b \]
\[ 3 = b \]

PTS: 2  REF: 011701geo  NAT: G.GPE.B.5  TOP: Parallel and Perpendicular Lines
KEY: write equation of parallel line

160  ANS: 4  PTS: 2  REF: 081822geo  NAT: G.CO.C.10
TOP: Medians, Altitudes and Bisectors

161  ANS: 4


162  ANS: 2  
\[ \frac{512\pi}{3} \cdot 2\pi = \frac{4\pi}{3} \]

PTS: 2  REF: 081723geo  NAT: G.C.B.5  TOP: Sectors

163  ANS: 1  PTS: 2  REF: 011716geo  NAT: G.CO.C.11
TOP: Special Quadrilaterals

164  ANS: 
\[ x^2 + x^2 = 58^2 \]
\[ A = (\sqrt{1682} + 8)^2 \approx 2402.2 \]
\[ 2x^2 = 3364 \]
\[ x = \sqrt{1682} \]

PTS: 4  REF: 081734geo  NAT: G.MG.A.3  TOP: Area of Polygons

165  ANS: 2  PTS: 2  REF: 061720geo  NAT: G.CO.C.11
TOP: Parallelograms

166  ANS: 
\[ \tan 72 = \frac{x}{400} \]
\[ \sin 55 = \frac{400 \tan 72}{y} \]
\[ x = 400 \tan 72 \]
\[ y = \frac{400 \tan 72}{\sin 55} \approx 1503 \]

PTS: 4  REF: 061833geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find a Side
KEY: advanced
\[
\frac{7-1}{0-2} = \frac{6}{-2} = -3 \quad \text{The diagonals of a rhombus are perpendicular.}
\]

**PTS:** 2  \quad **REF:** 011719geo  \quad **NAT:** G.GPE.B.4  \quad **TOP:** Quadrilaterals in the Coordinate Plane

168  \quad **ANS:** 3

In (1) and (2), \(ABCD\) could be a rectangle with non-congruent sides. (4) is not possible

**PTS:** 2  \quad **REF:** 081714geo  \quad **NAT:** G.CO.C.11  \quad **TOP:** Special Quadrilaterals

169  \quad **ANS:**

\[
tan 36 = \frac{x}{10} \quad \cos 36 = \frac{10}{y} \quad 12.3607 \times 3 \approx 37
\]

\[x \approx 7.3 \quad y \approx 12.3607\]

**PTS:** 4  \quad **REF:** 081833geo  \quad **NAT:** G.SRT.C.8  \quad **TOP:** Using Trigonometry to Find a Side

170  \quad **ANS:** 4  \quad **PTS:** 2  \quad **REF:** 011819geo  \quad **NAT:** G.CO.C.11  

**TOP:** Special Quadrilaterals

171  \quad **ANS:** 1

Distance and angle measure are preserved after a reflection and translation.

**PTS:** 2  \quad **REF:** 081802geo  \quad **NAT:** G.CO.B.6  \quad **TOP:** Properties of Transformations

**KEY:** basic

172  \quad **ANS:**

Parallelogram \(ABCD\), \(BF \perp AFD\), and \(DE \perp BEC\) (given); \(BC \parallel AD\) (opposite sides of a \(\square\) are \(\parallel\)); \(BE \parallel FD\) (parts of \(\parallel\) lines are \(\parallel\)); \(BF \parallel DE\) (two lines \(\perp\) to the same line are \(\parallel\)); \(BEDF\) is \(\square\) (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).

**PTS:** 6  \quad **REF:** 061835geo  \quad **NAT:** G.CO.C.11  \quad **TOP:** Quadrilateral Proofs

173  \quad **ANS:**

**PTS:** 2  \quad **REF:** 081728geo  \quad **NAT:** G.CO.D.13  \quad **TOP:** Constructions
174 ANS:

![Diagram of a circle with three lines intersecting at point B.](image)

PTS: 2 REF: 081825geo NAT: G.CO.D.12 TOP: Constructions

KEY: parallel and perpendicular lines

175 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

KEY: intersecting chords, length

176 ANS: 1

\[ V = \frac{1}{3} \pi (4)^2 (6) = 32\pi \]

PTS: 2 REF: 061718geo NAT: G.GMD.B.4 TOP: Rotations of Two-Dimensional Objects

177 ANS: 2

![Diagram of three lines with angles labeled 42.5°, 68.75°, and 42.5°.](image)

PTS: 2 REF: 011818geo NAT: G.CO.C.9 TOP: Lines and Angles

TOP: Compositions of Transformations KEY: grids
179 ANS: 3
\[ \frac{x + 72}{2} = 58 \]
\[ x + 72 = 116 \]
\[ x = 44 \]

PTS: 2 REF: 061817geo NAT: G.C.A.2 TOP: Chords, Secants and Tangents
KEY: intersecting chords, angle

180 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

181 ANS: 2
\[ -4 + \frac{2}{5} (6 - 4) = -4 + \frac{2}{5} (10) = -4 + 4 = 0 \]
\[ 5 + \frac{2}{5} (20 - 5) = 5 + \frac{2}{5} (15) = 5 + 6 = 11 \]

PTS: 2 REF: 061715geo NAT: G.GPE.B.6 TOP: Directed Line Segments

182 ANS: 4

\[ \Delta ABC \sim \Delta AED \text{ by AA. } \angle DAE \cong \angle CAB \text{ because they are the same } \angle. \]
\[ \angle DEA \cong \angle CBA \text{ because they are both right } \angle \text{s.} \]


183 ANS:

NYSED has stated that all students should be awarded credit regardless of their answer to this question.

PTS: 2 REF: 061722geo NAT: G.CO.B.7 TOP: Triangle Congruency
185 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

186 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

187 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

188 ANS: 2

\[ m = \frac{3}{2} \quad 1 = -\frac{2}{3} (-6) + b \]

\[ m_\perp = -\frac{2}{3} \quad 1 = 4 + b \]

\[-3 = b \]

PTS: 2  REF: 061719geo  NAT: G.GPE.B.5  TOP: Parallel and Perpendicular Lines
KEY: write equation of perpendicular line

189 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

190 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

191 ANS:
Reflection across the y-axis, then translation up 5.

PTS: 2  REF: 061827geo  NAT: G.CO.A.5  TOP: Compositions of Transformations
KEY: identify

192 ANS: 1

The slope of \( 3x + 2y = 12 \) is \(-\frac{3}{2}\), which is the opposite reciprocal of \( \frac{2}{3} \).

PTS: 2  REF: 081811geo  NAT: G.GPE.B.5  TOP: Parallel and Perpendicular Lines
KEY: identify perpendicular lines
193 ANS: 1
\[24x = 10^2\]
\[24x = 100\]
\[x \approx 4.2\]

PTS: 2    REF: 061823geo    NAT: G.SRT.B.5    TOP: Similarity
KEY: leg

194 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

195 ANS: 4    PTS: 2    REF: 011704geo    NAT: G.CO.C.10
TOP: Midsegments

196 ANS:

Right triangle because \(\angle CBF\) is inscribed in a semi-circle.

PTS: 4    REF: 011733geo    NAT: G.CO.D.13    TOP: Constructions

197 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

198 ANS: 4

PTS: 2    REF: 061717geo    NAT: G.CO.C.10    TOP: Interior and Exterior Angles of Triangles
\[ V = (\pi)(4^2)(9) + \left(\frac{1}{2}\right)\left(\frac{4}{3}\right)(\pi)(4^3) \approx 586 \]


\[ \frac{360^\circ}{5} = 72^\circ \quad 216^\circ \text{ is a multiple of } 72^\circ \]

PTS: 2  REF: 061819geo  NAT: G.CO.A.3  TOP: Mapping a Polygon onto Itself

\[ \sqrt[3]{\frac{3V_f}{4\pi}} - \sqrt[3]{\frac{3V_p}{4\pi}} = \sqrt[3]{\frac{3(294)}{4\pi}} - \sqrt[3]{\frac{3(180)}{4\pi}} \approx 0.6 \]

PTS: 2  REF: 061728geo  NAT: G.GMD.A.3  TOP: Volume  KEY: spheres

\[ 4\sqrt{(-1-2)^2 + (2-3)^2} = 4\sqrt{10} \]

PTS: 2  REF: 081808geo  NAT: G.GPE.B.7  TOP: Polygons in the Coordinate Plane

\[ \cos x = \frac{12}{13} \quad x \approx 23 \]

PTS: 2  REF: 081809ai  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find an Angle

\[ \frac{30}{360}(\pi)^2 \approx 6.5 \]

PTS: 2  REF: 081818geo  NAT: G.C.B.5  TOP: Sectors

\[ 2\left(\frac{36}{12} \times \frac{36}{12} \times \frac{4}{12}\right) \times 3.25 = 19.50 \]

\[
\sqrt{(2.5 - 1)^2 + (-.5 - 1.5)^2} = \sqrt{2.25 + 4} = 2.5
\]

208 ANS: 2

\[V = \frac{1}{3} \left( \frac{36}{4} \right)^2 \cdot 15 = 405\]

209 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.

210 ANS: 1

NYSED accepts either (1) or (3) as a correct answer. Statement III is not true if \(A, B, A',\) and \(B'\) are collinear.

211 ANS: 2

\[\angle B = 180 - (82 + 26) = 72; \quad \angle DEC = 180 - 26 = 154; \quad \angle EDB = 360 - (154 + 26 + 72) = 108; \quad \angle BDF = \frac{108}{2} = 54; \quad \angle DFB = 180 - (54 + 72) = 54\]

212 ANS:

No. Since \(BC = 5\) and \(ST = \sqrt{18}\) are not congruent, the two triangles are not congruent. Since rigid motions preserve distance, there is no rigid motion that maps \(\triangle ABC\) onto \(\triangle RST\).
213 ANS: 
\[ \frac{1}{2} (5)(10) = 25 \]

PTS: 2  
REF: 061926geo  
NAT: G.GPE.B.7  
TOP: Polygons in the Coordinate Plane

214 ANS: 1  
\[ 8 \times 3.5 \times 2.25 \times 1.055 = 66.465 \]

PTS: 2  
REF: 012014geo  
NAT: G.MG.A.2  
TOP: Density

215 ANS: 2  
\[ \frac{x}{360} (15)^2 \pi = 75 \pi \]
\[ x = 120 \]

PTS: 2  
REF: 011914geo  
NAT: G.C.B.5  
TOP: Sectors

216 ANS: 4  
\[ x^2 - 8x + y^2 + 6y = 39 \]
\[ x^2 - 8x + 16 + y^2 + 6y + 9 = 39 + 16 + 9 \]
\[ (x - 4)^2 + (y + 3)^2 = 64 \]

PTS: 2  
REF: 081906geo  
NAT: G.GPE.A.1  
TOP: Equations of Circles  
KEY: completing the square

217 ANS: 1  
\[ \cos C = \frac{15}{17} \]
\[ C \approx 28 \]

PTS: 2  
REF: 012007geo  
NAT: G.SRT.C.8  
TOP: Using Trigonometry to Find an Angle
218 ANS:
\[
\begin{align*}
7.5 + 7 + 10 &= 24.5
\end{align*}
\]
PTS: 2 REF: 012030geo NAT: G.CO.C.10 TOP: Centroid, Orthocenter, Incenter and Circumcenter

219 ANS: 4
\[
2x - 1 = 16
\]
\[
x = 8.5
\]

220 ANS:
\[
\frac{124 - 56}{2} = 34
\]
PTS: 2 REF: 081930geo NAT: G.C.A.2 TOP: Chords, Secants and Tangents KEY: secant and tangent drawn from common point, angle

221 ANS: 1
PTS: 2 REF: 081916geo NAT: G.SRT.B.5 TOP: Similarity KEY: leg

222 ANS: 1
\[
h = \sqrt{6.5^2 - 2.5^2} = 6, \quad V = \frac{1}{3} \pi (2.5)^2 6 = 12.5\pi
\]
PTS: 2 REF: 011923geo NAT: G.GMD.A.3 TOP: Volume KEY: cones

223 ANS: 2
\[
\begin{align*}
\end{align*}
\]
Theresa. \((30 \times 15 \times (4 - 0.5)) \text{ ft}^3 \times \frac{7.48 \text{ g}}{1 \text{ ft}^3} \times \frac{3.95}{100 \text{ g}} = \$465.35,\ (\pi \times 12^2 \times (4 - 0.5)) \text{ ft}^3 \times \frac{7.48 \text{ g}}{1 \text{ ft}^3} \times \frac{200}{6000 \text{ g}} = \$394.79\)

\(\sin 38 = \frac{24.5}{x}\)

\(x \approx 40\)

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, \((0, \frac{3}{4}, -4 \cdot \frac{3}{4}) \rightarrow (0, -3)\). So the equation of the dilated line is \(y = \frac{3}{2} x - 3\).

Yes, because a dilation preserves angle measure.

\(\sqrt{40^2 - \left(\frac{64}{2}\right)^2} = 24\)

\(V = \frac{1}{3} \cdot (64)^2 \cdot 24 = 32768\)

\(\sqrt{8^2 + 6^2} = 10\) for one side
232 ANS: 4
\[-8 + \frac{2}{3}(10 - 8) = -8 + \frac{2}{3}(18) = -8 + 12 = 4 \quad 4 + \frac{2}{3}(-2 - 4) = 4 + \frac{2}{3}(-6) = 4 - 4 = 0\]

PTS: 2 \quad REF: 061919geo \quad NAT: G.GPE.B.6 \quad TOP: Directed Line Segments

233 ANS: 4
\[
\frac{18}{4.5} = 4
\]

PTS: 2 \quad REF: 011901geo \quad NAT: G.SRT.A.1 \quad TOP: Line Dilations

234 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 \quad REF: 011925geo \quad NAT: G.GPE.B.5 \quad TOP: Parallel and Perpendicular Lines
KEY: write equation of parallel line

235 ANS: 3
\[
\frac{1}{2} \times 24 = 12
\]

PTS: 2 \quad REF: 012009geo \quad NAT: G.CO.C.10 \quad TOP: Midsegments

236 ANS:
Quadrilateral $ABCD$ with diagonal $\overline{AC}$, segments $GH$, $EF$, $AE \cong CG$, $BE \cong DG$, $AH \cong CF$, 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 \quad REF: 011935geo \quad NAT: G.SRT.B.5 \quad TOP: Quadrilateral Proofs

237 ANS: 3
$\angle N$ is the smallest angle in $\triangle N YA$, so side $\overline{AY}$ is the shortest side of $\triangle NYA$. $\angle VYA$ is the smallest angle in $\triangle V YA$, so side $\overline{VA}$ is the shortest side of both triangles.

PTS: 2 \quad REF: 011919geo \quad NAT: G.CO.C.10 \quad TOP: Angle Side Relationship

238 ANS:
\[
m = \frac{5}{4}, \quad m_\perp = -\frac{4}{5} \quad y - 12 = -\frac{4}{5}(x - 5)
\]

PTS: 2 \quad REF: 012031geo \quad NAT: G.GPE.B.5 \quad TOP: Parallel and Perpendicular Lines
KEY: write equation of perpendicular line
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

240 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

241 ANS: 3

\[ M_x = \frac{-5 + -1}{2} = \frac{-6}{2} = -3 \quad M_y = \frac{5 + -1}{2} = \frac{4}{2} = 2 \]

PTS: 2  REF: 081902geo  NAT: G.GPE.B.4  TOP: Quadrilaterals in the Coordinate Plane
KEY: general

242 ANS: 2

\[ \frac{x}{15} = \frac{5}{12} \]

\[ x = 6.25 \]

PTS: 2  REF: 011906geo  NAT: G.SRT.B.5  TOP: Side Splitter Theorem

243 ANS: 1

\[ m = \frac{-A}{B} = \frac{-3}{2} \quad m_\perp = \frac{2}{3} \]

PTS: 2  REF: 081908geo  NAT: G.GPE.B.5  TOP: Parallel and Perpendicular Lines
KEY: identify perpendicular lines

244 ANS:

\[ \left(10 \times 6 + \sqrt{(7 - 6)(7 - 4)(7 - 4)}\right)(6.5) \approx 442 \]

PTS: 4  REF: 081934geo  NAT: G.GMD.A.3  TOP: Volume
KEY: compositions

245 ANS:

\[ \left(\frac{2.5}{3}\right)(\pi)\left(\frac{8.25}{2}\right)^2 \approx 134 \]

PTS: 2  REF: 081931geo  NAT: G.GMD.A.3  TOP: Volume
KEY: cylinders
\[ \Delta ABC \sim \Delta RST \]

PTS: 2  
REF: 011908geo  
NAT: G.SRT.B.5  
TOP: Similarity

KEY: basic

ANS: 3  
PTS: 2  
REF: 061924geo  
NAT: G.CO.C.11  
TOP: Special Quadrilaterals

\[ 108\pi = \frac{6^2 \cdot \pi h}{3} \]

\[ \frac{324\pi}{36\pi} = h \]

\[ 9 = h \]

PTS: 2  
REF: 012002geo  
NAT: G.GMD.A.3  
TOP: Volume

KEY: cones

ANS: 3  
PTS: 2  
REF: 081913geo  
NAT: G.CO.C.11  
TOP: Special Quadrilaterals

ANS: 3  
\[ \frac{10}{x} = \frac{15}{12} \]

\[ x = 8 \]

PTS: 2  
REF: 081918geo  
NAT: G.SRT.B.5  
TOP: Similarity

KEY: basic

ANS: 4  
\[ \sin x = \frac{10}{12} \]

\[ x \approx 56 \]

PTS: 2  
REF: 061922geo  
NAT: G.SRT.C.8  
TOP: Using Trigonometry to Find an Angle

ANS: 3  
\[ 2(2x + 8) = 7x - 2 \]

\[ AB = 7(6) - 2 = 40 \]

Since \( \overline{EF} \) is a midsegment, \( EF = \frac{40}{2} = 20 \). Since \( \Delta ABC \) is equilateral,

\[ 4x + 16 = 7x - 2 \]

\[ 18 = 3x \]

\[ 6 = x \]

\[ AE = BF = \frac{40}{2} = 20. \ 40 + 20 + 20 + 20 = 100 \]

PTS: 2  
REF: 061923geo  
NAT: G.CO.C.10  
TOP: Midsegments
253 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

254 ANS: 4 PTS: 2 REF: 011921geo NAT: G.GPE.B.4
TOP: Triangles in the Coordinate Plane

255 ANS:
\[ \frac{72}{360} \pi \left( 10^2 \right) = 20\pi \]

PTS: 2 REF: 061928geo NAT: G.C.B.5 TOP: Sectors

256 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

257 ANS: 2
Create two congruent triangles by drawing \(BD\), which has a length of 8. Each triangle has an area of \(\frac{1}{2} \times 8 \times 3 = 12\).

PTS: 2 REF: 012018geo NAT: G.GPE.B.7 TOP: Polygons in the Coordinate Plane

258 ANS: 2
\[ 90 - 57 = 33 \]

PTS: 2 REF: 061909geo NAT: G.SRT.C.7 TOP: Cofunctions

259 ANS: 1
\[ V = \frac{1}{2} \times \frac{4}{3} \pi r^3 = \frac{1}{2} \times \frac{4}{3} \pi \cdot \left( \frac{12.6}{2} \right)^3 \approx 523.7 \]

PTS: 2 REF: 061910geo NAT: G.GMD.A.3 TOP: Volume KEY: spheres

260 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
261 ANS: 
\[ \triangle ABE \cong \triangle CBD \text{ (given)}; \angle A \cong \angle C \text{ (CPCTC)}; \angle AFD \cong \angle CFE \text{ (vertical angles are congruent)}; \overline{AB} \cong \overline{CB}, \overline{DB} \cong \overline{EB} \text{ (CPCTC)}; \overline{AD} \cong \overline{CE} \text{ (segment subtraction)}; \triangle AFD \cong \triangle CFE \text{ (AAS)} \]

PTS: 4
KEY: proof

262 ANS: 2
\[ \tan 36^\circ = \frac{x}{8} \]
\[ 5.8 + 1.5 \approx 7 \]
\[ x \approx 5.8 \]

PTS: 2
KEY: G.SRT.C.8

263 ANS: 3
\[ -9 + \frac{1}{3} (9 - 9) = -9 + \frac{1}{3} (18) = -9 + 6 = -3 \]
\[ 8 + \frac{1}{3} (-4 - 8) = 8 + \frac{1}{3} (-12) = 8 - 4 = 4 \]

PTS: 2
KEY: G.GPE.B.6

264 ANS: 1
PTS: 2
KEY: advanced

265 ANS:
\[ \tan 30^\circ = \frac{y}{440} \]
\[ \tan 38.8^\circ = \frac{h}{440} \]
\[ y \approx 254 \quad h \approx 353.8 \]

PTS: 4
KEY: G.SRT.C.8

266 ANS:
\[ \angle Q \cong \angle M \quad \angle P \cong \angle N \quad \overline{QP} \cong \overline{MN} \]

PTS: 2
KEY: G.CO.B.7

267 ANS: 4
PTS: 2
KEY: G.CO.C.10

268 ANS: 4
PTS: 2
KEY: G.GMD.B.4

269 ANS: 1
PTS: 2
KEY: G.CO.C.10

270 ANS: 2
\[ m = \frac{-(2)}{3} = \frac{2}{3} \]

PTS: 2
KEY: write equation of parallel line
271 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

272 ANS: 3
\[ 4x + 3x + 13 = 90 \quad 4(11) < 3(11) + 13 \]
\[ 7x = 77 \quad 44 < 46 \]
\[ x = 11 \]

PTS: 2 REF: 012021geo NAT: G.SRT.C.7 TOP: Cofunctions

273 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

274 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

275 ANS: 2 PTS: 2 REF: 081901geo NAT: G.SRT.A.1
TOP: Line Dilations

276 ANS: 1
\[ \frac{6.5}{10.5} = \frac{5.2}{x} \]
\[ x = 8.4 \]

PTS: 2 REF: 012006geo NAT: G.CO.C.11 TOP: Trapezoids

277 ANS: 4 PTS: 2 REF: 081923geo NAT: G.CO.A.3
TOP: Mapping a Polygon onto Itself

278 ANS: 4
\[ 90 - 35 = 55 \quad 55 \times 2 = 110 \]

PTS: 2 REF: 012015geo NAT: G.CO.B.6 TOP: Properties of Transformations
KEY: basic
279 ANS: 2

The slope of $-3x + 4y = 8$ is $\frac{3}{4}$.

280 ANS: 2

281 ANS: 3

282 ANS:

\[
\frac{1}{2}(5)(12) = 30
\]

283 ANS:

\[
x^2 = 8 \times 12.5
\]

\[
x = 10
\]

284 ANS: 1

\[
\frac{1}{3} \pi (2)^2 \left(\frac{1}{2}ight) = 2
\]

\[
\frac{1}{3} \pi (1)^2 (1)
\]
<table>
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<tr>
<th>Question Number</th>
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| 285             | \[
\frac{2}{4} = \frac{8}{x + 2} \quad \text{and} \quad 14 + 2 = 16
\]
|                 | \[2x + 4 = 32\] | 2      | 012024geo | G.SRT.B.5         | Side Splitter Theorem |
|                 | \[x = 14\]     |        |           |                   |                   |
| 286             | 4                 | 2      | 081911geo | G.GMD.B.4         | Rotations of Two-Dimensional Objects |
| 287             | \[
\sin 4.76 = \frac{1.5}{x} \quad \text{and} \quad \tan 4.76 = \frac{1.5}{x} \quad 18 - \frac{16}{12} \approx 16.7
\]
|                 | \[x \approx 18.1\] | 4      | 011934geo | G.SRT.C.8         | Using Trigonometry to Find a Side |
| 288             | \[
\tan 56 = \frac{x}{1.3} \quad \sqrt{(1.3 \tan 56)^2 + 1.5^2} \approx 3.7
\]
|                 | \[x = 1.3 \tan 56\] | 4      | 012033geo | G.SRT.C.8         | Using Trigonometry to Find a Side |
| 289             | 3                 | 2      | 061912geo | G.CO.C.11         | Parallelograms |
| 290             | 2                 | 2      | 081909geo | G.CO.A.5          | Compositions of Transformations |
|                 | \[
\cos 65 = \frac{x}{15}
\]
|                 | \[x \approx 6.3\] | 1      |           |                   |                   |
| 292             | 3                 | 2      | 081924geo | G.SRT.C.8         | Using Trigonometry to Find a Side |
| 293             | \[
\frac{150}{360} \cdot 9^2 \pi = 33.75\pi
\]
|                 | \[x \approx 555\] | 2      | 012013geo | G.C.B.5           | Sectors |
| 294             | 2                 | 2      | 011913geo | G.SRT.C.8         | Using Trigonometry to Find a Side |
294 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

295 ANS: 2 PTS: 2 REF: 012012geo NAT: G.CO.C.10
TOP: Medians, Altitudes and Bisectors

296 ANS: 3

\[(6 - 2)180 = 720 \quad \frac{720}{6} = 120 \]

PTS: 2 REF: 012011geo NAT: G.CO.A.3 TOP: Mapping a Polygon onto Itself

297 ANS: 2

\[ V = \frac{1}{3} (8)^2 \cdot 6 = 128 \]

PTS: 2 REF: 061906geo NAT: G.GMD.A.3 TOP: Volume
KEY: pyramids

298 ANS: 1

\[ y = \frac{1}{2} x + 4 \quad \frac{2}{4} = \frac{1}{2} \]

\[ y = \frac{1}{2} x + 2 \]

PTS: 2 REF: 012008geo NAT: G.SRT.A.1 TOP: Line Dilations

299 ANS:
\[ r_y = 2 \circ r_y = \text{axis} \]

PTS: 2 REF: 081927geo NAT: G.CO.A.5 TOP: Compositions of Transformations
KEY: identify

300 ANS:

\[ \text{Diagram of a polygon with a 20° angle} \]


301 ANS: 4 PTS: 2 REF: 061901geo NAT: G.CO.A.5
TOP: Compositions of Transformations KEY: identify
302 ANS: 
\[ \angle D = 46^\circ \] because the angles of a triangle equal 180°. 
\[ \angle B = 46^\circ \] because opposite angles of a parallelogram are congruent.


303 ANS: 3
\[ 180 - (48 + 66) = 180 - 114 = 66 \]

PTS: 2   REF: 012001geo   NAT: G.CO.C.9   TOP: Lines and Angles

304 ANS:
\[ m_{AD} = \frac{0 - 6}{1 - 1} = -3 \]
\[ \overrightarrow{AD} \parallel \overrightarrow{BC} \] because their slopes are equal. \( ABCD \) is a trapezoid
\[ m_{BC} = \frac{-1 - 8}{6 - 3} = -3 \]

because it has a pair of parallel sides. 
\[ AC = \sqrt{(-1 - 6)^2 + (6 - 1)^2} = \sqrt{98} \]
\( ABCD \) is not an isosceles trapezoid
\[ BD = \sqrt{(8 - 0)^2 + (3 - 1)^2} = \sqrt{68} \]

because its diagonals are not congruent.

PTS: 4   REF: 061932geo   NAT: G.GPE.B.4   TOP: Quadrilaterals in the Coordinate Plane

305 ANS: 2
\( \triangle ABC \sim \triangle BDC \)
\[ \cos A = \frac{AB}{AC} = \frac{BD}{BC} \]

PTS: 2   REF: 012023geo   NAT: G.SRT.C.6   TOP: Trigonometric Ratios

306 ANS:
\( R_{90^\circ} \) or \( T_{2, -6} \circ R_{(-4,2), 90^\circ} \) 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

307 ANS: 4   PTS: 2   REF: 061904geo   NAT: G.CO.A.3
TOP: Mapping a Polygon onto Itself
308 ANS:

![Diagram of parallel and perpendicular lines](image1.png)

PTS: 2  REF: 012029geo  NAT: G.CO.D.12  TOP: Constructions
KEY: parallel and perpendicular lines

309 ANS: 4

![Diagram of triangle proofs](image2.png)

PTS: 2  REF: 061908geo  NAT: G.SRT.B.5  TOP: Triangle Proofs
KEY: statements

310 ANS: 1

\[-1 + \frac{1}{3}(8 - 1) = -1 + \frac{1}{3}(9) = -1 + 3 = 2 -3 + \frac{1}{3}(9 - 3) = -3 + \frac{1}{3}(12) = -3 + 4 = 1\]

PTS: 2  REF: 011915geo  NAT: G.GPE.B.6  TOP: Directed Line Segments

311 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

312 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

313 ANS: 1  PTS: 2  REF: 011922geo  NAT: G.SRT.C.7  TOP: Cofunctions
314 ANS: 3

315 ANS: 1

\[(x - 1)^2 + (y - 4)^2 = \left(\frac{10}{2}\right)^2\]

\[x^2 - 2x + 1 + y^2 - 8y + 16 = 25\]

\[x^2 - 2x + y^2 - 8y = 8\]

316 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); \(\angle HEA\) and \(\angle TAH\) 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); \(\overline{MA} \parallel \overline{TH}\) (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).

317 ANS: 4

\[\left(\frac{360 - 120}{360}\right)(\pi)(9^2) = 54\pi\]

318 ANS: 4

\[-7 + \frac{1}{4}(5 - 7) = -7 + \frac{1}{4}(12) = -7 + 3 = -4, -5 + \frac{1}{4}(3 - 5) = -5 + \frac{1}{4}(8) = -5 + 2 = -3\]

319 ANS: 3

Broome: \(\frac{200536}{706.82} \approx 284\) Dutchess: \(\frac{280150}{801.59} \approx 349\) Niagara: \(\frac{219846}{522.95} \approx 420\) Saratoga: \(\frac{200635}{811.84} \approx 247\)

320 ANS: 4

Broome: \(\frac{200536}{706.82} \approx 284\) Dutchess: \(\frac{280150}{801.59} \approx 349\) Niagara: \(\frac{219846}{522.95} \approx 420\) Saratoga: \(\frac{200635}{811.84} \approx 247\)
321 ANS:
\[ 8 \times 3 \times \frac{1}{12} \times 43 = 86 \]

PTS: 2 REF: 012027geo NAT: G.MG.A.2 TOP: Density

322 ANS: 2
\[ ER = \sqrt{17^2 - 8^2} = 15 \]

PTS: 2 REF: 061917geo NAT: G.CO.C.11 TOP: Special Quadrilaterals

323 ANS: 2 PTS: 1 REF: 012017geo NAT: G.CO.A.5
TOP: Compositions of Transformations KEY: identify

324 ANS: 2
The line \( x = -2 \) will be tangent to the circle at \((-2, -4)\). A segment connecting this point and \((2, -4)\) is a radius of the circle with length 4.

PTS: 2 REF: 012020geo NAT: G.GPE.A.1 TOP: Equations of Circles
KEY: other

325 ANS:
Quadrilateral \( ABCD \), \( E \) and \( F \) are points on \( BC \) and \( AD \), respectively, and \( \overline{BGD} \) and \( \overline{EGF} \) are drawn such that \( \angle ABG \cong \angle CDG \), \( AB \cong CD \), and \( CE \cong AF \) (given); \( \overline{BD} \cong \overline{BD} \) (reflexive); \( \Delta ABD \cong \Delta CDB \) (SAS); \( \overline{BC} \cong \overline{DA} \) (CPCTC); \( BE + CE \cong AF + DF \) (segment addition); \( \overline{BE} \cong \overline{DF} \) (segment subtraction); \( \angle BGE \cong \angle DGF \) (vertical angles are congruent); \( \angle CBD \cong \angle ADB \) (CPCTC); \( \Delta EBG \cong \Delta FDG \) (AAS); \( \overline{FG} \cong \overline{EG} \) (CPCTC).


326 ANS: 2 PTS: 2 REF: 061903geo NAT: G.GMD.B.4
TOP: Rotations of Two-Dimensional Objects

327 ANS:

PTs: 2 REF: 011929geo NAT: G.CO.D.12 TOP: Constructions
KEY: equilateral triangles

328 ANS:
\[ 17x = 15^2 \]
\[ 17x = 225 \]
\[ x \approx 13.2 \]

PTS: 2 REF: 061930geo NAT: G.SRT.B.5 TOP: Similarity
KEY: leg
329 ANS: 4
\[ x^2 = 10.2 \times 14.3 \]
\[ x \approx 12.1 \]

PTS: 2  REF: 012016geo  NAT: G.SRT.B.5  TOP: Similarity
KEY: leg
330 ANS: 4
d) is SSA

PTS: 2  REF: 061914geo  NAT: G.CO.B.7  TOP: Triangle Congruency
331 ANS:
\[ \text{Quadrilateral } NATS \text{ is a rhombus} \]
\[ \sqrt{5^2 + 5^2} = \sqrt{7^2 + 1^2} = \sqrt{5^2 + 5^2} = \sqrt{7^2 + 1^2} \]
\[ \sqrt{50} = \sqrt{50} = \sqrt{50} = \sqrt{50} \]

because all four sides are congruent.

PTS: 4  REF: 012032geo  NAT: G.GPE.B.4  TOP: Quadrilaterals in the Coordinate Plane
KEY: grids
333 ANS:

\[
(7^2)18\pi = 16x^2 \quad \frac{80}{13.2} \approx 6.1 \quad \frac{60}{13.2} \approx 4.5 \quad 6 \times 4 = 24
\]

\[13.2 \approx x\]

PTS: 4 REF: 012034geo NAT: G.GMD.A.3 TOP: Volume
KEY: cylinders

334 ANS:

\[
\sin^{-1}\left(\frac{5}{25}\right) \approx 11.5
\]

PTS: 2 REF: 081926geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find an Angle

335 ANS:

No. The midpoint of \(DF\) 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

336 ANS:

\[30^\circ \triangle CAD\text{ is an equilateral triangle, so } \angle CAB = 60^\circ. \text{ Since } \overrightarrow{AD}\text{ is an angle bisector, } \angle CAD = 30^\circ.\]

PTS: 2 REF: 081929geo NAT: G.CO.D.12 TOP: Constructions
KEY: equilateral triangles

337 ANS: 1 PTS: 2 REF: 012022geo NAT: G.SRT.A.2 TOP: Compositions of Transformations
KEY: grids


339 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

340 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
KEY: leg

341 ANS: 2 PTS: 2 REF: 012003geo NAT: G.SRT.B.5 TOP: Similarity
KEY: basic
342 ANS:
\[ \frac{6}{14} = \frac{9}{21} \text{ SAS} \]
126 = 126

PTS: 2  REF: 081529geo  NAT: G.SRT.B.5  TOP: Similarity
KEY: basic

343 ANS:
\[ R_{(-5,2),90°} \circ T_{-3,1} \circ r_{x-axis} \]

PTS: 2  REF: 011928geo  NAT: G.CO.A.5  TOP: Compositions of Transformations
KEY: identify

344 ANS:
\[ \frac{120}{230} = \frac{x}{315} \]
\[ x = 164 \]

PTS: 2  REF: 081527geo  NAT: G.SRT.B.5  TOP: Similarity
KEY: basic

345 ANS: 3
\[ 5 \cdot \frac{10}{4} = \frac{50}{4} = 12.5 \]

PTS: 2  REF: 081512geo  NAT: G.C.A.2  TOP: Chords, Secants and Tangents
KEY: common tangents

346 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).
\( (0,-4) \). \( AD = \sqrt{(1-0)^2 + (2-4)^2} = \sqrt{37}, \quad CD = \sqrt{(-6-0)^2 + (-3-4)^2} = \sqrt{37}, \)
\[ m_{AB} = \frac{3-2}{-5-1} = -\frac{1}{6}, \quad m_{CD} = \frac{3-3}{-5-6} = 0 \] (because all four sides are congruent, consecutive sides are perpendicular since slopes are opposite reciprocals and so \( \angle B \) is a right angle).

PTS: 6  REF: 081935geo  NAT: G.GPE.B.4  TOP: Quadrilaterals in the Coordinate Plane
KEY: grids
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); $AC \cong BC = \sqrt{34}$ (distance formula); $\triangle ABC$ is an isosceles triangle (an isosceles triangle has two congruent sides).
\[ \frac{4}{3} \pi \times \left( \frac{1.68}{2} \right)^3 \times 0.6523 \approx 1.62 \]

**PTS:** 2  
**REF:** 081914geo  
**NAT:** G.MG.A.2  
**TOP:** Density

\[ \frac{x}{4} = \frac{6}{9} \]

\[ x = 6 \]

**PTS:** 2  
**REF:** 061915geo  
**NAT:** G.SRT.B.5  
**TOP:** Similarity

**KEY:** basic
Geometry Regents at Random Worksheets
Answer Section

357 ANS: 2

\[14 \times 16 \times 10 = 2240 \quad \frac{2240 - 1680}{2240} = 0.25\]

PTS: 2 \quad REF: 011604geo \quad NAT: G.GMD.A.3 \quad TOP: Volume
KEY: prisms

358 ANS:

\[\frac{40000}{\pi \left( \frac{51}{2} \right)^2} \approx 19.6 \quad \frac{72000}{\pi \left( \frac{75}{2} \right)^2} \approx 16.3\] Dish A

PTS: 2 \quad REF: 011630geo \quad NAT: G.MG.A.2 \quad TOP: Density

359 ANS: 1 \quad PTS: 2 \quad REF: 081603geo \quad NAT: G.GMD.B.4
TOP: Rotations of Two-Dimensional Objects

360 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 (\(TS, SR, RP, PT\) 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.

\[\sin 70 = \frac{x}{20}\]

\[x \approx 18.8\]

PTS: 6 \quad REF: 061536geo \quad NAT: G.GPE.B.4 \quad TOP: Quadrilaterals in the Coordinate Plane
KEY: grids

361 ANS: 4

\[\sin 70 = \frac{x}{20}\]

\[x \approx 18.8\]

PTS: 2 \quad REF: 061611geo \quad NAT: G.SRT.C.8 \quad TOP: Using Trigonometry to Find a Side
KEY: without graphics
362 ANS:
\[ \frac{2}{5} \cdot (16 - 1) = 6 \quad \frac{2}{5} \cdot (14 - 4) = 4 \quad (1 + 6,4 + 4) = (7,8) \]

PTS: 2 REF: 081531geo NAT: G.GPE.B.6 TOP: Directed Line Segments

363 ANS:
\[ \ell: y = 3x - 4 \]
\[ m: y = 3x - 8 \]

PTS: 2 REF: 011631geo NAT: G.SRT.A.1 TOP: Line Dilations

364 ANS: \[ \sqrt{20^2 - 10^2} \approx 17.3 \]

PTS: 2 REF: 081608geo NAT: G.SRT.C.8 TOP: 30-60-90 Triangles

365 ANS: \[ \frac{9}{5} = \frac{9.2}{x} \]
\[ 5.1 + 9.2 = 14.3 \]
\[ 9x = 46 \]
\[ x \approx 5.1 \]

PTS: 2 REF: 061511geo NAT: G.SRT.B.5 TOP: Side Splitter Theorem

366 ANS: Reflections are rigid motions that preserve distance.

PTS: 2 REF: 061530geo NAT: G.CO.B.7 TOP: Triangle Congruency

367 ANS: \[ \frac{360^\circ}{45^\circ} = 8 \]

PTS: 2 REF: 061510geo NAT: G.CO.A.3 TOP: Mapping a Polygon onto Itself

368 ANS: \[ -5 + \frac{3}{5} (5 - 5) = -4 + \frac{3}{5} (1 - 4) \]
\[ -5 + \frac{3}{5} (10) = -4 + \frac{3}{5} (5) \]
\[ -5 + 6 = -4 + 3 \]
\[ 1 = 1 \]

PTS: 2 REF: spr1401geo NAT: G.GPE.B.6 TOP: Directed Line Segments

370 ANS: 2

371 ANS: 2
\[ \sqrt{3 \cdot 21} = \sqrt{63} = 3\sqrt{7} \]

372 ANS:
\[ V = \frac{1}{3} \pi \left( \frac{3}{2} \right)^2 \cdot 8 \approx 18.85 \cdot 100 = 1885 \]
\[ 1885 \cdot 0.52 \cdot 0.10 = 98.02 \]
\[ 1.95(100) - (37.83 + 98.02) = 59.15 \]

373 ANS: 3
\[ \theta = \frac{s}{r} = \frac{2\pi}{10} = \frac{\pi}{5} \]

374 ANS: 2
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, \( \left( 0 - \frac{3}{2}, -4 - \frac{3}{2} \right) \rightarrow (0,-6) \). So the equation of the dilated line is \( y = 2x - 6 \).

375 ANS: 3

376 ANS: 3

377 ANS: 1
\[ \frac{1}{2} \left( \frac{4}{3} \right) \pi \cdot 5^3 \cdot 62.4 \approx 16,336 \]

378 ANS: 4
379 ANS:

\[
\tan 3.47 = \frac{M}{6336} \quad \text{tan} 0.64 = \frac{A}{20,493}
\]

\[
M \approx 384 \\
A \approx 229 \\
4960 + 384 = 5344 \\
5344 - 229 = 5115
\]

PTS: 6  REF: fall1413geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find a Side

KEY: advanced

380 ANS: 4

\[
\begin{align*}
-2 - 1 &= -3 \\
-1 - 3 &= -2 \\
0 - 5 &= -5 \\
3 - 1 &= 2 \\
5 - 1 &= 6 \\
3 - 2 &= 4
\end{align*}
\]

PTS: 2  REF: 081522geo  NAT: G.GPE.B.4  TOP: Quadrilaterals in the Coordinate Plane

KEY: general

381 ANS:

\[s = \theta \cdot r\]

Yes, both angles are equal.

\[
\begin{align*}
\pi &= A \cdot 4 \\
\frac{13\pi}{8} &= B \cdot 6.5 \\
\pi &= A \\
\frac{\pi}{4} &= B
\end{align*}
\]


KEY: arc length

382 ANS:

\[M = 180 - (47 + 57) = 76\]

Rotations do not change angle measurements.

PTS: 2  REF: 081629geo  NAT: G.CO.B.6  TOP: Properties of Transformations

383 ANS:

\[
\begin{align*}
\pi \cdot 11.25^2 \cdot 33.5 &= 231 \\
\approx 57.7
\end{align*}
\]

PTS: 4  REF: 081632geo  NAT: G.GMD.A.3  TOP: Volume

KEY: cylinders

384 ANS: 3  PTS: 2  REF: 081515geo  NAT: G.C.A.3  TOP: Inscribed Quadrilaterals

385 ANS:

\[
\begin{align*}
\tan 7 &= \frac{125}{x} \\
\tan 16 &= \frac{125}{y} \\
1018 - 436 &\approx 582
\end{align*}
\]

\[
\begin{align*}
x &\approx 1018 \\
y &\approx 436
\end{align*}
\]

PTS: 4  REF: 081532geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find a Side

KEY: advanced
\[ \cos A = \frac{9}{14} \]
\[ A \approx 50^\circ \]

**387 ANS:**
A dilation of 5\( \frac{5}{2} \) about the origin. Dilations preserve angle measure, so the triangles are similar by AA.

**388 ANS:**
\[ \frac{x}{360} \cdot 3^2 \pi = 2\pi \]
\[ 180 - 80 = 100 \]
\[ x = 80 \]
\[ \frac{180 - 100}{2} = 40 \]

**390 ANS:**
\[ V = 12 \cdot 8.5 \cdot 4 = 408 \]
\[ W = 408 \cdot 0.25 = 102 \]

**391 ANS:**
As the sum of the measures of the angles of a triangle is 180°, \( m\angle ABC + m\angle BCA + m\angle CAB = 180^\circ \). Each interior angle of the triangle and its exterior angle form a linear pair. Linear pairs are supplementary, so \( m\angle ABC + m\angle FBC = 180^\circ \), \( m\angle BCA + m\angle DCA = 180^\circ \), and \( m\angle CAB + m\angle EAB = 180^\circ \). 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.
\[ \frac{1.65}{4.15} = \frac{x}{16.6} \]
\[ 4.15x = 27.39 \]
\[ x = 6.6 \]

PTS: 2  REF: 061531geo  NAT: G.SRT.B.5  TOP: Similarity
KEY: basic

ANS: 4  PTS: 2  REF: 081514geo  NAT: G.SRT.A.2
TOP: Compositions of Transformations  KEY: grids

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

ANS:
\[ \sin x = \frac{4.5}{11.75} \]
\[ x \approx 23 \]

PTS: 2  REF: 061528geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find an Angle

ANS:
\[ \tan 47 = \frac{x}{8.5} \]
Cone: \(V = \frac{1}{3} \pi(8.5)^2(9.115) \approx 689.6\)  Cylinder: \(V = \pi(8.5)^2(25) \approx 5674.5\)  Hemisphere:
\[ V = \frac{1}{2} \left( \frac{4}{3} \pi(8.5)^3 \right) \approx 1286.3 \quad 689.6 + 5674.5 + 1286.3 \approx 7650 \quad \text{No, because} \quad 7650 \cdot 62.4 = 477,360 \]
\[ 477,360 \cdot .85 = 405,756, \text{which is greater than} 400,000. \]


ANS: 4  PTS: 2  REF: 061513geo  NAT: G.CO.C.11
TOP: Parallelograms

ANS: 2
\[ \frac{4}{3} \pi \cdot 4^3 + 0.075 \approx 20 \]

PTS: 2  REF: 011619geo  NAT: G.MG.A.2  TOP: Density
\[
180 - 2(30) = 120
\]

No, the weight of the bricks is greater than 900 kg. \(500 \times (5.1 \text{ cm} \times 10.2 \text{ cm} \times 20.3 \text{ cm}) = 528,003 \text{ cm}^3\).

\[
528,003 \text{ cm}^3 \times \frac{1 \text{ m}^3}{1000000 \text{ cm}^3} = 0.528003 \text{ m}^3. \quad \frac{1920 \text{ kg}}{\text{ m}^3} \times 0.528003 \text{ m}^3 \approx 1013 \text{ kg}.
\]

\[
\frac{12}{4} = \frac{36}{x}
\]

\[12x = 144\]

\[x = 12\]

Alternate interior angles

\[
\frac{12}{9} = \frac{4}{3}
\]

1) AA 2) \(\frac{32}{16} \neq \frac{8}{2}\) 4) SAS

\[
V = \pi \left(\frac{6.7}{2}\right)^2 (4 \cdot 6.7) \approx 945
\]

\[
\frac{60}{360} \cdot 6^2 \pi = 6\pi
\]
ANS: 3
\[
x = \frac{6}{4} \quad CD = 15 - 4 = 11
\]
\[
x = 15
\]

PTS: 2  REF: 081612geo  NAT: G.SRT.B.5  TOP: Similarity
KEY: basic

ANS:
(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


ANS: 3  PTS: 2  REF: 011621geo  NAT: G.C.A.2
TOP: Chords, Secants and Tangents  KEY: inscribed

ANS: 1
\[
3^2 = 9
\]

PTS: 2  REF: 081520geo  NAT: G.SRT.A.2  TOP: Dilations

ANS:
\[
M \left( \frac{4+0}{2}, \frac{6-1}{2} \right) = M \left( \frac{2}{2}, \frac{5}{2} \right) \quad m = \frac{6-1}{4-0} = \frac{7}{4} \quad m_{\perp} = -\frac{4}{7} \quad y - 2.5 = -\frac{4}{7} (x - 2) \quad \text{The diagonals, } MT \text{ and } AH \text{, of rhombus } MATH \text{ are perpendicular bisectors of each other.}
\]

PTS: 4  REF: fall1411geo  NAT: G.GPE.B.4  TOP: Quadrilaterals in the Coordinate Plane
KEY: grids

ANS: 4
\[
\sqrt{(32-8)^2 + (28-4)^2} = \sqrt{576 + 1024} = \sqrt{1600} = 40
\]

PTS: 2  REF: 081621geo  NAT: G.SRT.A.1  TOP: Line Dilations

ANS:
\[
\triangle \text{CAB} \cong \triangle \text{CAB} \quad \text{SAS } \cong \text{ SAS}
\]

PTS: 4  REF: 011634geo  NAT: G.CO.D.12  TOP: Constructions
KEY: congruent and similar figures
\[ V = \frac{4}{3} \pi \left( \frac{10}{2} \right)^3 \approx 261.8 \cdot 62.4 = 16,336 \]

PTS: 2  REF: 081516geo  NAT: G.MG.A.2  TOP: Density

\[ \frac{3.75}{5} = \frac{4.5}{6} \]

\[ AB \] is parallel to \[ CD \] because \[ AB \] divides the sides proportionately.

\[ 39.375 = 39.375 \]

PTS: 2  REF: 061627geo  NAT: G.SRT.B.5  TOP: Side Splitter Theorem

\[ m = -\frac{2}{3} \]

\[ 1 = \left( -\frac{2}{3} \right) 6 + b \]

\[ 1 = -4 + b \]

\[ 5 = b \]

PTS: 2  REF: 081510geo  NAT: G.GPE.B.5  TOP: Parallel and Perpendicular Lines

KEY: write equation of parallel line

Quadrilateral \[ ABCD \] with diagonals \[ AC \] and \[ BD \] that bisect each other, and \( \angle 1 \cong \angle 2 \) (given); quadrilateral \[ ABCD \] is a parallelogram (the diagonals of a parallelogram bisect each other); \[ AB \parallel CD \] (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).


Parallelogram \[ ABCD \], \( \overline{BE} \perp \overline{CED} \), \( \overline{DF} \perp \overline{BFC} \), \( \overline{CE} \parallel \overline{CF} \) (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). \( \overline{BC} \cong \overline{CD} \) (CPCTC). \[ ABCD \] is a rhombus (a parallelogram with consecutive congruent sides is a rhombus).

PTS: 6  REF: 081535geo  NAT: G.SRT.B.5  TOP: Quadrilateral Proofs

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
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.

\[
\frac{360}{6} = 60
\]

PTS: 2  REF: 081627geo  NAT: G.CO.A.3  TOP: Mapping a Polygon onto Itself
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 $y = -2x + 4$. 

\[
\frac{f}{4} = \frac{15}{6} \\
\frac{f}{6} = 10
\]

The length of $A'C'$ is twice $AC$. 

\[
\frac{4}{6} = \frac{15}{2}
\]
430 ANS: 4 PTS: 2 REF: 011609geo NAT: G.SRT.C.7 TOP: Cofunctions

431 ANS: 1
\[ x^2 - 4x + 4 + y^2 + 8y + 16 = -11 + 4 + 16 \]
\[ (x - 2)^2 + (y + 4)^2 = 9 \]

PTS: 2 REF: 081616geo NAT: G.GPE.A.1 TOP: Equations of Circles KEY: completing the square

432 ANS: 3
\[ \tan 34^\circ = \frac{T}{20} \]
\[ T \approx 13.5 \]

PTS: 2 REF: 061505geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side KEY: graphics

433 ANS: 3
\[ \frac{12}{4} = \frac{x}{5} \]
\[ 15 - 4 = 11 \]
\[ x = 15 \]

PTS: 2 REF: 011624geo NAT: G.SRT.B.5 TOP: Similarity KEY: basic

434 ANS: 2
\[ \frac{11}{1.2 \text{ oz}} \left( \frac{16 \text{ oz}}{1 \text{ lb}} \right) = \frac{13.31}{\text{ lb}} \left( \frac{1 \text{ g}}{3.7851 \text{ lb}} \right) \approx \frac{3.5 \text{ g}}{1 \text{ lb}} \]

PTS: 2 REF: 061618geo NAT: G.MG.A.2 TOP: Density

435 ANS: 1
\[ \frac{1000}{20\pi} \approx 15.9 \]

PTS: 2 REF: 011623geo NAT: G.GMD.A.1 TOP: Circumference

436 ANS: 3
\[ A = \frac{1}{2} ab \]
\[ 3 - 6 = -3 = x \]
\[ 24 = \frac{1}{2} a(8) \]
\[ \frac{4 + 12}{2} = 8 = y \]
\[ a = 6 \]

PTS: 2 REF: 081615geo NAT: G.GPE.B.7 TOP: Polygons in the Coordinate Plane
437 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

438 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

439 ANS: 1
PTS: 2 REF: 081605geo NAT: G.CO.A.5
TOP: Rotations KEY: grids

440 ANS: 4
PTS: 2 REF: 061608geo NAT: G.SRT.A.2
TOP: Compositions of Transformations KEY: grids

441 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

442 ANS: 4
\[
\frac{1}{2} = \frac{x + 3}{3x - 1}
\]
\[GR = 3(7) - 1 = 20\]
\[3x - 1 = 2x + 6\]
\[x = 7\]

PTS: 2 REF: 011620geo NAT: G.SRT.B.5 TOP: Similarity
KEY: basic

443 ANS: 4
\[
\frac{2}{6} = \frac{5}{15}
\]

PTS: 2 REF: 081517geo NAT: G.SRT.B.5 TOP: Side Splitter Theorem

444 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
Equal cofunctions are complementary.

\[ 73 + R = 90 \]

\[ R = 17 \]

\[ \frac{6}{8} = \frac{9}{12} \]

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.

\[ \tan x = \frac{69}{102} \]

\[ x \approx 34.1 \]

\[ r = \sqrt{(7-3)^2 + (1-(-2))^2} = \sqrt{16 + 9} = 5 \]

\[ C = \pi d \quad V = \pi \left( \frac{2.25}{\pi} \right)^2 \cdot 8 \approx 12.8916 \quad W = 12.8916 \cdot 752 \approx 9694 \]

\[ 4.5 = \pi d \]

\[ \frac{4.5}{\pi} = d \]

\[ \frac{2.25}{\pi} = r \]

\[ \frac{3}{8} \cdot 56 = 21 \]

\[ W = 12.8916 \cdot 752 \approx 9694 \]
1) only proves AA; 2) need congruent legs for HL; 3) SAS; 4) only proves product of altitude and base is equal

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 $-\frac{2}{3}$.

Parallel line $\overline{AW}$ and $\overline{DE}$ bisecting $\overline{NWD}$ and $\overline{REA}$ at points $W$ and $E$ (Given). $\overline{AN} \cong \overline{RD}$, $\overline{AR} \cong \overline{DN}$ (Opposite sides of a parallelogram are congruent). $\angle ADE = \frac{1}{2} \angle AWR$, $\angle WDE = \frac{1}{2} \angle DNR$, so $\overline{AE} \cong \overline{WD}$ (Definition of bisect and division property of equality). $\overline{AR} \parallel \overline{DN}$ (Opposite sides of a parallelogram are parallel). $\overline{AWDE}$ is a parallelogram (Definition of parallelogram). $\overline{RE} = \frac{1}{2} \overline{AR}$, $\overline{NW} = \frac{1}{2} \overline{DN}$, so $\overline{AE} \cong \overline{WD}$ (Definition of bisect and division property of equality). $\overline{ED} \cong \overline{AW}$ (Opposite sides of a parallelogram are congruent). $\triangle ANW \cong \triangle DRE$ (SSS).

$\sin 70 = \frac{30}{L}$

$L \approx 32$

$x^2 + 4x + 4 + y^2 - 6y + 9 = 12 + 4 + 9$

$(x + 2)^2 + (y - 3)^2 = 25$
461 ANS:  
\( T_{6,0} \circ r_{x\text{-axis}} \)

PTS: 2  REF: 061625geo  NAT: G.CO.A.5  TOP: Compositions of Transformations

462 ANS: 2
\[ h^2 = 30 \cdot 12 \]
\[ h^2 = 360 \]
\[ h = 6\sqrt{10} \]

PTS: 2  REF: 061613geo  NAT: G.SRT.B.5  TOP: Similarity

463 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

464 ANS: 3

(3) Could be a trapezoid.

PTS: 2  REF: 081607geo  NAT: G.CO.C.11  TOP: Parallelograms


466 ANS:
Circle \( O \), chords \( \overline{AB} \) and \( \overline{CD} \) intersect at \( E \) (Given); Chords \( \overline{CB} \) and \( \overline{AD} \) 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).

PTS: 6  REF: 081635geo  NAT: G.SRT.B.5  TOP: Circle Proofs

467 ANS: 4
The line \( y = 3x - 1 \) passes through the center of dilation, so the dilated line is not distinct.

PTS: 2  REF: 081524geo  NAT: G.SRT.A.1  TOP: Line Dilations

468 ANS: 4
\[ x^2 + 6x + 9 + y^2 - 4y + 4 = 23 + 9 + 4 \]
\[ (x + 3)^2 + (y - 2)^2 = 36 \]

PTS: 2  REF: 011617geo  NAT: G.GPE.A.1  TOP: Equations of Circles

KEY: completing the square
\[ 4x - .07 = 2x + .01 \]

\[ 4x = 2.08 \]

\[ x = 0.4 \]

\[ \sin A \] 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, \( \sin A = \cos B \).

\[ m_{RT} = \frac{5 - 3}{4 - 2} = \frac{2}{2} = 1 \]

\[ m_{ST} = \frac{5 - 2}{4 - 2} = \frac{3}{2} \]

Slopes are opposite reciprocals, so lines form a right angle.

\[ (x^2 - 1)^2 + (y + 2)^2 = 4^2 \]

\[ (3.4 - 1)^2 + (1.2 + 2)^2 = 16 \]

\[ 5.76 + 10.24 = 16 \]

\[ 16 = 16 \]

\[ \frac{4}{3} \left( \frac{9.5}{2} \right)^3 \approx 55 \]

\[ \frac{4}{3} \left( \frac{2.5}{2} \right)^3 \]

\[ \text{KEY: spheres} \]
476 ANS: 1
\[180 - (68 \cdot 2)\]

PTS: 2 REF: 081624geo NAT: G.CO.C.11 TOP: Interior and Exterior Angles of Polygons

477 ANS: 1 PTS: 2 REF: 081505geo NAT: G.CO.A.3
TOP: Mapping a Polygon onto Itself

478 ANS: 3


479 ANS:
Circle \(O\), secant \(ACD\), tangent \(AB\) (Given). Chords \(BC\) and \(BD\) are drawn (Auxiliary lines). \(\angle A \cong \angle A\), \(BC \cong BC\) (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).

480 ANS: 6 REF: spr1413geo NAT: G.SRT.B.5 TOP: Circle Proofs

\[\frac{7}{12} \cdot 30 = 17.5\]

481 ANS: 2

PTS: 2 REF: 061521geo NAT: G.SRT.B.5 TOP: Similarity KEY: perimeter and area

482 ANS: 2 PTS: 2 REF: 081513geo NAT: G.CO.A.2
TOP: Identifying Transformations KEY: graphics

483 ANS: 1 PTS: 2 REF: 081606geo NAT: G.SRT.C.7
TOP: Cofunctions

484 ANS: 3 PTS: 2 REF: 061524geo NAT: G.CO.B.7
TOP: Triangle Congruency
485 \[ m = -\frac{1}{2}, \quad -4 = 2(6) + b \]
\[ m_{\perp} = 2, \quad -4 = 12 + b \]
\[ -16 = b \]

486

\[ \text{Circle } A \text{ can be mapped onto circle } B \text{ by first translating circle } A \text{ along vector } AB \text{ such that } A \text{ maps onto } B, \text{ and then dilating circle } A, \text{ centered at } A, \text{ by a scale factor of } \frac{5}{3}. \text{ Since there exists a sequence of transformations that maps circle } A \text{ onto circle } B, \text{ circle } A \text{ is similar to circle } B. \]

487 \[ 2592276 = \frac{1}{3} \cdot s^2 \cdot 146.5 \]
\[ 230 \approx s \]

488 \[ m_{TA} = -1, \quad y = mx + b \]
\[ m_{EM} = 1, \quad 1 = 1(2) + b \]
\[ -1 = b \]

489 \[ \text{ANS: } 2, \text{ PTS: } 2 \]
\[ \text{REF: } 061603geo, \text{ NAT: } G.GPE.A.1, \text{ TOP: } \text{Equations of Circles} \]
\[ \text{KEY: } \text{find center and radius | completing the square} \]

490 \[ \text{ANS: } 4 \]

491 \[ \text{ANS: } 4, \text{ PTS: } 2 \]
\[ \text{REF: } 011611geo, \text{ NAT: } G.CO.B.6, \text{ TOP: } \text{Properties of Transformations} \]
\[ \text{KEY: } \text{graphics} \]
Since linear angles are supplementary, \( m\angle GIH = 65^\circ \). Since \( \overline{GH} \cong \overline{IH} \), \( m\angle GHI = 50^\circ \) \((180° - (65 + 65))\). Since \( \angle EGB \cong \angle GHI \), the corresponding angles formed by the transversal and lines are congruent and \( AB \parallel CD \).

The transformation is a rotation, which is a rigid motion.
\[ \triangle XYZ, \overline{XY} \cong \overline{YZ}, \text{ and } \overline{YW} \text{ bisects } \angle XYZ \text{ (Given). } \triangle XYZ \text{ is isosceles (Definition of isosceles triangle). } \overline{YW} \text{ is an altitude of } \triangle XYZ \text{ (The angle bisector of the vertex of an isosceles triangle is also the altitude of that triangle). } \overline{YW} \perp \overline{XZ} \text{ (Definition of altitude). } \angle YWZ \text{ is a right angle (Definition of perpendicular lines).} \]

**502** ANS:
\[
\tan x = \frac{12}{75} \quad \tan y = \frac{72}{75} \\
x \approx 9.09 \quad y \approx 43.83
\]

**PTS:** 4  
**REF:** spr1411geo  
**NAT:** G.CO.C.10  
**TOP:** Triangle Proofs

**503** ANS:
\[
\tan x = \frac{10}{4} \\
x \approx 68
\]

**PTS:** 2  
**REF:** 081634geo  
**NAT:** G.SRT.C.8  
**TOP:** Using Trigonometry to Find an Angle

**504** ANS:
\[ x \text{ is } \frac{1}{2} \text{ the circumference. } \frac{C}{2} = \frac{10\pi}{2} \approx 16 \]

**PTS:** 2  
**REF:** 061523geo  
**NAT:** G.GMD.A.1  
**TOP:** Circumference

**505** ANS:
\[
\text{Translations preserve distance. If point } D \text{ is mapped onto point } A, \text{ point } F \text{ would map onto point } C. \quad \triangle DEF \cong \triangle ABC \text{ as } AC \cong DF \text{ and points are collinear on line } \ell \text{ and a reflection preserves distance.} 
\]

**PTS:** 4  
**REF:** 081534geo  
**NAT:** G.CO.B.7  
**TOP:** Triangle Congruency

**507** ANS:
\[
\text{PTS: } 2 \quad \text{REF: } 011606geo \quad \text{NAT: G.CO.C.9}  
\]

**TOP:** Lines and Angles
508 ANS:

\[ r = 25 \text{ cm} \left(\frac{1 \text{ m}}{100 \text{ cm}}\right) = 0.25 \text{ m} \quad V = \pi (0.25 \text{ m})^2 (10 \text{ m}) = 0.625\pi \text{ m}^3 \quad W = 0.625\pi \text{ m}^3 \left(\frac{380 \text{ K}}{1 \text{ m}^3}\right) \approx 746.1 \text{ K} \]

\[ n = \frac{\$50,000}{\left(\frac{\$4.75}{\text{K}}\right)(746.1 \text{ K})} = 14.1 \quad \text{15 trees} \]

PTS: 4  REF: spr1412geo  NAT: G.MG.A.2  TOP: Density

509 ANS:

\[ x = \sqrt{.55^2 - 2.5^2} \approx 0.49 \quad \text{No,} \quad .49^2 = .25 \quad .9604 + .25 < 1.5 \]

\[ .9604 = y \]

PTS: 4  REF: 061534geo  NAT: G.SRT.B.5  TOP: Similarity

KEY: leg

510 ANS: 1  PTS: 2  REF: 011608geo  NAT: G.CO.A.5  TOP: Compositions of Transformations

KEY: identify

511 ANS:

\[ \triangle MNO \text{ is congruent to } \triangle PNO \text{ by SAS.} \quad \text{Since} \quad \triangle MNO \cong \triangle PNO, \text{ then} \quad \overline{MO} \cong \overline{PO} \text{ by CPCTC.} \quad \text{So} \quad \overline{NO} \text{ must divide} \quad \overline{MP} \text{ in half, and} \quad MO = 8. \]

PTS: 2  REF: fall1405geo  NAT: G.CO.C.10  TOP: Medians, Altitudes and Bisectors

512 ANS:

\[ V = \frac{1}{3} \pi \left(\frac{8.3}{2}\right)^2 (10.2) + \frac{1}{2} \cdot \frac{4}{3} \pi \left(\frac{8.3}{2}\right)^3 \approx 183.961 + 149.693 \approx 333.65 \text{ cm}^3 \quad 333.65 \times 50 = 16682.7 \text{ cm}^3 \]

\[ 16682.7 \times 0.697 = 11627.8 \text{ g} \quad 11.6278 \times 3.83 = \$44.53 \]

PTS: 6  REF: 081636geo  NAT: G.MG.A.2  TOP: Density

513 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
514 ANS:
\[ \tan 52.8 = \frac{h}{x} \]
\[ x \tan 52.8 = x \tan 34.9 + 8 \tan 34.9 \]
\[ \tan 52.8 \approx \frac{h}{9} \]
\[ 11.86 + 1.7 \approx 13.6 \]
\[ h = x \tan 52.8 \]
\[ x \tan 52.8 - x \tan 34.9 = 8 \tan 34.9 \]
\[ x(\tan 52.8 - \tan 34.9) = 8 \tan 34.9 \]
\[ x \approx 11.86 \]
\[ \tan 34.9 = \frac{h}{x + 8} \]
\[ h = (x + 8) \tan 34.9 \]
\[ x = \frac{8 \tan 34.9}{\tan 52.8 - \tan 34.9} \]
\[ x \approx 9 \]

PTS: 6 REF: 011636geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side KEY: advanced

515 ANS:
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 \( E \).

PTS: 4 REF: 061533geo NAT: G.SRT.B.5 TOP: Quadrilateral Proofs

516 ANS:

\[ -6 + \frac{2}{5}(4 - 6) \]
\[ -5 + \frac{2}{5}(0 - 5) \]
\[ (-2, -3) \]
\[ -6 + \frac{2}{5}(10) \]
\[ -5 + \frac{2}{5}(5) \]
\[ (-2, -3) \]
\[ -6 + 4 \]
\[ -5 + 2 \]
\[ -2 \]
\[ -3 \]

PTS: 2 REF: 061527geo NAT: G.GPE.B.6 TOP: Directed Line Segments KEY: mixed


518 ANS: 2
\[ \sqrt{(-1 - 2)^2 + (4 - 3)^2} = \sqrt{10} \]

PTS: 2 REF: 011615geo NAT: G.GPE.B.7 TOP: Polygons in the Coordinate Plane
ANS: 

\( ABC \) – point of reflection \( \rightarrow (-y, x) \) + point of reflection \( \Delta DEF \cong \Delta A'B'C' \) because \( \Delta DEF \) is a reflection of

\( A(2, -3) - (2, -3) = (0, 0) \rightarrow (0, 0) + (2, -3) = A'(2, -3) \)

\( B(6, -8) - (2, -3) = (4, -5) \rightarrow (5, 4) + (2, -3) = B'(7, 1) \)

\( C(2, -9) - (2, -3) = (0, -6) \rightarrow (6, 0) + (2, -3) = C'(8, -3) \)

\( \Delta A'B'C' \) and reflections preserve distance.

PTS: 4  REF: 081633geo  NAT: G.CO.A.5  TOP: Rotations

KEY: grids

520 ANS: 1

\( m = \frac{-A}{B} = \frac{-2}{-1} = 2 \)

\( m_\perp = -\frac{1}{2} \)

PTS: 2  REF: 061509geo  NAT: G.GPE.B.5  TOP: Parallel and Perpendicular Lines

KEY: identify perpendicular lines

521 ANS: 2  PTS: 2  REF: 061516geo  NAT: G.SRT.A.2  TOP: Dilations

522 ANS: 4

The slope of \( BC \) is \( \frac{2}{5} \). Altitude is perpendicular, so its slope is \( -\frac{5}{2} \).

PTS: 2  REF: 061614geo  NAT: G.GPE.B.4  TOP: Triangles in the Coordinate Plane

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.

PTS: 2  REF: spr1407geo  NAT: G.SRT.C.7  TOP: Cofunctions

524 ANS:

\[
\begin{align*}
x &= \frac{2}{3} (4 - 2) = 4 \quad -2 + 4 = 2 \quad J(2, 5) \\
y &= \frac{2}{3} (7 - 1) = 4 \quad 1 + 4 = 5
\end{align*}
\]

PTS: 2  REF: 011627geo  NAT: G.GPE.B.6  TOP: Directed Line Segments
\[ \sqrt{45} = 3\sqrt{5} \quad a = \frac{1}{2} \left( 3\sqrt{5} \right) \left( 6\sqrt{5} \right) = \frac{1}{2} (18)(5) = 45 \]
\[ \sqrt{180} = 6\sqrt{5} \]

\[ x \approx 1051.3 \quad y \approx 77.4 \]

\[ 4 + \frac{4}{9} (22 - 4) \quad 2 + \frac{4}{9} (2 - 2) \quad (12, 2) \]
\[ 4 + \frac{4}{9} (18) \quad 2 + \frac{4}{9} (0) \]
\[ 4 + 8 \quad 2 + 0 \]
\[ 12 \quad 2 \]
531 ANS:

\[ A = 6^2 \pi = 36 \pi \quad 36 \pi \cdot \frac{x}{360} = 12 \pi \]

\[ x = 360 \cdot \frac{12}{36} \]

\[ x = 120 \]

PTS: 2  REF: 061529geo  NAT: G.C.B.5  TOP: Sectors

532 ANS:

\[ \frac{16}{9} = \frac{x}{20.6} \quad D = \sqrt{36.6^2 + 20.6^2} \approx 42 \]

\[ x \approx 36.6 \]

PTS: 4  REF: 011632geo  NAT: G.SRT.B.5  TOP: Similarity

KEY: basic

533 ANS:

Parallelogram \( ABCD \), diagonals \( AC \) and \( BD \) intersect at \( E \) (given). \( DC \parallel AB; DA \parallel CB \) (opposite sides of a parallelogram are parallel). \( \angle ACD \cong \angle CAB \) (alternate interior angles formed by parallel lines and a transversal are congruent).


534 ANS:

Similar triangles are required to model and solve a proportion. \( \frac{x + 5}{1.5} = \frac{x}{1} \quad \frac{1}{3} \pi (1.5)^2 (15) - \frac{1}{3} \pi (1)^2 (10) \approx 24.9 \)

\[ x + 5 = 1.5x \]

\[ 5 = .5x \]

\[ 10 = x \]

\[ 10 + 5 = 15 \]

PTS: 6  REF: 061636geo  NAT: G.GMD.A.3  TOP: Volume

KEY: cones

535 ANS: 3  PTS: 2  REF: 061601geo  NAT: G.GMD.B.4  TOP: Rotations of Two-Dimensional Objects

536 ANS: 2  PTS: 2  REF: 081501geo  NAT: G.CO.C.11  TOP: Special Quadrilaterals
The slopes of perpendicular lines are opposite reciprocals. Since the lines are perpendicular, they form right angles and a right triangle. 

\[ m_{BC} = -\frac{3}{2} \]
\[ m_{\perp} = \frac{2}{3} \]
\[ -1 = \frac{2}{3} (-3) + b \]  \text{ or }  \[ -4 = \frac{2}{3} (-1) + b \]

\[ m_{\perp} = \frac{2}{3} \]
\[ -1 = -2 + b \]
\[ 1 = b \]
\[ 3 = \frac{2}{3} x + 1 \]
\[ 3 = \frac{2}{3} x + \frac{10}{3} \]
\[ 2 = \frac{2}{3} x \]
\[ 3 = x \]
\[ 9 = 2x - 10 \]
\[ 9.5 = x \]

\[ \sin 75 = \frac{15}{x} \]
\[ x = \frac{15}{\sin 75} \]
\[ x \approx 15.5 \]
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 $\overline{XY} || \overline{UV}$. 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, $\triangle XYZ \sim \triangle UVZ$.
544 ANS:

\[
\frac{\left(180 - 20\right)}{2} \times \pi(6)^2 = \frac{80}{360} \times 36\pi = 8\pi
\]

PTS: 2  REF: 061631geo  NAT: G.CO.D.12  TOP: Constructions
KEY: parallel and perpendicular lines

545 ANS:

The other statements are true only if \( AD \perp BC \).


546 ANS: 1

\[
s^2 + s^2 = 7^2
\]

\[
2s^2 = 49
\]

\[
s^2 = 24.5
\]

\[
s \approx 4.9
\]

PTS: 2  REF: 081623geo  NAT: G.C.A.2  TOP: Chords, Secants and Tangents
KEY: inscribed

547 ANS: 2

\[
\overline{LA} \cong \overline{DN}, \overline{CA} \cong \overline{CN}, \text{ and } \angle DAC \perp \angle LCN \text{ (Given). } \angle LCA \text{ and } \angle DCN \text{ are right angles (Definition of perpendicular lines). } \triangle LAC \text{ and } \triangle DNC \text{ are right triangles (Definition of a right triangle). } \triangle LAC \cong \triangle DNC \text{ (HL).}
\]

\( \triangle LAC \) will map onto \( \triangle DNC \) after rotating \( \triangle LAC \) counterclockwise 90° about point \( C \) such that point \( L \) maps onto point \( D \).

PTS: 2  REF: 081511geo  NAT: G.C.A.3  TOP: Inscribed Quadrilaterals

548 ANS: 2

\[
\overline{LA} \cong \overline{DN}, \overline{CA} \cong \overline{CN}, \text{ and } \angle DAC \perp \angle LCN \text{ (Given). } \angle LCA \text{ and } \angle DCN \text{ are right angles (Definition of perpendicular lines). } \triangle LAC \text{ and } \triangle DNC \text{ are right triangles (Definition of a right triangle). } \angle LAC \cong \angle DNC \text{ (HL).}
\]

\( \triangle LAC \) will map onto \( \triangle DNC \) after rotating \( \triangle LAC \) counterclockwise 90° about point \( C \) such that point \( L \) maps onto point \( D \).

PTS: 4  REF: spr1408geo  NAT: G.CO.B.8  TOP: Triangle Congruency
550  \[3 \times 6 = 18\]

PTS: 2  REF: 061602geo  NAT: G.SRT.A.1  TOP: Line Dilations

551 ANS:
Translate \( \triangle ABC \) along \( \overline{CF} \) such that point \( C \) maps onto point \( F \), resulting in image \( \triangle A'B'C' \). Then reflect \( \triangle A'B'C' \) over \( \overline{DF} \) such that \( \triangle A'B'C' \) maps onto \( \triangle DEF \).

or

Reflect \( \triangle ABC \) over the perpendicular bisector of \( \overline{EB} \) such that \( \triangle ABC \) maps onto \( \triangle DEF \).

552 ANS: 1  PTS: 2  REF: 011601geo  NAT: G.GMD.B.4
TOP: Cross-Sections of Three-Dimensional Objects

553 ANS: 4  PTS: 2  REF: 081503geo  NAT: G.GMD.B.4
TOP: Rotations of Two-Dimensional Objects

554 ANS:

\[
\begin{align*}
&\text{key: grids} \\
&V = \frac{1}{3} \cdot 6^2 \cdot 12 = 144
\end{align*}
\]

PTS: 2  REF: 011625geo  NAT: G.CO.A.5  TOP: Reflections

555 ANS: 2

TOP: Sectors

557 ANS:
Opposite angles in a parallelogram are congruent, so \( m \angle O = 118^\circ \). The interior angles of a triangle equal \( 180^\circ \).
\[180 - (118 + 22) = 40.\]

Since the midpoint of \( \overline{AB} \) is \((3, -2)\), the center must be either \((5, -2)\) or \((1, -2)\).

\[
r = \sqrt{2^2 + 5^2} = \sqrt{29}
\]

PTS: 2  REF: 061623geo  NAT: G.GPE.A.1  TOP: Equations of Circles
KEY: other

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.

The measures of the angles of a triangle remain the same after all rotations because rotations are rigid motions which preserve angle measure.

PTS: 2  REF: fall1402geo  NAT: G.CO.B.6  TOP: Properties of Transformations
KEY: graphics