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

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

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

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

1) $5.6$
2) $8.75$
3) $11$
4) $15$

3 In the diagram below of circle $O$ with diameter $\overline{BC}$ and radius $\overline{OA}$, chord $\overline{DC}$ is parallel to chord $\overline{BA}$.

If $\overline{m\angle BCD} = 30^\circ$, determine and state $\overline{m\angle AOB}$.

4 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.
5 The graph below shows two congruent triangles, \( \triangle ABC \) and \( \triangle A'B'C' \).

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 \( y = x \)

6 Which transformation would not carry a square onto itself?

1) a reflection over one of its diagonals
2) a 90° rotation clockwise about its center
3) a 180° rotation about one of its vertices
4) a reflection over the perpendicular bisector of one side

7 Which rotation about its center will carry a regular decagon onto itself?

1) 54°
2) 162°
3) 198°
4) 252°

8 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.

9 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.

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

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

1) cone
2) sphere
3) cylinder
4) hemisphere
11 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 $x = 1$.

![Graph of triangle ABC and its reflection over the line x = 1]

12 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 $C'(3,0)$

13 William is drawing pictures of cross sections of the right circular cone below.

![Right circular cone withdrawings of cross sections]

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

1)
2)
3)
4)

14 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
15 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) \((-8,5\sqrt{21})\)

16 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

17 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) \(83^\circ\)

18 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) \(20\)

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

20 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.
21 Given the theorem, "The sum of the measures of the interior angles of a triangle is 180°," complete the proof for this theorem.

Given: \( \triangle ABC \)
Prove: \( m\angle 1 + m\angle 2 + m\angle 3 = 180° \)

Fill in the missing reasons below.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
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<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° )</td>
<td>(4)</td>
</tr>
<tr>
<td>(5) ( m\angle 1 + m\angle 2 + m\angle 3 = 180° )</td>
<td>(5)</td>
</tr>
</tbody>
</table>
22 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) \( \frac{160\pi}{3} \)

23 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.

24 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

25 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
26 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) $m\angle ACB \cong \frac{1}{2} m\angle DAB$

27 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.

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

Which statement is true?
1) $BC \cong DE$
2) $AB \cong DF$
3) $\angle C \cong \angle E$
4) $\angle A \cong \angle D$

29 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) $(0, \frac{3}{2})$
4) $(1,-1)$

30 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) $(x,y) \rightarrow (x+2,y+3)$
31 Given: \( \triangle XYZ \), \( XY \cong ZY \), and \( YW \) bisects \( \angle XYZ \). Prove that \( \angle YWZ \) is a right angle.

32 Using a straightedge and compass, construct a square inscribed in circle \( O \) below. [Leave all construction marks.]

33 A man was parasailing above a lake at an angle of elevation of 32° 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

34 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
35 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

36 Quadrilateral $ABCD$ is graphed on the set of axes below.

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

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

38 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.

39 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

40 Given: Parallelogram $ANDR$ with $AW$ and $DE$ bisecting $NWD$ and $REA$ at points $W$ and $E$, respectively

Prove that $\triangle ANW \cong \triangle DRE$. Prove that quadrilateral $AWDE$ is a parallelogram.
41 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

42 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

43 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.

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

45 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 $34.9^\circ$. She walks 8 meters closer and determines the new measure of the angle of elevation to be $52.8^\circ$. 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.

46 New streetlights will be installed along a section of the highway. The posts for the streetlights will be 7.5 m tall and made of aluminum. The city can choose to buy the posts shaped like cylinders or the posts shaped like rectangular prisms. The cylindrical posts have a hollow core, with aluminum 2.5 cm thick, and an outer diameter of 53.4 cm. The rectangular-prism posts have a hollow core, with aluminum 2.5 cm thick, and a square base that measures 40 cm on each side. The density of aluminum is 2.7 g/cm$^3$, and the cost of aluminum is $0.38 per kilogram. If all posts must be the same shape, which post design will cost the town less? How much money will be saved per streetlight post with the less expensive design?
47 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) \(y + 9 = \frac{2}{3}(x + 6)\)

48 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.

49 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 \(\angle C \cong \angle F\)

50 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

51 In quadrilateral \(ABCD\), \(AB \equiv CD\), \(AB \parallel CD\), and \(BF\) and \(DE\) are perpendicular to diagonal \(AC\) at points \(F\) and \(E\).

Prove: \(AE \equiv CF\)

52 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
53 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.

54 Parallelogram $ABCD$ has coordinates $A(0,7)$ and $C(2,1)$. Which statement would prove that $ABCD$ is a rhombus?

1) The midpoint of $AC$ is (1,4).
2) The length of $BD$ is $\sqrt{40}$.
3) The slope of $BD$ is $\frac{1}{3}$.
4) The slope of $AB$ is $\frac{1}{3}$.

55 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.

56 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.]

57 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
58. 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) \( 4\sqrt{6} \)

59. The graph below shows \( \triangle ABC \) and its image, \( \triangle A'B'C'' \).

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

60. 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) \( y = -2x + 3 \)

61. 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 \( ABCD \).

62. 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 \( \sqrt{35} \)
63 In the diagram below, secant $ACD$ and tangent $AB$ are drawn from external point $A$ to circle $O$.

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

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

1) $3 \frac{3}{4}$
2) 5
3) 15
4) $24 \frac{3}{4}$

65 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

66 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.

67 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

68 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) $y = 2x + 1$
69. In the diagram below, a sequence of rigid motions maps $ABCD$ onto $JKLM$.

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

1) 53°
2) 82°
3) 104°
4) 121°

70. 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) $\frac{XY}{SR} = \frac{YZ}{RZ}$

71. 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) $25\sqrt{2}$

72. Given: Parallelogram $ABCD$ with diagonal $AC$ drawn.

Prove: $\triangle ABC \cong \triangle CDA$

73. In the diagram of $\triangle LAC$ and $\triangle DNC$ below, $LA \cong DN$, $CA \cong CN$, and $DAC \perp LCN$.

a) Prove that $\triangle LAC \cong \triangle DNC$.
b) Describe a sequence of rigid motions that will map $\triangle LAC$ onto $\triangle DNC$. 
74 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 $180^\circ$ rotation about the origin followed by a reflection over the line $y = x$
3) a $90^\circ$ 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 $90^\circ$ counterclockwise rotation about the origin

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

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

76 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.

77 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

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

80 As shown in the diagram below, $ABC \parallel EFG$ and $BF \cong EF$.

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

81 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) $(6,0)$

82 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 $y = 70$

83 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) $\frac{5}{\pi}$
84 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 \( CD \).

85 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

86 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) \( \widehat{BC} = \angle BMC \)
4) \( \widehat{AB} = \frac{1}{2} \angle ACB \)

87 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 \( \angle N \)?
1) 10\(^\circ\)
2) 20\(^\circ\)
3) 40\(^\circ\)
4) 80\(^\circ\)
88 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.

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

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

91 In the diagram below, \( \overline{DE} \), \( \overline{DF} \), and \( \overline{EF} \) are midsegments of \( \triangle ABC \).

The perimeter of quadrilateral \( ADEF \) is equivalent to
1) \( AB + BC + AC \)
2) \( \frac{1}{2} AB + \frac{1}{2} AC \)
3) \( 2AB + 2AC \)
4) \( AB + AC \)

89 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
92 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 $\triangle XYZ$.

94 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.]

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

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

93 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) $y = 2x - 16$
96 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. [The use of the set of axes below is optional.] State the coordinates of $R$ so that quadrilateral $PART$ is a parallelogram. Prove that quadrilateral $PART$ is a parallelogram.

97 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°

98 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) $(1,-6)$

99 In the diagram below of isosceles triangle $ABC$, $\overline{AB} \cong \overline{CB}$ and angle bisectors $AD$, $BF$, and $CE$ are drawn and intersect at $X$.

If $m\angle BAC = 50^\circ$, find $m\angle AXC$. 

21
100 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) $\frac{AB}{AC}$

101 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

102 Using a compass and straightedge, construct the line of reflection over which triangle $RST$ reflects onto triangle $R'S'T'$. [Leave all construction marks.]

103 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
104 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.

105 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 $AH$.

106 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.]
109 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

110 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

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

112 In the diagram below, \(FE\) bisects \(AC\) at \(B\), and \(GE\) bisects \(BD\) at \(C\).

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

113 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

114 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) \(y = 3x - 6\)
115 In the diagram below, triangles $\triangle XYZ$ and $\triangle UVZ$ are drawn such that $\angle X \cong \angle U$ and $\angle XZY \cong \angle UZV$.

![Diagram of triangles XYZ and UVZ]

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

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

![Diagram of triangle ABC with an altitude drawn]

117 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?

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

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

119 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 $m\angle C = (x + 20)^\circ$.

![Diagram of triangle ABC with extended side AC]

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

120 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
121 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 $ABC$.

122 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: $\triangle ABC \cong \triangle DEC$

123 In the diagram below, $\overline{DC}$, $\overline{AC}$, $\overline{DOB}$, $\overline{CB}$, and $\overline{AB}$ are chords of circle $O$, $\overline{FDE}$ is tangent at point $D$, and radius $\overline{AO}$ 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) $\angle FDB$

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

1) 11
2) 17
3) 18
4) 22
125 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).

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

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 $AB = 17$

127 Given $\triangle ABC \cong \triangle DEF$, which statement is not always true?
1) $\overline{BC} \cong \overline{DF}$
2) $m\angle A = m\angle D$
3) area of $\triangle ABC = $ area of $\triangle DEF$
4) perimeter of $\triangle ABC = $ perimeter of $\triangle DEF$

128 Parallelogram $\text{HAND}$ is drawn below with diagonals $\overline{HN}$ and $\overline{AD}$ 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) $\angle HDS \cong \angle NDS$

129 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
130 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

131 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° angle with the ground. To the nearest foot, determine and state the length of the ladder.

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

133 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.

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

135 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.
136 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.

137 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.

138 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) $y = 3x - 1$

139 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) $6\sqrt{35}$

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

If the point is 20 feet from the base of the tree, what is the height of the tree, to the nearest tenth of a foot?

1) 29.7
2) 16.6
3) 13.5
4) 11.2
141 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 $\triangle ABC \cong \triangle DEF$.

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

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

143 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) $2y - x = 0$

144 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 $NM = 10$
145 If the rectangle below is continuously rotated about side $w$, which solid figure is formed?

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

146 In the diagram below, $BC$ is the diameter of circle $A$.

Point $D$, which is unique from points $B$ and $C$, is plotted on circle $A$. Which statement must always be true?
1) $\triangle BCD$ is a right triangle.
2) $\triangle BCD$ is an isosceles triangle.
3) $\triangle BAD$ and $\triangle CBD$ are similar triangles.
4) $\triangle BAD$ and $\triangle CAD$ are congruent triangles.

147 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

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

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

149 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
150 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 $BC \parallel AD$

151 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.

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

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

153 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 $AE \cdot EB = CE \cdot ED$. 
154 In the diagram below, \( CD \) is the image of \( AB \) 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) \( \frac{EA}{EC} \)

155 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) \( \sin B \)

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

1) \( (3,6) \)
2) \( (8,-3) \)
3) \( (-3,8) \)
4) \( (6,3) \)

157 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.

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

The measure of angle \( DFB \) is

1) \( 36^\circ \)
2) \( 54^\circ \)
3) \( 72^\circ \)
4) \( 82^\circ \)
159 Triangle $FGH$ is inscribed in circle $O$, the length of radius $OH$ is 6, and $FH \cong OG$.

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

160 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

161 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

162 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) $(x - 5)^2 + (y + 2)^2 = 25$
163 The endpoints of $\overline{DEF}$ are $D(1,4)$ and $F(16,14)$. Determine and state the coordinates of point $E$, if $DE:EF = 2:3$.

164 Triangle $PQR$ has vertices $P(-3,-1), Q(-1,7)$, and $R(3,3)$, and points $A$ and $B$ are midpoints of $\overline{PQ}$ and $\overline{RQ}$, respectively. Use coordinate geometry to prove that $\overline{AB}$ is parallel to $\overline{PR}$ and is half the length of $\overline{PR}$. [The use of the set of axes below is optional.]

165 The image of $\triangle DEF$ is $\triangle D'EF'$. 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

166 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

167 Which transformation would not always produce an image that would be congruent to the original figure?
1) translation
2) dilation
3) rotation
4) reflection

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

169 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.
170 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.

171 A 20-foot support post leans against a wall, making a 70° 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

172 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.

173 In the diagram below of circle O, chord \( \overline{DF} \) bisects chord \( \overline{BC} \) at E.

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

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

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

175 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.
176  In the diagram below, \( \overline{ABC} = 268^\circ \).

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

177  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) \( m \parallel n \)

178  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) \( y = -x - 3 \)

179  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.
180  In the diagram of \( \triangle ABC \) shown below, use a compass and straightedge to construct the median to \( AB \). [Leave all construction marks.]

![Diagram of triangle ABC with median constructed]

181  Triangle \( \triangle ABC \) has vertices with \( A(x,3), B(-3,-1), \) and \( C(-1,-4) \). Determine and state a value of \( x \) that would make triangle \( \triangle ABC \) a right triangle. Justify why \( \triangle ABC \) is a right triangle. [The use of the set of axes below is optional.]

![Graph with axes]

182  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.

![Diagram of snow cone]

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

183  In the diagram below, \( \overline{AD} \) intersects \( \overline{BE} \) at \( C \), and \( \overline{AB} \parallel \overline{DE} \).

![Diagram with line segments]

If \( CD = 6.6 \) cm, \( DE = 3.4 \) cm, \( CE = 4.2 \) cm, and \( BC = 5.25 \) 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
184 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

185 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 $\overline{BE}$ to $\overline{CD}$ is
1) $\frac{2}{3}$
2) $\frac{3}{2}$
3) $\frac{3}{4}$
4) $\frac{4}{3}$

186 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

187 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) $4x + 3y = 9$
188 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) \( m\angle ABD = 80^\circ \)
4) \( \triangle ABD \) is scalene.

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

190 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) \( BC \parallel DE \)

191 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 \( E \)
192 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

193 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.]

194 Line segment \( EA \) is the perpendicular bisector of \( ZT \), and \( ZE \) and \( TE \) are drawn.

Which conclusion can \textit{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 \( T \).

195 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) \( AB \perp CD \)

196 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
197. In the diagram below, $EF$ intersects $AB$ and $CD$ at $G$ and $H$, respectively, and $GI$ is drawn such that $GH \cong IH$.

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

198. Which statement is sufficient evidence that $\triangle DEF$ is congruent to $\triangle ABC$?

1) $AB = DE$ and $BC = EF$
2) $\angle D \cong \angle A$, $\angle B \cong \angle E$, $\angle C \cong \angle F$
3) There is a sequence of rigid motions that maps $AB$ onto $DE$, $BC$ onto $EF$, and $AC$ onto $DF$
4) There is a sequence of rigid motions that maps point $A$ onto point $D$, $AB$ onto $DE$, and $\angle B$ onto $\angle E$.

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

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

---

42
201 Given: Quadrilateral \(ABCD\) with diagonals \( \overline{AC} \) and \( \overline{BD}\) that bisect each other, and \( \angle 1 \equiv \angle 2 \)

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

202 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

203 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) \(\angle BAC \equiv \angle BOC\)
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 \(\triangle BOC\).

204 In right triangle \(ABC\), \(m\angle A = 32^\circ\), \(m\angle B = 90^\circ\), and \(AE = 6.2\) cm. What is the length of \(\overline{BC}\), to the nearest tenth of a centimeter?

1) 3.3
2) 3.9
3) 5.3
4) 11.7

205 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.

206 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) \(\frac{64\pi}{3}\)
207 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 $AC = 15$

208 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

209 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

210 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

211 Given $\overline{MN}$ 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 $\overline{MN}$?

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

212 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.
213 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) \(3x - 2y = 5\)

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

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

215 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

216 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 \(AP:PB = 2:3\). [The use of the set of axes below is optional.]

217 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 \(\overline{AB}\) is parallel to \(\overline{CD}\).
218 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.

219 In the diagram below, radius \( \overline{OA} \) is drawn in circle \( O \). Using a compass and a straightedge, construct a line tangent to circle \( O \) at point \( A \). [Leave all construction marks.]

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

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

221 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
222 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.

223 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

224 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

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

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

226 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) \( x + y = 4 \)
227 Using a compass and straightedge, construct a regular hexagon inscribed in circle $O$. [Leave all construction marks.]

228 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

229 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 $\angle DCB$

230 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) $\frac{64\pi}{3}$

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

Is Sue correct? Explain why.
232 In the diagram below, $DB$ and $AF$ intersect at point $C$, and $AD$ and $FBE$ are drawn.

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

1) 10  
2) 12  
3) 17  
4) 22.5

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

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

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

Which triangle similarity statement is correct?

1) $\triangle GRS \sim \triangle ART$ by AA.  
2) $\triangle GRS \sim \triangle ART$ by SAS.  
3) $\triangle GRS \sim \triangle ART$ by SSS.  
4) $\triangle GRS$ is not similar to $\triangle ART$.

235 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

236 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) $135^\circ$
237 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</td>
<td>18,801,310</td>
</tr>
<tr>
<td>Illinois</td>
<td>231.1</td>
<td>12,830,632</td>
</tr>
<tr>
<td>New York</td>
<td>411.2</td>
<td>19,378,102</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>283.9</td>
<td>12,702,379</td>
</tr>
</tbody>
</table>

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

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

238 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

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

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

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

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

241 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?
242 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) 59º
2) 62º
3) 118º
4) 121º

243 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 \( m\angle AOC \).

244 In the two distinct acute triangles \( ABC \) and \( DEF \), \( \angle B \cong \angle E \). Triangles \( ABC \) and \( DEF \) are congruent when there is a sequence of rigid motions that maps
1) \( \angle A \) onto \( \angle D \), and \( \angle C \) onto \( \angle F \)
2) \( \overline{AC} \) onto \( \overline{DF} \), and \( \overline{BC} \) onto \( \overline{EF} \)
3) \( \angle C \) onto \( \angle F \), and \( \overline{BC} \) onto \( \overline{EF} \)
4) point \( A \) onto point \( D \), and \( \overline{AB} \) onto \( \overline{DE} \)

245 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?

246 Isosceles trapezoid \( ABCD \) has bases \( \overline{DC} \) and \( \overline{AB} \) with nonparallel legs \( \overline{AD} \) and \( \overline{BC} \). 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.
247 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) $\frac{AB}{DE} = \frac{FE}{CB}$

249 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

248 In the diagram below of circle $O$, chord $CD$ is parallel to diameter $AOB$ and $m\overline{CD} = 130$.

Describe a sequence of transformations that maps quadrilateral $MATH$ onto quadrilateral $M^\prime A^\prime T^\prime H^\prime$.

250 Quadrilateral $MATH$ and its image $M^\prime A^\prime T^\prime H^\prime$ are graphed on the set of axes below.

What is $m\overline{AC}$?

1) 25
2) 50
3) 65
4) 115

251 Quadrilateral $ABCD$ has diagonals $\overline{AC}$ and $\overline{BD}$. Which information is not sufficient to prove $ABCD$ is a parallelogram?

1) $\overline{AC}$ and $\overline{BD}$ bisect each other.
2) $\overline{AB} \parallel \overline{CD}$ and $\overline{BC} \parallel \overline{AD}$
3) $\overline{AB} \parallel \overline{CD}$ and $\overline{AB} \parallel \overline{CD}$
4) $\overline{AB} \parallel \overline{CD}$ and $\overline{BC} \parallel \overline{AD}$
252 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.

253 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) \( \frac{5}{\sqrt{21}} \)

254 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) \(3(m\angle C') = m\angle C\)

255 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

256 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
257  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)  

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

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

260  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
261. Using the information given below, which set of triangles can *not* be proven similar?

1) 
2) 
3) 
4) 

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

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

263. Given: $\overline{RS}$ and $\overline{TU}$ bisect each other at point $X$ $\overline{TR}$ and $\overline{SV}$ are drawn.

Prove: $\overline{TR} \parallel \overline{SV}$

264. 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

265. 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

266. 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) $252^\circ$
267 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) $4\sqrt{2}$

268 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.

269 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.

270 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.

271 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) $\sin A = \cos B$
272 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) \(y = 2x + 6\)

273 The coordinates of the endpoints of \(AB\) are \(A(-8,-2)\) and \(B(16,6)\). Point \(P\) is on \(AB\). 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) \((6.4,2.8)\)

274 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

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

276 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.

277 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) \(\tan E = \frac{TM}{JM}\)
278 Describe a sequence of transformations that will map \( \triangle ABC \) onto \( \triangle DEF \) as shown below.

279 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

280 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

281 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) \( (4,\frac{5}{2}) \)  
2) \( \left(\frac{1}{2},-4\right) \)  
3) \( \left(-4\frac{1}{2},0\right) \)  
4) \( (-4,-\frac{1}{2}) \)

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

283 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 \( \text{SAS} \cong \text{SAS} \)?

1) \( \angle CDB \cong \angle AEB \)  
2) \( \angle AFD \cong \angle EFC \)  
3) \( AD \cong CE \)  
4) \( AE \cong CD \)
284 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

285 In the diagram of parallelogram $ABCD$ below, $BE \perp CED$, $DF \perp BFC$, $CE \cong CF$.

Prove $ABCD$ is a rhombus.

286 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

287 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 $BC = 8.7$
288 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 $CD$.

![Diagram](image)

289 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

290 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.

![Diagram](image)

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

291 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.

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

![Diagram](image)

Given $\triangle AEC \sim \triangle BED$, which equation is true?
1) $\frac{CE}{DE} = \frac{EB}{EA}$
2) $\frac{AE}{BE} = \frac{AC}{BD}$
3) $\frac{EC}{AE} = \frac{BE}{ED}$
4) $\frac{ED}{EC} = \frac{AC}{BD}$

293 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) $\cos x$
294 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.

295 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) $(8.5)^3 - \frac{1}{3} \pi(4)^2(8)$

296 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

297 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.
298 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 $180^\circ$ about the origin
4) a rotation of $180^\circ$ about the point (4,0)

299 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

300 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

301 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.
302 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

303 In the diagram below, quadrilateral $ABCD$ is inscribed in circle $P$. What is $m\angle ADC$?

1) $70^\circ$
2) $72^\circ$
3) $108^\circ$
4) $110^\circ$

304 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

305 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) $4\sqrt{40}$
306 In the diagram of circle $A$ shown below, chords $CD$ and $EF$ intersect at $G$, and chords $CE$ and $FD$ are drawn.

![Diagram of circle A with intersecting chords CD and EF, and CE and FD 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) $\triangle CEG \sim \triangle FDG$

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

![Diagram with collinear points A, C, D, and F on line $\ell$.]

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

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

![Diagram of a truncated right cone, possibly a water glass.]

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.

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

![Diagram of triangles ABC and DEF.]

If $AB \cong DE$, $AC \cong DF$, and $\angle A \cong \angle D$, write a sequence of transformations that maps triangle $ABC$ onto triangle $DEF$. 
310 Which figure can have the same cross section as a sphere?

1)  

2)  

3)  

4)  

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

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

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

312 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) $DE, CE$  

313 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  

314 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.]
315 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

316 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

317 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

318 Which point shown in the graph below is the image of point $P$ after a counterclockwise rotation of $90^\circ$ about the origin?
1) $A$
2) $B$
3) $C$
4) $D$

319 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.
320 A rectangular in-ground pool is modeled by the prism below. The inside of the pool is 16 feet wide and 35 feet long. The pool has a shallow end and a deep end, with a sloped floor connecting the two ends. Without water, the shallow end is 9 feet long and 4.5 feet deep, and the deep end of the pool is 12.5 feet long.

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

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

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

322 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
323 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 $A'C'$.

![Triangle](image1.png)

324 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 $\triangle CEB$.

![Parallelogram](image2.png)

325 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

326 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 $PQRS$.

![Rhombus](image3.png)

327 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.

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

329  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 $PC = 10$.

![Diagram of circles and line segments]

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

330  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

331  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)  $\overline{AC} \cong \overline{DF}$ and SAS
2)  $\overline{BC} \cong \overline{EF}$ and SAS
3)  $\angle C \cong \angle F$ and AAS
4)  $\angle CBA \cong \angle FED$ and ASA

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

![Diagram of right triangle]

What is the measure of $\angle S$, to the nearest degree?
1)  23°
2)  43°
3)  47°
4)  67°
333 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

334 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 \( \triangle A'B'C' \sim \triangle ABC \).

335 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

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

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

337 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° about the origin
338 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>

339 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

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

341 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 $m\angle N = 40°$.

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

342 In a right triangle, $\sin(40 - x)° = \cos(3x)°$. What is the value of $x$?
1) 10
2) 15
3) 20
4) 25
343 Given: Trapezoid $JKLM$ with $JK \parallel ML$
Using a compass and straightedge, construct the altitude from vertex $J$ to $ML$. [Leave all construction marks.]

344 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

345 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

346 In the diagram below, right triangle $ABC$ has legs whose lengths are 4 and 6.

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

347 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 ft$^3=7.48$ gallons]
348 Tennis balls are sold in cylindrical cans with the balls stacked one on top of the other. A tennis ball has a diameter of 6.7 cm. To the nearest cubic centimeter, what is the minimum volume of the can that holds a stack of 4 tennis balls?
1) 236
2) 282
3) 564
4) 945

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

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

350 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: \( \frac{BC}{CA} = \frac{AB}{EC} \)
1. 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

2. 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

3. ANS:
   \[ 180 - 2(30) = 120 \]
   
   PTS: 2  REF: 011626geo  NAT: G.C.A.2  TOP: Chords, Secants and Tangents
   KEY: parallel lines

4. 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 \( \triangle RST \).
   
   PTS: 2  REF: 011830geo  NAT: G.CO.B.7  TOP: Triangle Congruency

5. ANS: 4  PTS: 2
   REF: 011803geo  NAT: G.CO.A.2
   TOP: Identifying Transformations  KEY: graphics

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

7. ANS: 4
   \[ \frac{360^\circ}{10} = 36^\circ \] \( 252^\circ \) is a multiple of \( 36^\circ \)
   
   PTS: 2  REF: 011717geo  NAT: G.CO.A.3  TOP: Mapping a Polygon onto Itself

8. ANS:
   \[ \frac{16}{9} = \frac{x}{20.6} \]
   \[ D = \sqrt{36.6^2 + 20.6^2} \approx 42 \]
   \[ x \approx 36.6 \]
   
   PTS: 4  REF: 011632geo  NAT: G.SRT.C.8  TOP: Pythagorean Theorem
   KEY: without graphics
9 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

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

11 ANS:

\[
\text{KEY: grids}
\]

PTS: 2  REF: 011625geo  NAT: G.CO.A.5  TOP: Reflections

12 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

13 ANS: 1  PTS: 2  REF: 011601geo  NAT: G.GMD.B.4  TOP: Cross-Sections of Three-Dimensional Objects


15 ANS: 3  

\[
\sqrt{(-5)^2 + 12^2} = \sqrt{169} \quad \sqrt{11^2 + (2\sqrt{12})^2} = \sqrt{121 + 48} = \sqrt{169}
\]

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

16 ANS: 4  PTS: 2  REF: 011819geo  NAT: G.CO.C.11  TOP: Special Quadrilaterals

17 ANS: 3  

18 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

19 ANS:
No, the weight of the bricks is greater than 900 kg. 
\[ 500 \times (5.1 \times 10.2 \times 20.3) = 528,003 \text{ cm}^3. \]

\[ 528,003 \text{ cm}^3 \times \frac{1 \text{ m}^3}{100 \text{ cm}^3} = 0.528003 \text{ m}^3. \]
\[ \frac{1920 \text{ kg}}{\text{ m}^3} \times 0.528003 \text{ m}^3 \approx 1013 \text{ kg}. \]

PTS: 2 REF: fall1406geo NAT: G.MG.A.2 TOP: Density

20 ANS:

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

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

21 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


22 ANS: 4
\[ \frac{300 \cdot 8^2 \pi}{360} = \frac{160\pi}{3} \]

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

23 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

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

26 ANS: 2  PTS: 2  REF: 011702geo  NAT: G.SRT.A.2  TOP: Compositions of Transformations  KEY: basic


28 ANS: 4  The measures of the angles of a triangle remain the same after all rotations because rotations are rigid motions which preserve angle measure.


29 ANS: 4  
\[-5 + \frac{3}{5} (5 - 5) - 4 + \frac{3}{5} (1 - 4)\]

\[-5 + \frac{3}{5} (10) - 4 + \frac{3}{5} (5)\]

\[-5 + 6 - 4 + 3\]

\[1 - 1\]

PTS: 2  REF: spr1401geo  NAT: G.GPE.B.6  TOP: Directed Line Segments


31 ANS:

\[\triangle XYZ, \overline{XY} \cong \overline{ZY}, \text{ and } \overline{YW} \text{ bisects } \angle XYZ \text{ (Given). } \angle XYZ \text{ is isosceles (Definition of isosceles triangle).} \]

\[\overline{YW} \text{ is an altitude of } \triangle XYZ \text{ (The angle bisector of the vertex of an isosceles triangle is also the altitude of that triangle).} \]

\[\overline{YW} \perp \overline{XZ} \text{ (Definition of altitude).} \]

\[\triangle YWZ \text{ is a right angle (Definition of perpendicular lines).} \]

PTS: 4  REF: spr1411geo  NAT: G.CO.C.10  TOP: Triangle Proofs
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.

\[
\sin 32 = \frac{O}{129.5}
\]

\[O \approx 68.6\]

\[
\frac{24}{40} = \frac{15}{x}
\]

\[24x = 600\]

\[x = 25\]

\[
\frac{4}{3} \pi \left( \frac{9.5}{2} \right)^3 \approx 55
\]

\[
\frac{4}{3} \pi \left( \frac{2.5}{2} \right)^3
\]

\[
\text{PTS: 2} \quad \text{REF: 011614geo} \quad \text{NAT: G.GMD.A.3} \quad \text{TOP: Volume}
\]

\[
\text{ANS: 4} \quad \text{PTS: 2} \quad \text{REF: 011611geo} \quad \text{NAT: G.CO.B.6} \quad \text{TOP: Properties of Transformations} \quad \text{KEY: graphics}
\]
37 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

38 ANS: 
\[ C = 2\pi r, \quad V = \frac{\pi}{3} \cdot 5^2 \cdot 13 \approx 340 \]
\[ 31.416 = 2\pi r \]
\[ 5 \approx r \]

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

39 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

40 ANS: 
Parallelogram ANDR with \( \overline{AW} \) 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). \( \overline{AE} = \frac{1}{2} \overline{AR}, \overline{WD} = \frac{1}{2} \overline{DN}, \) 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 \( \overline{RE} \cong \overline{NW} \) (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).

PTS: 6 REF: 011635geo NAT: G.SRT.B.5 TOP: Quadrilateral Proofs

41 ANS: 4

42 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

43 ANS: 
Yes, because 28º and 62º 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
44 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

45 ANS:
\[
\begin{align*}
\tan 52.8 &= \frac{h}{x} \\
x \tan 52.8 &= x \tan 34.9 + 8 \tan 34.9 \\
tan 52.8 &= \frac{h}{9} \\
11.86 + 1.7 &= 13.6
\end{align*}
\]
\[
\begin{align*}
h &= x \tan 52.8 \\
x \tan 52.8 - x \tan 34.9 &= 8 \tan 34.9 \\
x &\approx 11.86
\end{align*}
\]
\[
\begin{align*}
tan 34.9 &= \frac{h}{x + 8} \\
h &= (x + 8) \tan 34.9 \\
x &= \frac{8 \tan 34.9}{\tan 52.8 - \tan 34.9} \\
x &\approx 9
\end{align*}
\]

PTS: 6  REF: 011636geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find a Side  KEY: advanced

46 ANS:
\[
\begin{align*}
C: \ V &= \pi (26.7)^2 (750) - \pi (24.2)^2 (750) = 95,437.5 \pi \\
95,437.5 \pi &\,\text{cm}^3 \left( \left( \frac{2.7 \,\text{g}}{\text{cm}^3} \right) \left( \frac{1 \,\text{kg}}{1000 \,\text{g}} \right) \left( \frac{\$0.38}{\text{kg}} \right) \right) = \$307.62
\end{align*}
\]
\[
\begin{align*}
P: \ V &= 40^2 (750) - 35^2 (750) = 281,250 \\
281,250 &\,\text{cm}^3 \left( \left( \frac{2.7 \,\text{g}}{\text{cm}^3} \right) \left( \frac{1 \,\text{kg}}{1000 \,\text{g}} \right) \left( \frac{\$0.38}{\text{kg}} \right) \right) = \$288.56
\end{align*}
\]

PTS: 6  REF: 011736geo  NAT: G.MG.A.2  TOP: Density

47 ANS: 1
\[
\begin{align*}
m &= \frac{-4}{-6} = \frac{2}{3} \\
m_\perp &= \frac{-3}{2}
\end{align*}
\]

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

48 ANS:
Circle \( A \) can be mapped onto circle \( B \) by first translating circle \( A \) along vector \( \overrightarrow{AB} \) such that \( A \) maps onto \( B \), and then dilating circle \( A \), centered at \( A \), by a scale factor of \( \frac{5}{3} \). Since there exists a sequence of transformations that maps circle \( A \) onto circle \( B \), circle \( A \) is similar to circle \( B \).

PTS: 2  REF: spr1404geo  NAT: G.C.A.1  TOP: Similarity Proofs
49 ANS: 1
\[ \frac{6}{8} = \frac{9}{12} \]
PTS: 2 REF: 011613geo NAT: G.SRT.B.5 TOP: Similarity
KEY: basic

50 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

51 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

52 ANS: 1
\[ m_{RT} = \frac{5 - 3}{4 - 2} = \frac{8}{6} = \frac{4}{3} \quad m_{ST} = \frac{5 - 2}{4 - 8} = \frac{3}{4} \quad \frac{3}{4} \]
Slopes are opposite reciprocals, so lines form a right angle.

PTS: 2 REF: 011618geo NAT: G.GPE.B.4 TOP: Triangles in the Coordinate Plane

53 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 REF: 011630geo NAT: G.MG.A.2 TOP: Density

54 ANS: 3
\[ \frac{7 - 1}{0 - 2} = \frac{6}{-2} = -3 \]
The diagonals of a rhombus are perpendicular.

PTS: 2 REF: 011719geo NAT: G.GPE.B.4 TOP: Quadrilaterals in the Coordinate Plane
55 ANS:
$$4x - .07 = 2x + .01$$  Sin A is the ratio of the opposite side and the hypotenuse while cos B is the ratio of the adjacent side and the hypotenuse. The side opposite angle A is the same side as the side adjacent to angle B. Therefore, sin A = cos B.

$$2x = 0.8$$
$$x = 0.4$$

PTS: 2  REF: fall1407geo  NAT: G.SRT.C.7  TOP: Cofunctions

56 ANS:

$$x = \frac{2}{3} (4 - 2) = 4 - 2 + 4 = 2 \ J(2,5)$$

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

PTS: 2  REF: 011627geo  NAT: G.GPE.B.6  TOP: Directed Line Segments

57 ANS: 3
$$\cos A = \frac{9}{14}$$
$$A \approx 50^\circ$$

PTS: 2  REF: 011616geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find an Angle

58 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

59 ANS:
$$T_{0,-2} \circ r_{y-axis}$$

PTS: 2  REF: 011726geo  NAT: G.CO.A.5  TOP: Compositions of Transformations
60  **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

61  **ANS: 1**  

**PTS: 2**  
**REF:** 011811geo  
**NAT:** G.SRT.A.2  
**TOP:** Dilations

62  **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

63  **ANS:**  
Circle \( O \), secant \( ACD \), tangent \( AB \) (Given). Chords \( BC \) and \( BD \) are drawn (Auxiliary lines). \( \angle A \cong \angle A \), \( \overarc{BC} \cong \overarc{BC} \) (Reflexive property). \( m\angle BDC = \frac{1}{2} m\overarc{BC} \) (The measure of an inscribed angle is half the measure of the intercepted arc). \( m\angle CBA = \frac{1}{2} m\overarc{BC} \) (The measure of an angle formed by a tangent and a chord is half the measure of the intercepted arc). \( \angle BDC \cong \angle CBA \) (Angles equal to half of the same arc are congruent). \( \triangle ABC \sim \triangle ADB \) (AA). \( \frac{AB}{AC} = \frac{AD}{AB} \) (Corresponding sides of similar triangles are proportional). \( AC \cdot AD = AB^2 \) 
(In a proportion, the product of the means equals the product of the extremes).

**PTS: 6**  
**REF:** spr1413geo  
**NAT:** G.SRT.B.5  
**TOP:** Circle Proofs

64  **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

65  **ANS: 1**  
\[ \frac{1000}{20\pi} \approx 15.9 \]

**PTS: 2**  
**REF:** 011623geo  
**NAT:** G.GMD.A.1  
**TOP:** Circumference
66 ANS:
\[ V = (\pi)(4^2)(9) + \left(\frac{1}{2}\right)\left(\frac{4}{3}\right)(\pi)(4^3) \approx 586 \]

67 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

68 ANS: 2
The given line \( h \), \( 2x + y = 1 \), does not pass through the center of dilation, the origin, because the \( y \)-intercept is at \((0,1)\). The slope of the dilated line, \( m \), will remain the same as the slope of line \( h \), -2. All points on line \( h \), such as \((0,1)\), the \( y \)-intercept, are dilated by a scale factor of 4; therefore, the \( y \)-intercept of the dilated line is \((0,4)\) because the center of dilation is the origin, resulting in the dilated line represented by the equation \( y = -2x + 4 \).

PTS: 2 REF: spr1403geo NAT: G.SRT.A.1 TOP: Line Dilations

69 ANS: 1
\[ 360 - (82 + 104 + 121) = 53 \]
PTS: 2 REF: 011801geo NAT: G.CO.B.6 TOP: Properties of Transformations KEY: basic

70 ANS: 4 PTS: 2 REF: 011817geo NAT: G.SRT.B.5 TOP: Similarity KEY: basic

71 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

72 ANS:
Parallelogram \( ABCD \) with diagonal \( \overline{AC} \) drawn (given). \( \overline{AC} \approx \overline{AC} \) (reflexive property). \( \overline{AD} \approx \overline{CB} \) and \( \overline{BA} \approx \overline{DC} \) (opposite sides of a parallelogram are congruent). \( \triangle ABC \approx \triangle CDA \) (SSS).

PTS: 2 REF: 011825geo NAT: G.SRT.B.5 TOP: Quadrilateral Proofs

73 ANS:
\( \overline{LA} \approx \overline{DN} \), \( \overline{CA} \approx \overline{CN} \), and \( \overline{DAC} \perp \overline{LCN} \) (Given). \( \angle LCA \) and \( \angle DCN \) are right angles (Definition of perpendicular lines). \( \triangle LAC \) and \( \triangle DNC \) are right triangles (Definition of a right triangle). \( \triangle LAC \approx \triangle DNC \) (HL). \( \triangle LAC \) will map onto \( \triangle DNC \) after rotating \( \triangle LAC \) counterclockwise 90º about point \( C \) such that point \( L \) maps onto point \( D \).

PTS: 4 REF: spr1408geo NAT: G.CO.B.8 TOP: Triangle Congruency KEY: identify

74 ANS: 1 PTS: 2 REF: 011608geo NAT: G.CO.A.5 TOP: Compositions of Transformations KEY: identify
75 ANS: \[
\left(\frac{180 - 20}{2}\right) \cdot \pi(6)^2 = \frac{80}{360} \times 36\pi = 8\pi
\]


76 ANS: \[
\frac{Q}{360} (\pi \cdot 25^2) = (\pi \cdot 25^2) - 500\pi
\]
\[
Q = \frac{125\pi(360)}{625\pi}
\]
\[
Q = 72
\]

PTS: 2 REF: 011828geo NAT: G.C.B.5 TOP: Sectors

77 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

78 ANS: \[
l: y = 3x - 4
\]
\[
m: y = 3x - 8
\]

PTS: 2 REF: 011631geo NAT: G.SRT.A.1 TOP: Line Dilations

79 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 \(\triangle DEF\).

PTS: 2 REF: fall1408geo NAT: G.CO.B.7 TOP: Triangle Congruency

80 ANS: 2

PTS: 2 REF: 011818geo NAT: G.CO.C.9 TOP: Lines and Angles
81 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

82 ANS: 4

Opposite angles of an inscribed quadrilateral are supplementary.

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

83 ANS: 3

\[ \theta = \frac{s}{r} = \frac{2\pi}{10} = \frac{\pi}{5} \]


84 ANS: 3

\[ \frac{s_L}{s_S} = \frac{6\theta}{4\theta} = 1.5 \]


85 ANS: 2

\[ \frac{4}{3} \pi \cdot 4^3 + 0.075 \approx 20 \]

PTS: 2 REF: 011619geo NAT: G.MG.A.2 TOP: Density

86 ANS: 4

\[ \theta = \frac{360}{x} \pi = 2\pi \]

\[ 180 - 80 = 100 \]

\[ x = 80 \]

\[ \frac{180 - 100}{2} = 40 \]

PTS: 2 REF: 011612geo NAT: G.C.B.5 TOP: Sectors

87 ANS:

\[ \tan 3.47 = \frac{M}{6336} \]

\[ M \approx 384 \]

\[ 4960 + 384 = 5344 \]

\[ A \approx 229 \]

\[ 5344 - 229 = 5115 \]

PTS: 6 KEY: advanced REF: fall1413geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side
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.

\[ \text{SAS} \cong \text{SAS} \]

\[
m = \frac{1}{2} \quad -4 = 2(6) + b \\
\]
\[
m_\perp = 2 \quad -4 = 12 + b \\
\]
\[
-16 = b
\]

\[
\text{PTS: 2} \quad \text{REF: 011602geo} \quad \text{NAT: G.GPE.B.5} \quad \text{TOP: Parallel and Perpendicular Lines} \\
\text{KEY: write equation of perpendicular line}
\]
A dilation preserves slope, so the slopes of $QR$ and $Q'R'$ are equal. Because the slopes are equal, $Q'R' \parallel QR$.

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

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.
98 ANS: 1
\[ x = -5 + \frac{1}{3}(4 - 5) = -5 + \frac{1}{3}(-1) = -5 + \frac{1}{3} = -\frac{15}{3} + \frac{1}{3} = -\frac{14}{3} = -2 \]
\[ y = 2 + \frac{1}{3}(-10 - 2) = 2 - \frac{12}{3} = 2 - 4 = -2 \]

PTS: 2  REF: 011806geo  NAT: G.GPE.B.6  TOP: Directed Line Segments

99 ANS: 1
\[ 180 - 2(25) = 130 \]

PTS: 2  REF: 011730geo  NAT: G.SRT.B.5  TOP: Isosceles Triangle Theorem

100 ANS: 3
\[ 4 \times 4 \times 6 - \pi(1)^2(6) \approx 77 \]

PTS: 2  REF: 011711geo  NAT: G.GMD.A.3  TOP: Volume
KEY: compositions

101 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

102 ANS:

\[ \begin{align*}
V &= \frac{1}{3} \cdot 6^2 \cdot 12 = 144 \\
\end{align*} \]

PTS: 2  REF: 011725geo  NAT: G.CO.D.12  TOP: Constructions
KEY: line bisector

103 ANS: 2
\[ \begin{align*}
V &= \frac{1}{3} \cdot 6^2 \cdot 12 = 144 \\
\end{align*} \]

PTS: 2  REF: 011607geo  NAT: G.GMD.A.3  TOP: Volume
KEY: pyramids

104 ANS:
\[ \begin{align*}
r &= 25 \text{ cm} \left(\frac{1 \text{ m}}{100 \text{ cm}}\right) = 0.25 \text{ m}
V &= \pi(0.25 \text{ m})^2(10 \text{ m}) = 0.625 \pi \text{ m}^3 \\
W &= 0.625 \pi \text{ m}^3 \left(\frac{380 \text{ K}}{1 \text{ m}^3}\right) \approx 746.1 \text{ K} \\
n &= \frac{\$50,000}{\left(\frac{\$4.75}{\text{K}}\right)(746.1 \text{ K})} = 14.1 \text{ trees} \\
\end{align*} \]

PTS: 4  REF: spr1412geo  NAT: G.MG.A.2  TOP: Density
The diagonals, $MT$ and $AH$, of rhombus $MATH$ are perpendicular bisectors of each other.

105 ANS:

\[
M \left( \frac{4+0}{2}, \frac{6-1}{2} \right) = M \left( \frac{2+5}{2} \right) m = \frac{6-1}{4-0} = \frac{7}{4} \quad m_1 = -\frac{4}{7} \quad y - 2.5 = -\frac{4}{7} (x - 2)
\]

106 ANS:

\[
\begin{align*}
M(2,5) & = M(-1,3) \\
\text{PTS: 4} & \text{ REF: fall1411geo NAT: G.GPE.B.4 TOP: Quadrilaterals in the Coordinate Plane} \\
\text{KEY: grids}
\end{align*}
\]

107 ANS:

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

108 ANS:

\[
\begin{align*}
\text{PTS: 2} & \text{ REF: 011715geo NAT: G.C.A.2 TOP: Chords, Secants and Tangents} \\
\text{KEY: secants drawn from common point, length}
\end{align*}
\]

109 ANS:

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

110 ANS:

\[
\begin{align*}
\text{PTS: 2} & \text{ REF: 011822geo NAT: G.GMD.A.3 TOP: Volume} \\
\text{KEY: pyramids}
\end{align*}
\]

111 ANS:

\[
\begin{align*}
\text{PTS: 2} & \text{ REF: 011605geo NAT: G.CO.A.2 TOP: Analytical Representations of Transformations} \\
\text{KEY: basic}
\end{align*}
\]

112 ANS:

\[
\begin{align*}
\text{PTS: 2} & \text{ REF: 011606geo NAT: G.CO.C.9 TOP: Lines and Angles}
\end{align*}
\]
113 ANS: 2
\[14 \times 16 \times 10 = 2240 \quad \frac{2240 - 1680}{2240} = 0.25\]

PTS: 2 REF: 011604geo NAT: G.GMD.A.3 TOP: Volume KEY: prisms

114 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, \(\left(0, \frac{3}{2}, -4, \frac{3}{2}\right)\) → \((0, -6)\). So the equation of the dilated line is \(y = 2x - 6\).

PTS: 2 REF: fall1403geo NAT: G.SRT.A.1 TOP: Line Dilations

115 ANS:
Triangle \(X'Y'Z'\) is the image of \(\Delta XYZ\) after a rotation about point \(Z\) such that \(\overline{ZX}\) coincides with \(\overline{ZU}\). Since rotations preserve angle measure, \(\overline{ZY}\) coincides with \(\overline{ZV}\), and corresponding angles \(X\) and \(Y\), after the rotation, remain congruent, so \(\overline{XY} \parallel \overline{UV}\). Then, dilate \(\Delta X'Y'Z'\) by a scale factor of \(\frac{\overline{ZU}}{\overline{ZX}}\) with its center at point \(Z\). Since dilations preserve parallelism, \(\overline{XY}\) maps onto \(\overline{UV}\). Therefore, \(\Delta XYZ \sim \Delta UVZ\).

PTS: 2 REF: spr1406geo NAT: G.SRT.A.2 TOP: Compositions of Transformations KEY: grids

116 ANS:

PTS: 2 REF: fall1409geo NAT: G.CO.D.12 TOP: Constructions KEY: parallel and perpendicular lines

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

PTS: 2 REF: 011829geo NAT: G.MG.A.2 TOP: Density
118 ANS: 
\[ GI \parallel NT, \text{ and } 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)}; \triangle GI A \sim \triangle TNA \text{ (AA)}.

PTS: 2 REF: 011729geo NAT: G.SRT.A.3 TOP: Similarity Proofs

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

PTS: 2 REF: 011809geo NAT: G.CO.C.10 TOP: Exterior Angle Theorem

120 ANS: 1
The man’s height, 69 inches, is opposite to the angle of elevation, and the shadow length, 102 inches, is adjacent to the angle of elevation. Therefore, tangent must be used to find the angle of elevation. 
\[ \tan x = \frac{69}{102} \]
\[ x \approx 34.1 \]

PTS: 2 REF: fall1401geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find an Angle

121 ANS: A dilation of 3 centered at \( A \). A dilation preserves angle measure, so the triangles are similar.

PTS: 4 REF: 011832geo NAT: G.SRT.A.2 TOP: Dilations

122 ANS:
It is given that point \( D \) is the image of point \( A \) after a reflection in line \( CH \). It is given that \( \overrightarrow{CH} \) is the perpendicular bisector of \( BCE \) at point \( C \). Since a bisector divides a segment into two congruent segments at its midpoint, \( BC \cong EC \). Point \( E \) is the image of point \( B \) after a reflection over the line \( CH \), since points \( B \) and \( E \) are equidistant from point \( C \) and it is given that \( \overrightarrow{CH} \) is perpendicular to \( BE \). Point \( C \) is on \( \overrightarrow{CH} \), and therefore, point \( C \) maps to itself after the reflection over \( \overrightarrow{CH} \). Since all three vertices of triangle \( ABC \) map to all three vertices of triangle \( DEC \) under the same line reflection, then \( \triangle ABC \cong \triangle DEC \) because a line reflection is a rigid motion and triangles are congruent when one can be mapped onto the other using a sequence of rigid motions.

PTS: 6 REF: spr1414geo NAT: G.CO.B.7 TOP: Triangle Congruency

123 ANS: 3 PTS: 2 REF: 011621geo NAT: G.C.A.2 TOP: Chords, Secants and Tangents KEY: inscribed

124 ANS: 3
\[ \cos 40 = \frac{14}{x} \]
\[ x \approx 18 \]

PTS: 2 REF: 011712geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side
20

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 \quad \text{REF: 011834geo} \quad \text{NAT: G.SRT.C.8} \quad \text{TOP: Using Trigonometry to Find a Side}

\[
\sqrt{3 \cdot 21} = \sqrt{63} = 3\sqrt{7}
\]

PTS: 2 \quad \text{REF: 011622geo} \quad \text{NAT: G.SRT.B.5} \quad \text{TOP: Similarity}

KEY: altitude

\[
\text{ANS: 1} \quad \text{PTS: 2} \quad \text{REF: 011703geo} \quad \text{NAT: G.SRT.B.5} \quad \text{TOP: Triangle Congruency}
\]

\[
\text{ANS: 2} \quad \text{PTS: 2} \quad \text{REF: 011802geo} \quad \text{NAT: G.CO.C.11} \quad \text{TOP: Parallelograms}
\]

\[
\frac{64}{4} = 16 \quad 16^2 = 256 \quad 2w + 2(w + 2) = 64 \quad 15 \times 17 = 255 \quad 2w + 2(w + 4) = 64 \quad 14 \times 18 = 252 \quad 2w + 2(w + 6) = 64
\]

\[
w = 15 \quad w = 14 \quad w = 13
\]

\[
13 \times 19 = 247
\]

PTS: 2 \quad \text{REF: 011708geo} \quad \text{NAT: G.MG.A.3} \quad \text{TOP: Area of Polygons}

\[
\text{ANS: 1} \quad \text{PTS: 2} \quad \text{REF: 011716geo} \quad \text{NAT: G.CO.C.11} \quad \text{TOP: Special Quadrilaterals}
\]

\[
\sin 70 = \frac{30}{L}
\]

\[
L \approx 32
\]

PTS: 2 \quad \text{REF: 011629geo} \quad \text{NAT: G.SRT.C.8} \quad \text{TOP: Using Trigonometry to Find a Side}

KEY: graphics

\[
\text{ANS:}
\]

\[
\text{PTS: 2} \quad \text{REF: 081526geo} \quad \text{NAT: G.CO.D.13} \quad \text{TOP: Constructions}
\]
133 ANS:
\[ x \text{ represents the distance between the lighthouse and the canoe at 5:00; } y \text{ represents the distance between the lighthouse and the canoe at 5:05.} \]
\[ \tan 6 = \frac{112 - 1.5}{x} \quad \tan(49 + 6) = \frac{112 - 1.5}{y} \quad \frac{1051.3 - 77.4}{5} \approx 195 \]
\[ x \approx 1051.3 \quad y \approx 77.4 \]

PTS: 4 REF: spr1409geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side KEY: advanced

134 ANS:
As the sum of the measures of the angles of a triangle is 180°, \( m\angle ABC + m\angle BCA + m\angle CAB = 180° \). Each interior angle of the triangle and its exterior angle form a linear pair. Linear pairs are supplementary, so \( m\angle ABC + m\angle FBC = 180° \), \( m\angle BCA + m\angle DCA = 180° \), and \( m\angle CAB + m\angle EAB = 180° \). By addition, the sum of these linear pairs is 540°. When the angle measures of the triangle are subtracted from this sum, the result is 360°, the sum of the exterior angles of the triangle.

PTS: 4 REF: fall1410geo NAT: G.CO.C.10 TOP: Triangle Proofs

135 ANS:
\( \triangle MNO \) is congruent to \( \triangle PNO \) by SAS. Since \( \triangle MNO \cong \triangle PNO \), then \( MO \cong PO \) by CPCTC. So \( NO \) must divide \( MP \) in half, and \( MO = 8 \).

PTS: 2 REF: fall1405geo NAT: G.SRT.B.5 TOP: Isosceles Triangle Theorem
136 ANS: 
\[ s = \theta \cdot r \quad s = \theta \cdot r \]  Yes, both angles are equal.

\[ \pi = A \cdot 4 \quad \frac{13\pi}{8} = B \cdot 6.5 \]

\[ \frac{\pi}{4} = A \quad \frac{\pi}{4} = B \]

KEY: arc length

137 ANS: 
\[ \frac{360}{6} = 60 \]

PTS: 2  REF: 081627geo  NAT: G.CO.A.3  TOP: Mapping a Polygon onto Itself

138 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

139 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  
KEY: altitude

140 ANS: 3  
\[ \tan 34 = \frac{T}{20} \]
\[ T \approx 13.5 \]

PTS: 2  REF: 061505geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find a Side  
KEY: graphics
141 ANS:

![Diagram](image)

\[ r_{x=-1} \]  Reflections are rigid motions that preserve distance, so \( \triangle ABC \cong \triangle DEF \).

KEY: graphics

142 ANS: 1
180 – (68 \cdot 2)

PTS: 2  REF: 081624geo  NAT: G.CO.C.11  TOP: Interior and Exterior Angles of Polygons

143 ANS: 4

The segment’s midpoint is the origin and slope is \(-2\). The slope of a perpendicular line is \(\frac{1}{2}\).

\[
\begin{align*}
y &= \frac{1}{2}x + 0 \\
2y &= x \\
2y - x &= 0
\end{align*}
\]

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

144 ANS: 2
12^2 = 9 \cdot 16
144 = 144

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

145 ANS: 4  PTS: 2  REF: 081503geo  NAT: G.GMD.B.4
TOP: Rotations of Two-Dimensional Objects

146 ANS: 1
The other statements are true only if \( \overline{AD} \perp \overline{BC} \).

PTS: 2  REF: 081623geo  NAT: G.CA.2  TOP: Chords, Secants and Tangents
KEY: inscribed

147 ANS: 4  PTS: 2  REF: 061501geo  NAT: G.GMD.B.4
TOP: Rotations of Two-Dimensional Objects

148 ANS:

Parallelogram \( \overline{ABCD} \), diagonals \( \overline{AC} \) and \( \overline{BD} \) intersect at \( E \) (given). \( \overline{DC} \parallel \overline{AB}; \overline{DA} \parallel \overline{CB} \) (opposite sides of a parallelogram are parallel). \( \angle ACD \cong \angle CAB \) (alternate interior angles formed by parallel lines and a transversal are congruent).

149 ANS: 3
\[ V = 12 \cdot 8.5 \cdot 4 = 408 \]
\[ W = 408 \cdot 0.25 = 102 \]

PTS: 2 REFERENCES: 061507geo NAT: G.MG.A.2 TOP: Density

150 ANS: 3
(3) Could be a trapezoid.

PTS: 2 REFERENCES: 081607geo NAT: G.CO.C.11 TOP: Parallelograms

151 ANS:
\[ x = \sqrt{0.55^2 - 0.25^2} \approx 0.49 \] No, \[ 0.49^2 = 0.25 \]
\[ 0.9604 + 0.25 < 1.5 \]
\[ 0.9604 = y \]

PTS: 4 REFERENCES: 061534geo NAT: G.SRT.B.5 TOP: Similarity

152 ANS: 3
\[ \frac{10}{4} = \frac{6}{CD} = 15 - 4 = 11 \]
\[ x = 15 \]

PTS: 2 REFERENCES: 081612geo NAT: G.SRT.B.5 TOP: Similarity

153 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 REFERENCES: 081635geo NAT: G.SRT.B.5 TOP: Circle Proofs

154 ANS: 1

PTS: 2 REFERENCES: 061518geo NAT: G.SRT.A.1 TOP: Line Dilations

155 ANS: 3

PTS: 2 REFERENCES: 061703geo NAT: G.SRT.C.7 TOP: Cofunctions

156 ANS: 3
\[ A = \frac{1}{2} ab \quad 3 - 6 = -3 = x \]
\[ 24 = \frac{1}{2} a(8) \quad \frac{4 + 12}{2} = 8 = y \]
\[ a = 6 \]

PTS: 2 REFERENCES: 081615geo NAT: G.GPE.B.7 TOP: Polygons in the Coordinate Plane
157 ANS: 
\[
\tan x = \frac{10}{4} \\
x \approx 68
\]

PTS: 2 
REF: 061630geo 
NAT: G.SRT.C.8 
TOP: Using Trigonometry to Find an Angle

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

PTS: 2 
REF: 061710geo 
NAT: G.CO.C.10 
TOP: Interior and Exterior Angles of Triangles

159 ANS: 3
\[
\frac{60}{360} \cdot 6^2 \pi = 6\pi
\]

PTS: 2 
REF: 081518geo 
NAT: G.C.B.5 
TOP: Sectors

160 ANS: 3
\[
\frac{9}{5} = \frac{9.2}{x} \quad 5.1 + 9.2 = 14.3 \\
9x = 46 \\
x \approx 5.1
\]

PTS: 2 
REF: 061511geo 
NAT: G.SRT.B.5 
TOP: Side Splitter Theorem

161 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.

PTS: 2 
REF: 061714geo 
NAT: G.SRT.A.2 
TOP: Compositions of Transformations

162 ANS: 1
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: basic 
KEY: other
163 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

164 ANS:

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


166 ANS: 2

\[
C = \pi d \quad V = \pi \left( \frac{2.25}{\pi} \right)^2 \cdot 8 \approx 12.8916 \quad W = 12.8916 \cdot 752 \approx 9694
\]

PTS: 2 REF: 081617geo NAT: G.MG.A.2 TOP: Density


168 ANS: 1

\[
\frac{360^\circ}{45^\circ} = 8
\]

PTS: 2 REF: 061510geo NAT: G.CO.A.3 TOP: Mapping a Polygon onto Itself
169 ANS:
Opposite angles in a parallelogram are congruent, so \( m\angle O = 118^\circ \). The interior angles of a triangle equal \( 180^\circ \). 
\[ 180 - (118 + 22) = 40. \]


170 ANS: 1
\[ 3^2 = 9 \]

PTS: 2 REF: 081520geo NAT: G.SRT.A.2 TOP: Dilations

171 ANS: 4
\[ \sin 70 = \frac{x}{20} \]
\[ x \approx 18.8 \]

PTS: 2 REF: 061611geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side
KEY: without graphics

172 ANS:
\[ \tan 7 = \frac{125}{x} \quad \tan 16 = \frac{125}{y} \]
\[ 1018 - 436 \approx 582 \]
\[ x \approx 1018 \quad y \approx 436 \]

PTS: 4 REF: 081532geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side
KEY: advanced

173 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

174 ANS: 3

175 ANS:
Yes.  \((x - 1)^2 + (y + 2)^2 = 4^2\)
\((3.4 - 1)^2 + (1.2 + 2)^2 = 16\)
\(5.76 + 10.24 = 16\)
\(16 = 16\)

PTS: 2  REF: 081630geo  NAT: G.GPE.B.4  TOP: Circles in the Coordinate Plane

176 ANS: 4
\(\frac{1}{2} (360 - 268) = 46\)

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

177 ANS: 2  PTS: 2  REF: 081601geo  NAT: G.CO.C.9
TOP: Lines and Angles

178 ANS: 1
\(m_{TA} = -1 \ y = mx + b\)
\(m_{EM} = 1 \ 1 = 1(2) + b\)
\(-1 = b\)

PTS: 2  REF: 081614geo  NAT: G.GPE.B.4  TOP: Quadrilaterals in the Coordinate Plane
KEY: general

179 ANS:
Each triangular prism has the same base area. Therefore, each corresponding cross-section of the prisms will have the same area. Since the two prisms have the same height of 14, the two volumes must be the same.

PTS: 2  REF: 061727geo  NAT: G.GMD.A.1  TOP: Volume

180 ANS:

PTS: 2  REF: 081628geo  NAT: G.CO.D.12  TOP: Constructions
KEY: line bisector
The slopes of perpendicular line are opposite reciprocals. Since the lines are perpendicular, they form right angles and a right triangle.

\[ m_{BC} = -\frac{3}{2}, \quad m_{\perp} = \frac{2}{3} \]

\[ -1 = \frac{2}{3}(-3) + b \quad \text{or} \quad -4 = \frac{2}{3}(-1) + b \]

\[ m_{\perp} = \frac{2}{3} \]

\[ -1 = -2 + b \quad \Rightarrow \quad 1 = b \]

\[ 3 = \frac{2}{3}x + 1 \quad \Rightarrow \quad 3 = \frac{2}{3}x + \frac{10}{3} \]

\[ 2 = \frac{2}{3}x \quad \Rightarrow \quad 9 = 2x - 10 \]

\[ 3 = x \quad \Rightarrow \quad 19 = 2x \]

\[ 9.5 = x \]

\[ V = \frac{1}{3} \pi \left( \frac{8.3}{2} \right)^2 (10.2) + \frac{1}{2} \frac{4}{3} \pi \left( \frac{8.3}{2} \right)^3 \approx 183.961 + 149.693 \approx 333.65 \text{ cm}^3 \quad 333.65 \times 50 = 16682.7 \text{ cm}^3 \]

\[ 16682.7 \times 0.697 = 11627.8 \text{ g} \quad 11.6278 \times 3.83 = 44.53 \]

\[ \frac{6.6}{x} = \frac{4.2}{5.25} \]

\[ 4.2x = 34.65 \]

\[ x = 8.25 \]

\[ 3 \text{ PTS: 2} \quad \text{REF: 081613geo} \quad \text{NAT: G.GMD.B.4} \quad \text{TOP: Cross-Sections of Three-Dimensional Objects} \]

\[ 8 \]
185 ANS: 1
\[
\frac{4}{6} = \frac{3}{4.5} = \frac{2}{3}
\]
PTS: 2 REF: 081523geo NAT: G.SRT.A.2 TOP: Dilations

186 ANS: 2 PTS: 2 REF: 081619geo NAT: G.C.B.5
TOP: Sectors

187 ANS: 1
Since a dilation preserves parallelism, the line \(4y = 3x + 7\) and its image \(3x - 4y = 9\) are parallel, with slopes of \(\frac{3}{4}\).

PTS: 2 REF: 081710geo NAT: G.SRT.A.1 TOP: Line Dilations

188 ANS: 2

PTS: 2 REF: 081604geo NAT: G.CO.C.10 TOP: Interior and Exterior Angles of Triangles

189 ANS:
\[
\sqrt{(2.5 - 1)^2 + (-.5 - 1.5)^2} = \sqrt{2.25 + 4} = 2.5
\]
PTS: 2 REF: 081729geo NAT: G.SRT.A.2 TOP: Dilations

190 ANS: 4 PTS: 2 REF: 081506geo NAT: G.SRT.A.2
TOP: Dilations

191 ANS: 4 PTS: 2 REF: 081609geo NAT: G.SRT.A.2
TOP: Compositions of Transformations KEY: grids

192 ANS: 2
\(x\) is \(\frac{1}{2}\) the circumference.
\[
\frac{C}{2} = \frac{10\pi}{2} \approx 16
\]
PTS: 2 REF: 061523geo NAT: G.GMD.A.1 TOP: Circumference
ANS:
\[ m_{\overline{TS}} = \frac{-10}{6} = -\frac{5}{3} \quad m_{\overline{SR}} = \frac{3}{5} \]
Since the slopes of \( \overline{TS} \) and \( \overline{SR} \) are opposite reciprocals, they are perpendicular and form a right angle. \( \triangle RST \) is a right triangle because \( \angle S \) is a right angle. \( P(0,9) \)
\[ m_{\overline{RP}} = \frac{-10}{6} = -\frac{5}{3} \quad m_{\overline{PT}} = \frac{3}{5} \]
Since the slopes of all four adjacent sides (\( \overline{TS}, \overline{SR}, \overline{RP}, \overline{PT} \) and \( \overline{RS}, \overline{RP} \) and \( \overline{PT} \)) are opposite reciprocals, they are perpendicular and form right angles. Quadrilateral \( RSTP \) is a rectangle because it has four right angles.
199 ANS: 1

\[
m = \left( \frac{-11 + 5}{2}, \frac{5 + 7}{2} \right) = (-3, -1) \quad m = \frac{5 - 7}{-11 - 5} = \frac{12}{-16} = -\frac{3}{4} \quad m_2 = \frac{4}{3}
\]


200 ANS:

PTS: 2 REF: 081626geo NAT: G.CO.A.5 TOP: Compositions of Transformations KEY: grids

201 ANS:

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); \(AD \cong DC\) (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).


202 ANS: 3

\[
r = \sqrt{(7 - 3)^2 + (1 - -2)^2} = \sqrt{16 + 9} = 5
\]

PTS: 2 REF: 061503geo NAT: G.GPE.B.4 TOP: Circles in the Coordinate Plane


204 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
205 ANS:
\[
\sin x = \frac{4.5}{11.75} \\
\Rightarrow x \approx 23
\]

PTS: 2  REF: 061528geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find an Angle

206 ANS: 3
\[
\frac{60}{360} \cdot 8^2 \pi = \frac{1}{6} \cdot 64\pi = \frac{32\pi}{3}
\]

PTS: 2  REF: 061624geo  NAT: G.C.B.5  TOP: Sectors

207 ANS: 4
\[
\frac{2}{6} = \frac{5}{15}
\]

PTS: 2  REF: 081517geo  NAT: G.SRT.B.5  TOP: Side Splitter Theorem

208 ANS: 1  PTS: 2  REF: 081603geo  NAT: G.GMD.B.4  TOP: Rotations of Two-Dimensional Objects

209 ANS: 3
\[

\begin{align*}
\nu &= \pi r^2 h \\
(1) \quad 6^2 \cdot 10 &= 360 \\
\quad 150\pi &= \pi r^2 h \\
(2) \quad 10^2 \cdot 6 &= 600 \\
\quad 150 &= r^2 h \\
(3) \quad 5^2 \cdot 6 &= 150 \\
(4) \quad 3^2 \cdot 10 &= 900
\end{align*}
\]

PTS: 2  REF: 081713geo  NAT: G.GMD.B.4  TOP: Rotations of Two-Dimensional Objects

210 ANS: 3
1) only proves AA; 2) need congruent legs for HL; 3) SAS; 4) only proves product of altitude and base is equal

PTS: 2  REF: 061607geo  NAT: G.SRT.B.5  TOP: Triangle Proofs

211 ANS: 1
\[
m = -\frac{2}{3} \\
1 = \left(-\frac{2}{3}\right)6 + b \\
1 = -4 + b \\
5 = b
\]

PTS: 2  REF: 081510geo  NAT: G.GPE.B.5  TOP: Parallel and Perpendicular Lines
\[
\frac{1.65}{4.15} = \frac{x}{16.6} \\
4.15x = 27.39 \\
x = 6.6
\]

PTS: 2  REF: 061531geo  NAT: G.SRT.B.5  TOP: Similarity

KEY: basic

213 ANS: 1
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 \(-\frac{2}{3}\).

PTS: 2  REF: 061522geo  NAT: G.SRT.A.1  TOP: Line Dilations

214 ANS: The transformation is a rotation, which is a rigid motion.

PTS: 2  REF: 081530geo  NAT: G.CO.B.7  TOP: Triangle Congruency

215 ANS: 2
\[S_A = 6 \cdot 12^2 = 864\]
\[\frac{864}{450} = 1.92\]

PTS: 2  REF: 061519geo  NAT: G.MG.A.3  TOP: Surface Area
216 ANS:

\[-6 + \frac{2}{5}(4 - 6) - 5 + \frac{2}{5}(0 - 5) (-2, -3)\]

\[-6 + \frac{2}{5}(10) - 5 + \frac{2}{5}(5)\]

\[-6 + 4 - 5 + 2\]

\[-2 - 3\]

PTS: 2 REF: 061527geo NAT: G.GPE.B.6 TOP: Directed Line Segments

217 ANS:

\[
\frac{3.75}{5} = \frac{4.5}{6}
\]

\[\overline{AB}\] is parallel to \(\overline{CD}\) because \(\overline{AB}\) divides the sides proportionately.

\[39.375 = 39.375\]

PTS: 2 REF: 061627geo NAT: G.SRT.B.5 TOP: Side Splitter Theorem

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

219 ANS:

PTS: 2 REF: 061631geo NAT: G.CO.D.12 TOP: Constructions

KEY: parallel and perpendicular lines

220 ANS: 4

The slope of \(\overline{BC}\) is \(\frac{2}{5}\). Altitude is perpendicular, so its slope is \(-\frac{5}{2}\).

PTS: 2 REF: 061614geo NAT: G.GPE.B.5 TOP: Parallel and Perpendicular Lines

KEY: find slope of perpendicular line
\[x^2 - 4x + 4 + y^2 + 8y + 16 = -11 + 4 + 16\]
\[(x - 2)^2 + (y + 4)^2 = 9\]

\[\Delta DEF \cong \Delta A'B'C'\] because \(\Delta DEF\) is a reflection of \(\Delta A'B'C'\) and reflections preserve distance.

\[A(2, -3) - (2, -3) + (0, 0) = A'(2, -3)\]
\[B(6, -8) - (2, -3) + (4, -5) = B'(7, 1)\]
\[C(2, -9) - (2, -3) + (6, 0) = C'(8, -3)\]

Alternate interior angles

\[1)\text{ opposite sides; 2) adjacent sides; 3) perpendicular diagonals; 4) diagonal bisects angle}\]
\[
\frac{512\pi}{3} \cdot \frac{2\pi}{\left(\frac{32}{2}\right)^2} = \frac{4\pi}{3}
\]

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

**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

\[
f = \frac{15}{4} = 3.75
\]

**ANS:** 1

**PTS:** 2  **REF:** 061617geo  **NAT:** G.CO.C.9  **TOP:** Lines and Angles

**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); \(\angle EDF \cong \angle GFB\) (alternate interior angles are congruent); \(\triangle DEF \sim \triangle BGF\) (AA).

**PTS:** 4  **REF:** 061633geo  **NAT:** G.SRT.A.3  **TOP:** Similarity Proofs

\[
\frac{36}{45} \neq \frac{15}{18}
\]

\[
\frac{4}{5} \neq \frac{5}{6}
\]

**ANS:** 4

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

\[
x^2 + y^2 - 12y + 36 = -20 + 36
\]

\[
x^2 + (y - 6)^2 = 16
\]

**ANS:** 1

**PTS:** 2  **REF:** 061712geo  **NAT:** G.GPE.A.1  **TOP:** Equations of Circles

KEY: completing the square

**ANS:** 4

**PTS:** 2  **REF:** 081708geo  **NAT:** G.CO.C.11  **TOP:** Interior and Exterior Angles of Polygons
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

\[
\frac{12}{4} = \frac{36}{x}
\]

\[12x = 144\]
\[x = 12\]

PTS: 2  REF: 061621geo  NAT: G.SRT.B.5  TOP: Side Splitter Theorem

Reflections are rigid motions that preserve distance.

PTS: 2  REF: 061530geo  NAT: G.CO.B.7  TOP: Triangle Congruency

TOP: Parallelograms

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

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

KEY: spheres

242 ANS: 4


\[A = 6^2 \pi = 36\pi \cdot \frac{x}{360} = 12\pi\]
\[x = 360 \cdot \frac{12}{36}\]
\[x = 120\]

PTS: 2  REF: 061529geo  NAT: G.CB.5  TOP: Sectors
NYSED has stated that all students should be awarded credit regardless of their answer to this question.

\[ V = \frac{1}{3} \pi \left( \frac{3}{2} \right)^2 \cdot 8 \approx 18.85 \cdot 100 = 1885 \quad 1885 \cdot 0.52 \cdot 0.10 = 98.02 \quad 1.95(100) - (37.83 + 98.02) = 59.15 \]

Isosceles trapezoid \(ABCD\), \(\angle CDE \cong \angle DCE\), \(AE \perp DE\), and \(BE \perp CE\) (given); \(AD \cong BC\) (congruent legs of isosceles trapezoid); \(\angle DEA \cong \angle CEB\) (all right angles are congruent); \(\angle DCA \cong \angle DCB\) (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).

\[ AB \quad BC = DE \quad EF \]
\[ \frac{9}{15} = \frac{6}{10} \]
\[ 90 = 90 \]

Parallel chords intercept congruent arcs. \(\frac{180 - 130}{2} = 25\)

\[ \sqrt{20^2 - 10^2} \approx 17.3 \]

\[ R_{180}^\circ \text{ about } \left( \frac{1}{2}, \frac{1}{2} \right) \]
251 ANS: 4 PTS: 2 REF: 061513geo NAT: G.CO.C.11
TOP: Parallelograms

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

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

253 ANS: 1 PTS: 2 REF: 081606geo NAT: G.SRT.C.7
TOP: Cofunctions

254 ANS: 2 PTS: 2 REF: 061516geo NAT: G.SRT.A.2
TOP: Dilations

255 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

256 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

257 ANS: 3 PTS: 2 REF: 061601geo NAT: G.GMD.B.4
TOP: Rotations of Two-Dimensional Objects

258 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

259 ANS:

PTS: 2 REF: 061525geo NAT: G.CO.D.13 TOP: Constructions
\[ \frac{-2 - 1}{-1 - 3} = \frac{-3}{2} \quad \frac{3 - 2}{0 - 5} = \frac{1}{-5} \quad \frac{3 - 1}{0 - -3} = \frac{2}{3} \quad \frac{2 - -2}{5 - -1} = \frac{4}{6} = \frac{2}{3} \]

PTS: 2  
REF: 081522geo  
NAT: G.GPE.B.4  
TOP: Quadrilaterals in the Coordinate Plane

KEY: general

261 ANS: 3

1) \( \frac{12}{9} = \frac{4}{3} \)  
2) AA  
3) \( \frac{32}{16} \neq \frac{8}{2} \)  
4) SAS

PTS: 2  
REF: 061605geo  
NAT: G.SRT.B.5  
TOP: Similarity

KEY: basic

262 ANS: 2

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

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

KEY: proof

263 ANS:

\[ \overline{RS} \text{ and } \overline{TV} \text{ bisect each other at point } X; \quad \overline{TR} \text{ and } \overline{SV} \text{ are drawn (given); } \angle TXR \cong \angle VXS (\text{vertical angles are congruent}); \quad \triangle TXR \cong \triangle VXS \text{ (SAS)}; \quad \angle T \cong \angle V \text{ (CPCTC)}; \quad \overline{TR} \parallel \overline{SV} \text{ (a transversal that creates congruent alternate interior angles cuts parallel lines).} \]

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

KEY: proof

264 ANS: 3

\[ x^2 + 4x + 4 + y^2 - 6y + 9 = 12 + 4 + 9 \]

\[ (x + 2)^2 + (y - 3)^2 = 25 \]

PTS: 2  
REF: 081509geo  
NAT: G.GPE.A.1  
TOP: Equations of Circles

KEY: completing the square

265 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

266 ANS: 4

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

PTS: 2  
REF: 081722geo  
NAT: G.CO.A.3  
TOP: Mapping a Polygon onto Itself
267 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

268 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

269 ANS:
\[ 73 + R = 90 \]
Equal cofunctions are complementary.
\[ R = 17 \]

PTS: 2 REF: 061628geo NAT: G.SRT.C.7 TOP: Cofunctions

270 ANS:

The line is on the center of dilation, so the line does not change. \( p: 3x + 4y = 20 \)

PTS: 2 REF: 061731geo NAT: G.GPE.B.5 TOP: Parallel and Perpendicular Lines
KEY: identify perpendicular lines

TOP: Cofunctions

272 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

273 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
274 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

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

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

276 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

277 ANS: 4  PTS: 2  REF: 061615geo  NAT: G.SRT.C.6  
TOP: Trigonometric Ratios

278 ANS:  
\[ T_{6,0} \circ r_{x-axis} \]

PTS: 2  REF: 061625geo  NAT: G.CO.A.5  TOP: Compositions of Transformations  
KEY: identify

279 ANS: 1  
\[ V = \frac{\frac{4}{3} \pi \left( \frac{10}{2} \right)^3}{2} \approx 261.8 \cdot 62.4 = 16,336 \]

PTS: 2  REF: 081516geo  NAT: G.MG.A.2  TOP: Density

280 ANS: 4  
\[ 2592276 = \frac{1}{3} \cdot s^2 \cdot 146.5 \]
\[ 230 \approx s \]

PTS: 2  REF: 081521geo  NAT: G.GMD.A.3  TOP: Volume  
KEY: pyramids

281 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
282 ANS:
\[ 4 + \frac{4}{9} (22 - 4) + 2 + \frac{4}{9} (2 - 2) \ (12, 2) \]
\[ 4 + \frac{4}{9} (18) + 2 + \frac{4}{9} (0) \]
\[ 4 + 8 + 2 + 0 \]
\[ 12 + 2 \]
PTS: 2 REF: 061626geo NAT: G.GPE.B.6 TOP: Directed Line Segments

283 ANS: 3 PTS: 2 REF: 081622geo NAT: G.SRT.B.5
TOP: Triangle Proofs KEY: statements

284 ANS: 4 PTS: 2 REF: 061608geo NAT: G.SRT.A.2
TOP: Compositions of Transformations KEY: grids

285 ANS:
Parallelogram \(ABCD\), \(BE \perp CED\), \(DF \perp BFC\), \(CE \cong CF\) (given). \(\angle BEC \cong \angle DFC\) (perpendicular lines form right angles, which are congruent). \(\angle FCD \cong \angle BCE\) (reflexive property). \(\triangle BEC \cong \triangle DFC\) (ASA). \(BC \cong CD\) (CPCTC). \(ABCD\) is a rhombus (a parallelogram with consecutive congruent sides is a rhombus).

TOP: Identifying Transformations KEY: graphics

287 ANS: 2
(1) AA; (3) SAS; (4) SSS. NYSED has stated that all students should be awarded credit regardless of their answer to this question.

288 ANS:
\[ \frac{3}{8} \cdot 56 = 21 \]
PTS: 2 REF: 061724geo NAT: G.SRT.B.5 TOP: Similarity
KEY: basic

289 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
\[
\frac{120}{230} = \frac{x}{315}
\]

\[x = 164\]

PTS: 2 \hspace{1cm} \text{REF: 081527geo} \hspace{1cm} \text{NAT: G.SRT.B.5} \hspace{1cm} \text{TOP: Similarity}

\[
\pi \cdot 11.25^2 \cdot 33.5 \approx 57.7
\]

PTS: 4 \hspace{1cm} \text{REF: 061632geo} \hspace{1cm} \text{NAT: G.GMD.A.3} \hspace{1cm} \text{TOP: Volume}

\[
\tan 47 = \frac{x}{8.5}
\]

\[x \approx 9.115\]

\[
V = \frac{1}{3} \pi (8.5)^2 (9.115) \approx 689.6 \hspace{1cm} \text{Cylinder:} \hspace{1cm} V = \pi (8.5)^2 (25) \approx 5674.5 \hspace{1cm} \text{Hemisphere:} \hspace{1cm} V = \frac{1}{2} \left( \frac{4}{3} \pi (8.5)^3 \right) \approx 1286.3
\]

\[689.6 + 5674.5 + 1286.3 \approx 7650\]

No, because \(7650 \cdot 62.4 = 477,360\) is greater than 400,000.

PTS: 6 \hspace{1cm} \text{REF: 061535geo} \hspace{1cm} \text{NAT: G.MG.A.2} \hspace{1cm} \text{TOP: Density}

\[
\frac{7}{12} \cdot 30 = 17.5
\]

PTS: 2 \hspace{1cm} \text{REF: 061521geo} \hspace{1cm} \text{NAT: G.SRT.B.5} \hspace{1cm} \text{TOP: Similarity}

\[
\sin 75 = \frac{15}{x}
\]

\[x = \frac{15}{\sin 75}\]

\[x \approx 15.5\]

PTS: 2 \hspace{1cm} \text{REF: 081631geo} \hspace{1cm} \text{NAT: G.SRT.C.8} \hspace{1cm} \text{TOP: Using Trigonometry to Find a Side}
298 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

299 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

300 ANS: 1 PTS: 2 REF: 081507geo NAT: G.CO.A.5 TOP: Compositions of Transformations KEY: identify

301 ANS:
\[\frac{6}{14} = \frac{9}{21}\] SAS

126 = 126

PTS: 2 REF: 081529geo NAT: G.SRT.B.5 TOP: Similarity KEY: basic


303 ANS: 3 PTS: 2 REF: 081515geo NAT: G.C.A.3 TOP: Inscribed Quadrilaterals


305 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


307 ANS:
Translations preserve distance. If point \(D\) is mapped onto point \(A\), point \(F\) would map onto point \(C\).
\[\triangle DEF \cong \triangle ABC\] as \(\overline{AC} \cong \overline{DF}\) and points are collinear on line \(\ell\) and a reflection preserves distance.

PTS: 4 REF: 081534geo NAT: G.CO.B.7 TOP: Triangle Congruency
Similar triangles are required to model and solve a proportion.

\[
\frac{x + 5}{1.5} = \frac{x}{1}
\]

\[
\frac{1}{3} \pi (1.5)^2 (15) - \frac{1}{3} \pi (1)^2 (10) \approx 24.9
\]

\[
x + 5 = 1.5x
\]

\[
5 = .5x
\]

\[
10 = x
\]

\[
10 + 5 = 15
\]

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

311 ANS: 4

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

\[
3.5x = 18 - x
\]

\[
4.5x = 18
\]

\[
x = 4
\]

313 ANS: 3

PTS: 2 REF: 081502geo NAT: G.CO.A.2 TOP: Identifying Transformations KEY: basic
\[ PQ = \sqrt{(8-3)^2 + (3-2)^2} = \sqrt{50} \quad QR = \sqrt{(1-8)^2 + (4-3)^2} = \sqrt{50} \quad RS = \sqrt{(-4-1)^2 + (-1-4)^2} = \sqrt{50} \quad PS = \sqrt{(-4-3)^2 + (-1-2)^2} = \sqrt{50} \]

PQRS is a rhombus because all sides are congruent. \[ m_{\overline{PQ}} = \frac{8-3}{3-2} = \frac{5}{1} = 5 \]

\[ m_{\overline{QR}} = \frac{1-8}{4-3} = -7 \]

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.

\[ \pi \cdot \frac{5}{3} \cdot 62.4 \approx 16,336 \]

\[ 3 \times 6 = 18 \]

\[ \tan x = \frac{12}{75} \quad \tan y = \frac{72}{75} \quad 43.83 - 9.09 \approx 34.7 \]

\[ x \approx 9.09 \quad y \approx 43.83 \]
320 ANS:
\[
\tan 16.5 = \frac{x}{13.5} \quad 9 \times 16 \times 4.5 = 648 \quad 3752 - (35 \times 16 \times .5) = 3472
\]
\[
13.5 \times 16 \times 4.5 = 972 \quad 3472 \times 7.48 \approx 25971
\]
\[
x \approx 4 \quad 4 + 4.5 = 8.5 \quad \frac{1}{2} \times 13.5 \times 16 \times 4 = 432 \quad \frac{25971}{10.5} \approx 2473.4
\]
\[
12.5 \times 16 \times 8.5 = \frac{1700}{3752} \quad \frac{2473.4}{60} \approx 41
\]

PTS: 6 \quad REF: 081736geo \quad NAT: G.GMD.A.3 \quad TOP: Volume
KEY: compositions

321 ANS: 1 \quad PTS: 2 \quad REF: 061520geo \quad NAT: G.C.A.2
TOP: Chords, Secants and Tangents \quad KEY: mixed

322 ANS: 4 \quad PTS: 2 \quad REF: 061502geo \quad NAT: G.CO.A.2
TOP: Identifying Transformations \quad KEY: basic

323 ANS:
\[
\text{The length of } \overline{A'C} \text{ is twice } \overline{AC}.
\]

PTS: 4 \quad REF: 081632geo \quad NAT: G.CO.D.12 \quad TOP: Constructions
KEY: congruent and similar figures

324 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). $180^\circ$ rotation of $\triangle AED$ around point $E$.

PTS: 4 \quad REF: 061533geo \quad NAT: G.SRT.B.5 \quad TOP: Quadrilateral Proofs

325 ANS: 4 \quad PTS: 2 \quad REF: 061711geo \quad NAT: G.CO.C.11
TOP: Special Quadrilaterals

326 ANS:
The four small triangles are 8-15-17 triangles. $4 \times 17 = 68$

PTS: 2 \quad REF: 081726geo \quad NAT: G.CO.C.11 \quad TOP: Special Quadrilaterals
\[
\tan 15 = \frac{6250}{x} \quad \tan 52 = \frac{6250}{y} \\
23325.3 - 4883 = 18442 \left( \frac{\text{1 min}}{\text{5280 ft}} \right) \left( \frac{\text{60 min}}{\text{1 h}} \right) \approx 210
\]

\[
x \approx 23325.3 \quad y \approx 4883
\]

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

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

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

ANS: 2

\[
s^2 + s^2 = 7^2
\]

\[
2s^2 = 49
\]

\[
s^2 = 24.5
\]

\[
s \approx 4.9
\]

PTS: 2  
REF: 081511geo  
NAT: G.SRT.C.8  
TOP: Pythagorean Theorem

ANS: 2

TOP: Triangle Proofs  
KEY: statements

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

ANS: 1

TOP: Mapping a Polygon onto Itself

ANS:

A dilation of \(\frac{5}{2}\) about the origin. Dilations preserve angle measure, so the triangles are similar by AA.

PTS: 4  
REF: 061634geo  
NAT: G.SRT.A.3  
TOP: Similarity Proofs
\[
\frac{1\,\text{lb}}{1\,\text{lb}} \left( \frac{16\,\text{oz}}{1\,\text{lb}} \right) = \frac{13.3\,\text{l}}{3.785\,\text{lb}} \left( \frac{1\,\text{g}}{3.785\,\text{lb}} \right) \approx \frac{3.5\,\text{g}}{1\,\text{lb}}
\]

PTS: 2  REF: 061618geo  NAT: G.MG.A.2  TOP: Density

336  ANS: 4  PTS: 2  REF: 081514geo  NAT: G.SRT.A.2
TOP: Compositions of Transformations  KEY: grids

337  ANS: 1  PTS: 2  REF: 061604geo  NAT: G.CO.A.2
TOP: Identifying Transformations  KEY: graphics

338  ANS:
\[
\frac{137.8}{6} \approx 0.638 \text{ Ash}
\]

PTS: 2  REF: 081525geo  NAT: G.MG.A.2  TOP: Density

339  ANS: 3

\[
\sqrt{45} = 3\sqrt{5} \quad a = \frac{1}{2} \left( 3\sqrt{5} \right) \left( 6\sqrt{5} \right) = \frac{1}{2} (18)(5) = 45
\]

\[
\sqrt{180} = 6\sqrt{5}
\]

PTS: 2  REF: 061622geo  NAT: G.GPE.B.7  TOP: Polygons in the Coordinate Plane

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

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

341  ANS: 4

PTS: 2  REF: 061717geo  NAT: G.CO.C.10  TOP: Interior and Exterior Angles of Triangles
342 ANS: 4

\[ 40 - x + 3x = 90 \]
\[ 2x = 50 \]
\[ x = 25 \]

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

343 ANS: 

\[ \tan x = \frac{1}{12} \]
\[ x \approx 4.76 \]

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

344 ANS: 1

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

PTS: 2  REF: 081715geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find an Angle

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

346 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

347 ANS: 

\[ 20000 \text{ g} \left( \frac{1 \text{ ft}^3}{7.48 \text{ g}} \right) = 2673.8 \text{ ft}^3 \]
\[ 2673.8 \text{ ft}^3 = \pi r^2 (34.5) \]
\[ 9.9 + 1 = 10.9 \]
\[ r \approx 4.967 \]
\[ d \approx 9.9 \]

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

348 ANS: 4

\[ V = \pi \left( \frac{6.7}{2} \right)^2 (4 \cdot 6.7) \approx 945 \]

PTS: 2  REF: 081620geo  NAT: G.GMD.A.3  TOP: Volume
KEY: cylinders

Circle \( O \), tangent \( \overline{EC} \) to diameter \( \overline{AC} \), chord \( \overline{BC} \parallel \) 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); \( \overrightarrow{EC} \perp \overline{OC} \) (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); \( \angle BCA \cong \angle CAE \) (the transversal of parallel lines creates congruent alternate interior angles); \( \triangle ABC \sim \triangle ECA \) (AA); \( \frac{BC}{CA} = \frac{AB}{EC} \) (Corresponding sides of similar triangles are in proportion).