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

[Diagram of \( \triangle ABC \) with \( E \) on \( AC \) and \( D \) on \( AB \)]

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

2 The area of a sector of a circle with a radius measuring 15 cm is \( 75\pi \) cm\(^2\). What is the measure of the central angle that forms the sector?
1) 72°
2) 120°
3) 144°
4) 180°

3 What is an equation of a circle whose center is at \( (2, -4) \) and is tangent to the line \( x = -2 \)?
1) \( (x - 2)^2 + (y + 4)^2 = 4 \)
2) \( (x - 2)^2 + (y + 4)^2 = 16 \)
3) \( (x + 2)^2 + (y - 4)^2 = 4 \)
4) \( (x + 2)^2 + (y - 4)^2 = 16 \)

4 The coordinates of the vertices of parallelogram \( CDEH \) are \( C(-5, 5) \), \( D(2, 5) \), \( E(-1, -1) \), and \( H(-8, -1) \). What are the coordinates of \( P \), the point of intersection of diagonals \( CE \) and \( DH \)?
1) \((-2, 3)\)
2) \((-2, 2)\)
3) \((-3, 2)\)
4) \((-3, -2)\)

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

6 Lou has a solid clay brick in the shape of a rectangular prism with a length of 8 inches, a width of 3.5 inches, and a height of 2.25 inches. If the clay weighs 1.055 oz/in\(^3\), how much does Lou's brick weigh, to the nearest ounce?
1) 66
2) 64
3) 63
4) 60

7 What are the coordinates of the center and the length of the radius of the circle whose equation is \( x^2 + y^2 = 8x - 6y + 39 \)?
1) center \((-4, 3)\) and radius \(64\)
2) center \((4, -3)\) and radius \(64\)
3) center \((-4, 3)\) and radius \(8\)
4) center \((4, -3)\) and radius \(8\)
8 The table below shows the population and land area, in square miles, of four counties in New York State at the turn of the century.

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

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

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

10 What is an equation of the image of the line
\[ y = \frac{3}{2}x - 4 \]
after a dilation of a scale factor of \( \frac{3}{4} \) centered at the origin?
1) \( y = \frac{9}{8}x - 4 \)
2) \( y = \frac{9}{8}x - 3 \)
3) \( y = \frac{3}{2}x - 4 \)
4) \( y = \frac{3}{2}x - 3 \)

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

Which equation would determine the value of angle \( A \)?
1) \( \sin A = \frac{8}{17} \)
2) \( \tan A = \frac{8}{15} \)
3) \( \cos A = \frac{15}{17} \)
4) \( \tan A = \frac{15}{8} \)
12. Given points $A$, $B$, and $C$, use a compass and straightedge to construct point $D$ so that $ABCD$ is a parallelogram. [Leave all construction marks.]

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

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

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

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

16. A cone has a volume of $108\pi$ and a base diameter of 12. What is the height of the cone?
   1) 27
   2) 9
   3) 3
   4) 4

17. Theresa has a rectangular pool 30 ft long, 15 ft wide, and 4 ft deep. Theresa fills her pool using city water at a rate of $3.95 per 100 gallons of water. Nancy has a circular pool with a diameter of 24 ft and a depth of 4 ft. Nancy fills her pool with a water delivery service at a rate of $200 per 6000 gallons. If Theresa and Nancy both fill their pools 6 inches from the top of the pool, determine and state who paid more to fill her pool.
   \[1\text{ft}^3 \text{ water} = 7.48 \text{ gallons}\]

18. A child-sized swimming pool can be modeled by a cylinder. The pool has a diameter of $6\frac{1}{2}$ feet and a height of 12 inches. The pool is filled with water to $\frac{2}{3}$ of its height. Determine and state the volume of the water in the pool, to the nearest cubic foot. One cubic foot equals 7.48 gallons of water. Determine and state, to the nearest gallon, the number of gallons of water in the pool.
19 Which equation represents a line parallel to the line whose equation is \(-2x + 3y = -4\) and passes through the point \((1,3)\)?

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

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

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

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

20 As shown in the diagram below, secants \(PWR\) and \(PTS\) are drawn to circle \(O\) from external point \(P\).

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

21 Square \(MATH\) has a side length of 7 inches. Which three-dimensional object will be formed by continuously rotating square \(MATH\) around side \(AT\)?

1) a right cone with a base diameter of 7 inches

2) a right cylinder with a diameter of 7 inches

3) a right cone with a base radius of 7 inches

4) a right cylinder with a radius of 7 inches

22 What is the volume, in cubic centimeters, of a right square pyramid with base edges that are 64 cm long and a slant height of 40 cm?

1) 8192.0

2) 13,653.3

3) 32,768.0

4) 54,613.3

23 In the diagram below, circle \(O\) has a radius of 10.

If \(m\angle AB = 72^\circ\), find the area of shaded sector \(AOB\), in terms of \(\pi\).

24 In rhombus \(TIGE\), diagonals \(TG\) and \(IE\) intersect at \(R\). The perimeter of \(TIGE\) is 68, and \(TG = 16\).

What is the length of diagonal \(IE\)?

1) 15

2) 30

3) 34

4) 52
25 A walking path at a local park is modeled on the grid below, where the length of each grid square is 10 feet. The town needs to submit paperwork to pave the walking path. Determine and state, to the nearest square foot, the area of the walking path.

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

Determine and state the minimum length of a ladder, to the nearest tenth of a meter, that David will need to buy for his treehouse.
27. Write an equation of the line that is parallel to the line whose equation is $3y + 7 = 2x$ and passes through the point $(2,6)$.

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

1) $\frac{3}{2}$
2) $\frac{2}{3}$
3) 3
4) $\frac{1}{3}$

29. After a dilation with center $(0,0)$, the image of $DB$ is $D'B'$. If $DB = 4.5$ and $D'B' = 18$, the scale factor of this dilation is

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

30. Point $M$ divides $AB$ so that $AM:MB = 1:2$. If $A$ has coordinates $(-1, -3)$ and $B$ has coordinates $(8, 9)$, the coordinates of $M$ are

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

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

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

1) $18^\circ$
2) $48^\circ$
3) $66^\circ$
4) $114^\circ$

32. Triangle $ABC$ is shown below. Using a compass and straightedge, construct the dilation of $\triangle ABC$ centered at $B$ with a scale factor of 2. [Leave all construction marks.]

Is the image of $\triangle ABC$ similar to the original triangle? Explain why.
33. A tent is in the shape of a right pyramid with a square floor. The square floor has side lengths of 8 feet. If the height of the tent at its center is 6 feet, what is the volume of the tent, in cubic feet?

1) 48  
2) 128  
3) 192  
4) 384

34. What is an equation of a circle whose center is (1,4) and diameter is 10?

1) \(x^2 - 2x + y^2 - 8y = 8\)  
2) \(x^2 + 2x + y^2 + 8y = 8\)  
3) \(x^2 - 2x + y^2 - 8y = 83\)  
4) \(x^2 + 2x + y^2 + 8y = 83\)

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

If \(m\angle B = 75^\circ\), then the measure of \(\angle EFA\) is

1) 142.5\(^\circ\)  
2) 127.5\(^\circ\)  
3) 52.5\(^\circ\)  
4) 37.5\(^\circ\)

36. A quadrilateral must be a parallelogram if

1) one pair of sides is parallel and one pair of angles is congruent  
2) one pair of sides is congruent and one pair of angles is congruent  
3) one pair of sides is both parallel and congruent  
4) the diagonals are congruent

37. On the set of axes below, pentagon \(ABCDE\) is congruent to \(A'B'C'D'E'\).

Which describes a sequence of rigid motions that maps \(ABCDE\) onto \(A'B'C'D'E'\)?

1) a rotation of 90\(^\circ\) counterclockwise about the origin followed by a reflection over the \(x\)-axis  
2) a rotation of 90\(^\circ\) counterclockwise about the origin followed by a translation down 7 units  
3) a reflection over the \(y\)-axis followed by a reflection over the \(x\)-axis  
4) a reflection over the \(x\)-axis followed by a rotation of 90\(^\circ\) counterclockwise about the origin
38 As modeled in the diagram below, an access ramp starts on flat ground and ends at the beginning of the top step. Each step is 6 inches tall and 8 inches deep.

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

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

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

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

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

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

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

1) 28°
2) 41°
3) 62°
4) 88°
43 In quadrilateral $ABCD$, $E$ and $F$ are points on $BC$ and $AD$, respectively, and $BGD$ and $EGF$ are drawn such that $\angle ABG \cong \angle CDG$, $AB \cong CD$, and $CE \cong AF$.

Prove: $FG \cong EG$

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

What is the area of rhombus $ABCD$?
1) 20
2) 24
3) 25
4) 48

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

46 Triangles $JOE$ and $SAM$ are drawn such that $\angle E \cong \angle M$ and $EJ \cong MS$. Which mapping would not always lead to $\triangle JOE \cong \triangle SAM$?
1) $\angle J$ maps onto $\angle S$
2) $\angle O$ maps onto $\angle A$
3) $EO$ maps onto $MA$
4) $JO$ maps onto $SA$

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

Which expression represents the area of $\triangle ABC$?
1) $\frac{(BC)(AC)}{2}$
2) $\frac{(GC)(BC)}{2}$
3) $\frac{(CM)(AB)}{2}$
4) $\frac{(GC)(AB)}{2}$
48. A rhombus is graphed on the set of axes below.

Which transformation would carry the rhombus onto itself?
1) 180° rotation counterclockwise about the origin
2) reflection over the line \( y = \frac{1}{2} x + 1 \)
3) reflection over the line \( y = 0 \)
4) reflection over the line \( x = 0 \)

49. In triangle \( MAH \) below, \( MT \) is the perpendicular bisector of \( AH \).

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

50. In parallelogram \( PQRS \), \( QP \) is extended to point \( T \) and \( ST \) is drawn.

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

51. In the diagram below of triangle \( ABC \), \( AC \) is extended through point \( C \) to point \( D \), and \( BE \) is drawn to \( AC \).

Which equation is always true?
1) \( \angle 1 = \angle 3 + \angle 2 \)
2) \( \angle 5 = \angle 3 - \angle 2 \)
3) \( \angle 6 = \angle 3 - \angle 2 \)
4) \( \angle 7 = \angle 3 + \angle 2 \)
52 Francisco needs the three pieces of glass shown below to complete a stained glass window. The shapes, two triangles and a trapezoid, are measured in inches.

![Glass pieces](image)

Glass can be purchased in rectangular sheets that are 12 inches wide. What is the minimum length of a sheet of glass, in inches, that Francisco must purchase in order to have enough to complete the window?

1) 20  
2) 25  
3) 29  
4) 34

53 Parallelogram $ABCD$ is adjacent to rhombus $DEFG$, as shown below, and $FC$ intersects $AGD$ at $H$.

![Parallelogram and rhombus](image)

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

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

![Quadrilateral](image)

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

1) 9  
2) 10  
3) 12  
4) 21
55. A support wire reaches from the top of a pole to a clamp on the ground. The pole is perpendicular to the level ground and the clamp is 10 feet from the base of the pole. The support wire makes a 68° angle with the ground. Find the length of the support wire to the nearest foot.

56. A manufacturer is designing a new container for their chocolate-covered almonds. Their original container was a cylinder with a height of 18 cm and a diameter of 14 cm. The new container can be modeled by a rectangular prism with a square base and will contain the same amount of chocolate-covered almonds.

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

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

1) $19^\circ$
2) $38^\circ$
3) $53^\circ$
4) $106^\circ$

58. Jaden is comparing two cones. The radius of the base of cone $A$ is twice as large as the radius of the base of cone $B$. The height of cone $B$ is twice the height of cone $A$. The volume of cone $A$ is

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

59. Using the construction below, state the degree measure of $\angle CAD$. Explain why.

60. A large water basin is in the shape of a right cylinder. The inside of the basin has a diameter of $8\frac{1}{4}$ feet and a height of 3 feet. Determine and state, to the nearest cubic foot, the number of cubic feet of water that it will take to fill the basin to a level of $\frac{1}{2}$ foot from the top.
61 On the set of axes below, \( \triangle ABC \) has vertices at \( A(-2,0), B(2,-4), \) and \( C(4,2) \), and \( \triangle DEF \) has vertices at \( D(4,0), E(-4,8), \) and \( F(-8,-4) \).

Which sequence of transformations will map \( \triangle ABC \) onto \( \triangle DEF \)?
1) a dilation of \( \triangle ABC \) by a scale factor of 2 centered at point \( A \)
2) a dilation of \( \triangle ABC \) by a scale factor of \( \frac{1}{2} \) centered at point \( A \)
3) a dilation of \( \triangle ABC \) by a scale factor of 2 centered at the origin, followed by a rotation of 180° about the origin
4) a dilation of \( \triangle ABC \) by a scale factor of \( \frac{1}{2} \) centered at the origin, followed by a rotation of 180° about the origin

62 Given: Quadrilateral \( MATH, \overline{HM} \cong \overline{AT}, \overline{HT} \cong \overline{AM}, \overline{HE} \perp \overline{MEA}, \) and \( \overline{HA} \perp \overline{AT} \)

Prove: \( TA \cdot HA = HE \cdot TH \)

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

Which sequence of rigid motions will prove \( \triangle ABC \cong \triangle RST \)?
1) a line reflection over \( y = x \)
2) a rotation of 180° centered at \( (1,0) \)
3) a line reflection over the \( x \)-axis followed by a translation of 6 units right
4) a line reflection over the \( x \)-axis followed by a line reflection over \( y = 1 \)

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

Determine and state, to the nearest tenth, the length of \( \overline{RQ} \).
65 In the diagram below of $\triangle ABC$, $D$ is a point on $BA$, $E$ is a point on $BC$, and $DE$ is drawn. If $BD = 5$, $DA = 12$, and $BE = 7$, what is the length of $BC$ so that $AC \parallel DE$?

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

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

Which statement must be true?

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

67 Which statement about parallelograms is always true?

1) The diagonals are congruent.  
2) The diagonals bisect each other.  
3) The diagonals are perpendicular.  
4) The diagonals bisect their respective angles.

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

Prove: $EF \cong GH$

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

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

1) 12 and 9.5  
2) 14 and 8.5  
3) 16 and 7.5  
4) 18 and 6.5
70 In \( \triangle XYZ \), shown below, medians \( \overline{XE}, \overline{YF}, \) and \( \overline{ZD} \) intersect at \( C \).

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

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

Prove: \( \triangle AFD \cong \triangle CFE \)

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

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

73 Determine and state the area of triangle \( PQR \), whose vertices have coordinates \( P(-2,-5), Q(3,5), \) and \( R(6,1) \). [The use of the set of axes below is optional.]

74 In the diagram below, chords \( PQ \) and \( RS \) of circle \( O \) intersect at \( T \).

Which relationship must always be true?
1) \( RT = TQ \)
2) \( RT = TS \)
3) \( RT + TS = PT + TQ \)
4) \( RT \times TS = PT \times TQ \)
75 On the set of axes below, \( \triangle ABC \) is graphed with coordinates \( A(-2,-1) \), \( B(3,-1) \), and \( C(-2,-4) \). Triangle \( QRS \), the image of \( \triangle ABC \), is graphed with coordinates \( Q(-5,2) \), \( R(-5,7) \), and \( S(-8,2) \).

![Graph of \( \triangle ABC \) and \( QRS \)](image)

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

76 In quadrilateral \( QRST \), diagonals \( QS \) and \( RT \) intersect at \( M \). Which statement would always prove quadrilateral \( QRST \) is a parallelogram?

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

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

![Diagram of angle of elevation](image)

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

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

What is the volume, in cubic feet, of space the tent occupies?

1) 256
2) 640
3) 672
4) 768
79. A cargo trailer, pictured below, can be modeled by a rectangular prism and a triangular prism. Inside the trailer, the rectangular prism measures 6 feet wide and 10 feet long. The walls that form the triangular prism each measure 4 feet wide inside the trailer. The diagram below is of the floor, showing the inside measurements of the trailer. If the inside height of the trailer is 6.5 feet, what is the total volume of the inside of the trailer, to the nearest cubic foot?

80. If the line represented by \( y = \frac{1}{4} x - 2 \) is dilated by a scale factor of 4 centered at the origin, which statement about the image is true?
   1) The slope is \(-\frac{1}{4}\) and the y-intercept is \(-8\).
   2) The slope is \(-\frac{1}{4}\) and the y-intercept is \(-2\).
   3) The slope is \(-1\) and the y-intercept is \(-8\).
   4) The slope is \(-1\) and the y-intercept is \(-2\).

81. The line represented by \( 2y = x + 8 \) is dilated by a scale factor of \( k \) centered at the origin, such that the image of the line has an equation of \( y - \frac{1}{2} x = 2 \). What is the scale factor?
   1) \( k = \frac{1}{2} \)
   2) \( k = 2 \)
   3) \( k = \frac{1}{4} \)
   4) \( k = 4 \)

82. In the diagram below, right triangle \( PQR \) is transformed by a sequence of rigid motions that maps it onto right triangle \( NML \). Write a set of three congruency statements that would show \( ASA \) congruency for these triangles.

83. The line \( -3x + 4y = 8 \) is transformed by a dilation centered at the origin. Which linear equation could represent its image?
   1) \( y = \frac{4}{3} x + 8 \)
   2) \( y = \frac{3}{4} x + 8 \)
   3) \( y = -\frac{3}{4} x - 8 \)
   4) \( y = -\frac{4}{3} x - 8 \)
84 Quadrilateral $NATS$ has coordinates $N(-4,-3)$, $A(1,2)$, $T(8,1)$, and $S(3,-4)$. Prove quadrilateral $NATS$ is a rhombus. [The use of the set of axes below is optional.]

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

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

87 What are the coordinates of point $C$ on the directed segment from $A(-8,4)$ to $B(10,-2)$ that partitions the segment such that $AC:CB$ is 2:1?
1) (1,1)
2) (-2,2)
3) (2,-2)
4) (4,0)

88 The coordinates of the endpoints of $\overline{QS}$ are $Q(-9,8)$ and $S(9,-4)$. Point $R$ is on $\overline{QS}$ such that $QR:RS$ is in the ratio of 1:2. What are the coordinates of point $R$?
1) (0,2)
2) (3,0)
3) (-3,4)
4) (-6,6)
89 Triangle $JGR$ is similar to triangle $MST$. Which statement is not always true?

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

90 Given right triangle $ABC$ with a right angle at $C$, $m\angle B = 61^\circ$. Given right triangle $RST$ with a right angle at $T$, $m\angle R = 29^\circ$.

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

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

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

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

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

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

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

93 As shown in the diagram below, the radius of a cone is 2.5 cm and its slant height is 6.5 cm.

How many cubic centimeters are in the volume of the cone?

1) $12.5\pi$
2) $13.5\pi$
3) $30.0\pi$
4) $37.5\pi$
94 On the set of axes below, $\triangle ABC \cong \triangle DEF$.

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

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

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

96 For the acute angles in a right triangle, $\sin(4x)^{\circ} = \cos(3x + 13)^{\circ}$. What is the number of degrees in the measure of the smaller angle?
1) 11$^\circ$
2) 13$^\circ$
3) 44$^\circ$
4) 52$^\circ$

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

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

98 Which three-dimensional figure will result when a rectangle 6 inches long and 5 inches wide is continuously rotated about the longer side?
1) a rectangular prism with a length of 6 inches, width of 6 inches, and height of 5 inches
2) a rectangular prism with a length of 6 inches, width of 5 inches, and height of 5 inches
3) a cylinder with a radius of 5 inches and a height of 6 inches
4) a cylinder with a radius of 6 inches and a height of 5 inches
99. In the diagram below of right triangle $ABC$, altitude $BD$ is drawn.

Which ratio is always equivalent to $\cos A$?
1) $\frac{AB}{BC}$
2) $\frac{BD}{BC}$
3) $\frac{BD}{AB}$
4) $\frac{BC}{AC}$

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

101. The endpoints of directed line segment $PQ$ have coordinates of $P(-7,-5)$ and $Q(5,3)$. What are the coordinates of point $A$, on $PQ$, that divide $PQ$ into a ratio of 1:3?
1) $A(-1,-1)$
2) $A(2,1)$
3) $A(3,2)$
4) $A(-4,-3)$

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

If $KG = 9$ and $IG = 12$, the length of $IM$ is
1) 15
2) 16
3) 20
4) 25

103. The figure below shows a rhombus with noncongruent diagonals.

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

104. Triangle $A'B'C'$ is the image of triangle $ABC$ after a dilation with a scale factor of $\frac{1}{2}$ and centered at point $A$. Is triangle $ABC$ congruent to triangle $A'B'C'$? Explain your answer.
105 In parallelogram $ABCD$, diagonals $AC$ and $BD$ intersect at $E$. Which statement proves $ABCD$ is a rectangle?

1) $AC \cong BD$
2) $AB \perp BD$
3) $AC \perp BD$
4) $AC$ bisects $\angle BCD$

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

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

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

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

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

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

109 In trapezoid $ABCD$ below, $AB \parallel CD$.

If $AE = 5.2$, $AC = 11.7$, and $CD = 10.5$, what is the length of $AB$, to the nearest tenth?

1) 4.7
2) 6.5
3) 8.4
4) 13.1
110 Diego needs to install a support beam to hold up his new birdhouse, as modeled below. The base of the birdhouse is $24\frac{1}{2}$ inches long. The support beam will form an angle of $38^\circ$ with the vertical post. Determine and state the approximate length of the support beam, $x$, to the nearest inch.

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

If $m\angle DAB = 32^\circ$, what is $m\angle BDC$?
1) $32^\circ$
2) $52^\circ$
3) $58^\circ$
4) $64^\circ$

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

Which statement about $\triangle KAE$ and $\triangle ITE$ is always true?
1) They are neither congruent nor similar.
2) They are similar but not congruent.
3) They are right triangles.
4) They are congruent.

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

Which equation is always true?
1) $\frac{AD}{AC} = \frac{CD}{BC}$
2) $\frac{AD}{CD} = \frac{BD}{CD}$
3) $\frac{AC}{CD} = \frac{BC}{CD}$
4) $\frac{AD}{AC} = \frac{AC}{BD}$
Riley plotted $A(-1,6)$, $B(3,8)$, $C(6,-1)$, and $D(1,0)$ to form a quadrilateral. Prove that Riley's quadrilateral $ABCD$ is a trapezoid. [The use of the set of axes on the next page is optional.] Riley defines an isosceles trapezoid as a trapezoid with congruent diagonals. Use Riley's definition to prove that $ABCD$ is not an isosceles trapezoid.

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

If $RV = 4.1$ and $TV = 10.2$, what is the length of $ST$, to the nearest tenth?
1) 6.5
2) 7.7
3) 11.0
4) 12.1

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

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

If the altitudes of a triangle meet at one of the triangle's vertices, then the triangle is
1) a right triangle
2) an acute triangle
3) an obtuse triangle
4) an equilateral triangle
118 In the diagram below of circle $K$, secant $PLKE$ and tangent $PZ$ are drawn from external point $P$.

If $m\overline{LZ} = 56^\circ$, determine and state the degree measure of angle $P$.

119 The coordinates of the vertices of $\triangle ABC$ are $A(1,2)$, $B(-5,3)$, and $C(-6,-3)$. Prove that $\triangle ABC$ is isosceles. State the coordinates of point $D$ such that quadrilateral $ABCD$ is a square. Prove that your quadrilateral $ABCD$ is a square. [The use of the set of axes below is optional.]

120 If a rectangle is continuously rotated around one of its sides, what is the three-dimensional figure formed?
1) rectangular prism
2) cylinder
3) sphere
4) cone

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

122 In circle $B$ below, diameter $\overline{RT}$, radius $\overline{BE}$, and chord $\overline{RE}$ are drawn.

If $m\angle TRE = 15^\circ$ and $BE = 9$, then the area of sector $EBR$ is
1) $3.375\pi$
2) $6.75\pi$
3) $33.75\pi$
4) $37.125\pi$
123 A rectangular tabletop will be made of maple wood that weighs 43 pounds per cubic foot. The tabletop will have a length of eight feet, a width of three feet, and a thickness of one inch. Determine and state the weight of the tabletop, in pounds.

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

125 Which figure(s) below can have a triangle as a two-dimensional cross section?

I. cone  
II. cylinder  
III. cube  
IV. square pyramid  
1) I, only  
2) IV, only  
3) I, II, and IV, only  
4) I, III, and IV, only

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

127 In the diagram of quadrilateral \( NAVY \) below, \( m\angle YNA = 30^\circ \), \( m\angle YAN = 38^\circ \), \( m\angle AVY = 94^\circ \), and \( m\angle VAY = 46^\circ \). Which segment has the shortest length?

1) \( \overline{AY} \)  
2) \( \overline{NY} \)  
3) \( \overline{VA} \)  
4) \( \overline{VY} \)
128 A countertop for a kitchen is modeled with the dimensions shown below. An 18-inch by 21-inch rectangle will be removed for the installation of the sink.

![Countertop Diagram]

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

129 Rhombus $ABCD$ can be mapped onto rhombus $KLMN$ by a rotation about point $P$, as shown below.

![Rhombus Diagram]

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

130 Which transformation carries the parallelogram below onto itself?

![Parallelogram Diagram]

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

131 The equation of a circle is $x^2 + 8x + y^2 - 12y = 144$.

What are the coordinates of the center and the length of the radius of the circle?
1) center $(4, -6)$ and radius 12
2) center $(-4, 6)$ and radius 12
3) center $(4, -6)$ and radius 14
4) center $(-4, 6)$ and radius 14

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

1) 8
2) 7
3) 6
4) 4
133 In the diagram below, $BC$ connects points $B$ and $C$ on the congruent sides of isosceles triangle $ADE$, such that $\triangle ABC$ is isosceles with vertex angle $A$.

If $AB = 10$, $BD = 5$, and $DE = 12$, what is the length of $BC$?
1) 6
2) 7
3) 8
4) 9

134 Given $MT$ below, use a compass and straightedge to construct a $45^\circ$ angle whose vertex is at point $M$. [Leave all construction marks.]

135 On the set of axes below, $AB$ is dilated by a scale factor of $\frac{5}{2}$ centered at point $P$.

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

136 In rhombus $VENU$, diagonals $VN$ and $EU$ intersect at $S$. If $VN = 12$ and $EU = 16$, what is the perimeter of the rhombus?
1) 80
2) 40
3) 20
4) 10
137 Which information is not sufficient to prove that a parallelogram is a square?
1) The diagonals are both congruent and perpendicular.
2) The diagonals are congruent and one pair of adjacent sides are congruent.
3) The diagonals are perpendicular and one pair of adjacent sides are congruent.
4) The diagonals are perpendicular and one pair of adjacent sides are perpendicular.

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

Which information is always sufficient to prove $\triangle ABE \cong \triangle CDE$?
1) $\overline{AB} \parallel \overline{CD}$
2) $\overline{AB} \cong \overline{CD}$ and $\overline{BE} \cong \overline{DE}$
3) $E$ is the midpoint of $\overline{AC}$.
4) $\overline{BD}$ and $\overline{AC}$ bisect each other.

139 In the diagram below of circle $O$, secant $\overline{ABC}$ and tangent $\overline{AD}$ are drawn.

If $CA = 12.5$ and $CB = 4.5$, determine and state the length of $DA$.

140 Triangle $PQR$ is shown on the set of axes below.

Which quadrant will contain point $R''$, the image of point $R$, after a $90^\circ$ clockwise rotation centered at $(0,0)$ followed by a reflection over the $x$-axis?
1) I
2) II
3) III
4) IV

141 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) $AB + AC$
142 Line $MN$ is dilated by a scale factor of 2 centered at the point $(0,6)$. If $MN$ is represented by $y = -3x + 6$, which equation can represent $M'N'$, the image of $MN$?

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

143 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

144 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.]

145 The base of a pyramid is a rectangle with a width of 4.6 cm and a length of 9 cm. What is the height, in centimeters, of the pyramid if its volume is 82.8 cm$^3$?

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

146 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 $C'(3,0)$

147 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) $\sin B$
148 In $\triangle ABC$, $\overline{BD}$ is the perpendicular bisector of $\overline{AD}$. Based upon this information, which statements below can be proven?
I. $\overline{BD}$ is a median.
II. $\overline{BD}$ bisects $\angle ABC$.
III. $\triangle ABC$ is isosceles.
1) I and II, only  
2) I and III, only  
3) II and III, only  
4) I, II, and III

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

150 The coordinates of the endpoints of $\overline{AB}$ are $A(−8,−2)$ and $B(16,6)$. Point $P$ is on $\overline{AB}$. What are the coordinates of point $P$, such that $AP:PB$ is 3:5?
1) (1,1)  
2) (7,3)  
3) (9.6,3.6)  
4) (6.4,2.8)

151 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
154 Triangle $ABC$ and point $D(1,2)$ are graphed on the set of axes below.

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

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

What is the number of degrees in the measure of $\angle ABC$?

1) $134^\circ$
2) $92^\circ$
3) $68^\circ$
4) $46^\circ$

156 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

157 Triangle $ABC$ has vertices with coordinates $A(-1,-1)$, $B(4,0)$, and $C(0,4)$. Prove that $\triangle ABC$ is an isosceles triangle but not an equilateral triangle. [The use of the set of axes below is optional.]

158 Triangle $A'B'C'$ is the image of triangle $ABC$ after a translation of 2 units to the right and 3 units up. Is triangle $ABC$ congruent to triangle $A'B'C'$? Explain why.
159 In the diagram below of right triangle $AED$, \( BC \parallel DE \).

Which statement is always true?

1) \( \frac{AC}{BC} = \frac{DE}{AE} \)

2) \( \frac{AB}{AD} = \frac{BC}{DE} \)

3) \( \frac{AC}{CE} = \frac{BC}{DE} \)

4) \( \frac{DE}{BC} = \frac{DB}{AB} \)

160 Quadrilateral $MATH$ has both pairs of opposite sides congruent and parallel. Which statement about quadrilateral $MATH$ is always true?

1) \( MT \cong AH \)

2) \( MT \perp AH \)

3) \( \angle MHT \cong \angle ATH \)

4) \( \angle MAT \cong \angle MHT \)

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

Prove: $BEDF$ is a rectangle

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

Which expression represents the length of arc $AB$, in inches?

1) \( \frac{120}{360} (6\pi) \)

2) \( 120(6) \)

3) \( \frac{1}{3} (36\pi) \)

4) \( \frac{1}{3} (12\pi) \)
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 In right triangle $ABC$ shown below, altitude $\overline{CD}$ is drawn to hypotenuse $\overline{AB}$. Explain why $\triangle ABC \sim \triangle ACD$.

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

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

167 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

168 Given: Right triangle $ABC$ with right angle at $C$. If $\sin A$ increases, does $\cos B$ increase or decrease? Explain why.
169 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) \( 2y - x = 0 \)

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

Prove: \( AE \cong CF \)

171 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

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

If \( DB = 6.3 \) and \( AC = 9.4 \), what is the length of \( DE \), to the nearest tenth?
1) 3.8
2) 5.6
3) 5.9
4) 15.7

173 Given: Parallelogram \( ABCD \) with diagonal \( AC \) drawn

Prove: \( \triangle ABC \cong \triangle CDA \)
174 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

175 The graph below shows two congruent triangles, $ABC$ and $A'B'C'$.

Which rigid motion would map $\Delta ABC$ onto $\Delta A'B'C'$?
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 $y = x$

176 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

177 Yolanda is making a springboard to use for gymnastics. She has 8-inch-tall springs and wants to form a $16.5^\circ$ angle with the base, as modeled in the diagram below.

To the nearest tenth of an inch, what will be the length of the springboard, $x$?
1) 2.3
2) 8.3
3) 27.0
4) 28.2

178 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) $(6,0)$
179 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 $BC = 8.7$

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

Which statement is not true?

1) $\triangle ABC$ is a right triangle.
2) $\triangle ABM$ is isosceles.
3) $m\overarc{BC} = m\angle BMC$
4) $m\overarc{AB} = \frac{1}{2} m\angle ACB$

181 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) $4\sqrt{6}$

182 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.
183 In the diagram below, $AEFB \parallel CGD$, and $GE$ and $GF$ are drawn.

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

184 In the diagram below, $AB \parallel DEF$, $AE$ and $BD$ intersect at $C$, $\angle B = 43^\circ$, and $\angle CEF = 152^\circ$.

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

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

186 An isosceles right triangle whose legs measure 6 is continuously rotated about one of its legs to form a three-dimensional object. The three-dimensional object is a
1) cylinder with a diameter of 6
2) cylinder with a diameter of 12
3) cone with a diameter of 6
4) cone with a diameter of 12

187 Trapezoids $ABCD$ and $A'B'C'D'$ are graphed on the set of axes below.

Describe a sequence of transformations that maps trapezoid $ABCD$ onto trapezoid $A'B'C'D'$.

188 In right triangle $ABC$, $\angle A = 32^\circ$, $\angle B = 90^\circ$, and $AC = 6.2$ cm. What is the length of $BC$, to the nearest tenth of a centimeter?
1) 3.3
2) 3.9
3) 5.3
4) 11.7
189 Which equation represents a line that is perpendicular to the line represented by
\[ y = \frac{2}{3} x + 1? \]
1) \[ 3x + 2y = 12 \]
2) \[ 3x - 2y = 12 \]
3) \[ y = \frac{3}{2} x + 2 \]
4) \[ y = -\frac{2}{3} x + 4 \]

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

If \( RS = 6, ST = 4, \) and \( RP = 15, \) what is the length of \( \overline{RQ} \)?

191 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 \( \overline{DE} \)

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

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

193 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.
194 Line segment \( RW \) has endpoints \( R(\text{-}4,5) \) 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) \((10,2)\)

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

196 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 \( NM = 10\)

197 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) \(144\pi\)

198 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) \(30\)
199 Determine and state, in terms of $\pi$, the area of a sector that intercepts a $40^\circ$ arc of a circle with a radius of 4.5.

200 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.

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

Jamal says he can approximate how high the support wire attaches to the telephone pole by using similar triangles. Explain why the triangles are similar.

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

![Right Triangle Diagram]

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

203 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?

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

1) 10°
2) 150°
3) 225°
4) 252°
205 The 2010 U.S. Census populations and population densities are shown in the table below.

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

Based on the table above, which list has the states' areas, in square miles, in order from largest to smallest?
1) Illinois, Florida, New York, Pennsylvania
2) New York, Florida, Illinois, Pennsylvania

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

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

207 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
208 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) $AB \perp CD$

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

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

210 Triangle $A'B'C'$ is the image of $\triangle ABC$ after a dilation followed by a translation. Which statement(s) would always be true with respect to this sequence of transformations?
I. $\triangle ABC \cong \triangle A'B'C'$
II. $\triangle ABC \sim \triangle A'B'C'$
III. $AB \parallel A'B'$
IV. $AA' = BB'$
1) II, only
2) I and II
3) II and III
4) II, III, and IV

211 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 $\triangle A''B''C''$.

212 Directed line segment $DE$ has endpoints $D(-4,-2)$ and $E(1,8)$. Point $F$ divides $DE$ such that $DF:FE$ is 2:3. What are the coordinates of $F$?
1) $(-3,0)$
2) $(-2,2)$
3) $(-1,4)$
4) $(2,4)$
213 Triangle $ABC$ and triangle $DEF$ are drawn below.

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

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

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

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

216 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 $\triangle ART$.

217 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
218 In the diagram below of \( \triangle PQR \), \( ST \) is drawn parallel to \( PR \), \( PS = 2 \), \( SQ = 5 \), and \( TR = 5 \).

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

What is the length of \( QR \)?

1) 7
2) 2
3) \( 12 \frac{1}{2} \)
4) \( 17 \frac{1}{2} \)

219 In the diagram below, a sequence of rigid motions maps \( ABCD \) onto \( JKLM \).

![Diagram of \( ABCD \) mappings to \( JKLM \)]

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

1) 53°
2) 82°
3) 104°
4) 121°

220 Given: \( \triangle ABC \), \( \overline{AEC} \), \( \overline{BDE} \) with \( \angle ABE \cong \angle CBE \), and \( \angle ADE \cong \angle CDE \)

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

![Diagram of \( \triangle ABC \) with \( \overline{BDE} \) as the perpendicular bisector of \( \overline{AC} \)]

Fill in the missing statement and reasons below.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ( \triangle ABC, \overline{AEC}, \overline{BDE} ) with ( \angle ABE \cong \angle CBE ), and ( \angle ADE \cong \angle CDE )</td>
<td>1 Given</td>
</tr>
<tr>
<td>2 ( \overline{BD} \cong \overline{BD} )</td>
<td>2</td>
</tr>
<tr>
<td>3 ( \angle BDA ) and ( \angle ADE ) are supplementary. ( \angle BDC ) and ( \angle CDE ) are supplementary.</td>
<td>3 Linear pairs of angles are supplementary.</td>
</tr>
<tr>
<td>4</td>
<td>4 Supplements of congruent angles are congruent.</td>
</tr>
<tr>
<td>5 ( \triangle ABD \cong \triangle CBD )</td>
<td>5 ASA</td>
</tr>
<tr>
<td>6 ( \overline{AD} \cong \overline{CD}, \overline{AB} \cong \overline{CB} )</td>
<td>6</td>
</tr>
<tr>
<td>7 ( \overline{BDE} ) is the perpendicular bisector of ( \overline{AC} ).</td>
<td>7</td>
</tr>
</tbody>
</table>
221 In the diagram below, $AF$ and $DB$ intersect at $C$, and $AD$ and $FBE$ are drawn such that $m\angle D = 65^\circ$, $m\angle CBE = 115^\circ$, $DC = 7.2$, $AC = 9.6$, and $FC = 21.6$.

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

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

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

223 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

224 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?

225 Kelly is completing a proof based on the figure below. She was given that $\angle A \cong \angle EDF$, and has already proven $AB \cong DE$. Which pair of corresponding parts and triangle congruency method would not prove $\triangle ABC \cong \triangle DEF$?
1) $AC \cong DF$ and SAS
2) $BC \cong EF$ and SAS
3) $\angle C \cong \angle F$ and AAS
4) $\angle CBA \cong \angle FED$ and ASA
226 A right cylinder is cut perpendicular to its base. The shape of the cross section is a
1) circle
2) cylinder
3) rectangle
4) triangular prism

227 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.

228 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 $\frac{1}{3}$.

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

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

230 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

231 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
232 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

233 Parallelogram $HAND$ is drawn below with diagonals $HN$ and $AD$ intersecting at $S$.

Which statement is always true?
1) $AN = \frac{1}{2} AD$  
2) $AS = \frac{1}{2} AD$  
3) $\angle AHS \cong \angle ANS$  
4) $\angle HDS \cong \angle NDS$

234 A child's tent can be modeled as a pyramid with a square base whose sides measure 60 inches and whose height measures 84 inches. What is the volume of the tent, to the nearest cubic foot?
1) 35  
2) 58  
3) 82  
4) 175

235 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) $(1,-6)$
236 The coordinates of the endpoints of directed line segment \(\overline{ABC}\) are \(A(-8,7)\) and \(C(7,-13)\). If \(AB:BC = 3:2\), the coordinates of \(B\) are

1) \((-1,-5)\) 
2) \((-2,-1)\) 
3) \((-3,0)\) 
4) \((3,-6)\)

237 In the diagram below of circle \(O\), tangent \(\overrightarrow{EC}\) is drawn to diameter \(\overline{AC}\). Chord \(\overline{BC}\) is parallel to secant \(\overline{ADE}\), and chord \(\overline{AB}\) is drawn.

![Diagram of circle with tangent and chords](image)

Prove: \(\frac{BC}{CA} = \frac{AB}{EC}\)

238 The image of \(\triangle DEF\) is \(\triangle D' E' F'.\) Under which transformation will the triangles not be congruent?

1) a reflection through the origin 
2) a reflection over the line \(y = x\) 
3) a dilation with a scale factor of 1 centered at (2,3) 
4) a dilation with a scale factor of \(\frac{3}{2}\) centered at the origin

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

![Diagram of triangle with bisectors](image)

The measure of angle \(DFB\) is

1) \(36^\circ\) 
2) \(54^\circ\) 
3) \(72^\circ\) 
4) \(82^\circ\)

240 In the diagram shown below, \(\overline{PA}\) is tangent to circle \(T\) at \(A\), and secant \(\overline{PBC}\) is drawn where point \(B\) is on circle \(T\).

![Diagram of tangent and secant](image)

If \(PB = 3\) and \(BC = 15\), what is the length of \(\overline{PA}\)?

1) \(3\sqrt{5}\) 
2) \(3\sqrt{6}\) 
3) \(3\) 
4) \(9\)
241 A bakery sells hollow chocolate spheres. The larger diameter of each sphere is 4 cm. The thickness of the chocolate of each sphere is 0.5 cm. Determine and state, to the nearest tenth of a cubic centimeter, the amount of chocolate in each hollow sphere. The bakery packages 8 of them into a box. If the density of the chocolate is 1.308 g/cm³, determine and state, to the nearest gram, the total mass of the chocolate in the box.

242 Given: \(RS\) and \(TV\) bisect each other at point \(X\)
\(TR\) and \(SV\) are drawn

Prove: \(TR \parallel SV\)

243 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) \((-8, 5\sqrt{21})\)

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

245 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

246 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
247 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 $ABCD$.

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

249 Triangle $ABC$, with vertices at $A(0,0)$, $B(3,5)$, and $C(0,5)$, is graphed on the set of axes shown below.

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

1) $54^\circ$
2) $162^\circ$
3) $198^\circ$
4) $252^\circ$
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251 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 \( CD \).

252 Given: Trapezoid \( JKL \) with \( JK \parallel ML \)
Using a compass and straightedge, construct the altitude from vertex \( J \) to \( ML \). [Leave all construction marks.]

253 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) \( y = -2x + 3 \)

254 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) \( m\angle ACB \cong \frac{1}{2} m\angle DAB \)
255 In a right triangle, the acute angles have the relationship \(\sin(2x + 4) = \cos(46)\). What is the value of \(x\)?

1) 20
2) 21
3) 24
4) 25

256 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.

257 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 = \(\sqrt{35}\)

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

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

259 Using a compass and straightedge, construct the line of reflection over which triangle RST reflects onto triangle R’S’T’. [Leave all construction marks.]
260 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

261 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

262 In quadrilateral \( BLUE \) shown below, \( BE \approx EU \).

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

263 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.
264 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

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

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

267 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 $\triangle ABC \cong \triangle DEF$.

268 What is an equation of the line that passes through the point $(6,8)$ and is perpendicular to a line with equation $y = \frac{3}{2}x + 5$?
1) $y - 8 = \frac{3}{2}(x - 6)$
2) $y - 8 = -\frac{2}{3}(x - 6)$
3) $y + 8 = \frac{3}{2}(x + 6)$
4) $y + 8 = -\frac{2}{3}(x + 6)$
269 In right triangle $ABC$, hypotenuse $AB$ has a length of 26 cm, and side $BC$ has a length of 17.6 cm. What is the measure of angle $B$, to the nearest degree?
1) 48°
2) 47°
3) 43°
4) 34°

270 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

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

What is the area of $\Delta DAN$?
1) 60
2) 120
3) $20\sqrt{13}$
4) $40\sqrt{13}$

272 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

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

Is Sue correct? Explain why.

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

275 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.
276 If $\sin(2x + 7)^\circ = \cos(4x - 7)^\circ$, what is the value of $x$?
1) 7
2) 15
3) 21
4) 30

277 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 $y = 70$

278 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.

279 In the graph below, $\Delta ABC$ has coordinates $A(-9,2)$, $B(-6,-6)$, and $C(-3,-2)$, and $\Delta RST$ has coordinates $R(-2,9)$, $S(5,6)$, and $T(2,3)$.

Is $\Delta ABC$ congruent to $\Delta RST$? Use the properties of rigid motions to explain your reasoning.

280 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
281 In the diagram below, rectangle \(ABCD\) has vertices whose coordinates are \(A(7,1), B(9,3), C(3,9),\) and \(D(1,7)\).

Which transformation will \textit{not} carry the rectangle onto itself?

1) a reflection over the line \(y = x\)
2) a reflection over the line \(y = -x + 10\)
3) a rotation of 180° about the point (6,6)
4) a rotation of 180° about the point (5,5)

282 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\(\frac{3}{4}\)

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

284 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) \(y + 9 = \frac{2}{3}(x + 6)\)

285 An equation of circle \(O\) is \(x^2 + y^2 + 4x - 8y = -16\). The statement that best describes circle \(O\) is the

1) center is (2,−4) and is tangent to the \(x\)-axis
2) center is (2,−4) and is tangent to the \(y\)-axis
3) center is (−2,4) and is tangent to the \(x\)-axis
4) center is (−2,4) and is tangent to the \(y\)-axis
286 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

287 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) $XS \parallel YR$
4) $\frac{XY}{SR} = \frac{YZ}{RZ}$

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

289 In the diagram below of isosceles triangle $ABC$, $AB \parallel CB$ and angle bisectors $AD$, $BF$, and $CE$ are drawn and intersect at $X$.

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

290 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 $(4,0)$
291 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 $ABC$.

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

Which value of $x$ makes $\overline{AB} \cong \overline{CB}$?

1) $59^\circ$
2) $62^\circ$
3) $118^\circ$
4) $121^\circ$

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

If $m\angle TMR = 28^\circ$, the measure of angle $OTS$ is

1) $40^\circ$
2) $50^\circ$
3) $60^\circ$
4) $70^\circ$

294 In the diagram below, if $\triangle ABE \equiv \triangle CDF$ and $\overline{AEFC}$ is drawn, then it could be proven that quadrilateral $ABCD$ is a

1) square
2) rhombus
3) rectangle
4) parallelogram
295 In the diagram of \( \triangle ABC \) below, points \( D \) and \( E \) are on sides \( AB \) and \( CB \) respectively, such that \( DE \parallel AC \).

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

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

296 In the diagram below, \( AB \parallel DFC \), \( EDA \parallel CBG \), and \( EFB \) and \( AG \) are drawn.

Which statement is always true?

1) \( \Delta DEF \cong \Delta CBF \)
2) \( \Delta BAG \cong \Delta BAE \)
3) \( \Delta BAG \sim \Delta AEB \)
4) \( \Delta DEF \sim \Delta AEB \)

297 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

298 In the coordinate plane, the vertices of triangle \( PAT \) are \( P(−1,−6) \), \( A(−4,5) \), and \( T(5,−2) \). Prove that \( \Delta PAT \) is an isosceles triangle. State the coordinates of \( R \) so that quadrilateral \( PART \) is a parallelogram. Prove that quadrilateral \( PART \) is a parallelogram. [The use of the set of axes below is optional.]
299 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]

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

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

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

301 Ian needs to replace two concrete sections in his sidewalk, as modeled below. Each section is 36 inches by 36 inches and 4 inches deep. He can mix his own concrete for $3.25 per cubic foot. How much money will it cost Ian to replace the two concrete sections?
302 In the circle below, $\overline{AB}$ is a chord. Using a compass and straightedge, construct a diameter of the circle. [Leave all construction marks.]

303 In regular hexagon $ABCDEF$ shown below, $\overline{AD}$, $\overline{BE}$, and $\overline{CF}$ all intersect at $G$.

When $\triangle ABG$ is reflected over $BG$ and then rotated $180^\circ$ about point $G$, $\triangle ABG$ is mapped onto
1) $\triangle FEG$
2) $\triangle AFG$
3) $\triangle CBG$
4) $\triangle DEG$

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

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

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

63
306 The pyramid shown below has a square base, a height of 7, and a volume of 84.

![Pyramid diagram]

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

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

![Right triangle diagram]

Which ratio is always equivalent to the sine of $\angle A$?
1) $\frac{AD}{DE}$
2) $\frac{AE}{AD}$
3) $\frac{BC}{AB}$
4) $\frac{AB}{AC}$

308 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.

![Right triangle diagram]

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

![Quadrilateral diagram]

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

64
310 In parallelogram $ABCD$ shown below, the bisectors of $\angle ABC$ and $\angle DCB$ meet at $E$, a point on $AD$.

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

311 What is an equation of circle $O$ shown in the graph below?

1) $x^2 + 10x + y^2 + 4y = -13$
2) $x^2 - 10x + y^2 - 4y = -13$
3) $x^2 + 10x + y^2 + 4y = -25$
4) $x^2 - 10x + y^2 - 4y = -25$

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

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

To the nearest pound, determine and state the total weight of the training equipment if the base is filled to 85% of its capacity.
314 A gas station has a cylindrical fueling tank that holds the gasoline for its pumps, as modeled below. The tank holds a maximum of 20,000 gallons of gasoline and has a length of 34.5 feet. A metal pole is used to measure how much gas is in the tank. To the nearest tenth of a foot, how long does the pole need to be in order to reach the bottom of the tank and still extend one foot outside the tank? Justify your answer. [1 ft³ = 7.48 gallons]

315 In the diagram below of triangle HAR and triangle NTY, angles H and N are right angles, and triangle HAR is similar to triangle NTY. If AR = 13 and HR = 12, what is the measure of angle Y, to the nearest degree?

1) 23°
2) 25°
3) 65°
4) 67°

316 In the diagram below, line m is parallel to line n. Figure 2 is the image of Figure 1 after a reflection over line m. Figure 3 is the image of Figure 2 after a reflection over line n. Which single transformation would carry Figure 1 onto Figure 3?

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

317 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.
318 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) $\frac{160\pi}{3}$

319 After a counterclockwise rotation about point $X$, scalene triangle $ABC$ maps onto $\Delta RST$, as shown in the diagram below.

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

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

321 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

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

1) 4.2
2) 5.4
3) 15.5
4) 21.8
323 In the diagram below of circle $O$, chord $CD$ is parallel to diameter $AOB$ and $m\overline{CD} = 130$.

What is $m\overline{AC}$?
1) 25
2) 50
3) 65
4) 115

324 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.]

325 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) $4x + 3y = 9$

326 In the diagram below of circle $O$, chords $\overline{AB}$ and $\overline{CD}$ intersect at $E$.

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

327 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) $y = \frac{2}{3}x + 10$
328 In the diagram below of circle $O$, chord $DF$ bisects chord $BC$ at $E$.

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

329 In triangle $SRK$ below, medians $SC$, $KE$, and $RL$ intersect at $M$.

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

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

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

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

If $m\overset{\frown}{CD} = 46^\circ$ and $m\overset{\frown}{DB} = 102^\circ$, what is $m\angle CFE$?
332 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

333 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 \( Q'R' \parallel QR \).

334 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

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

What is the area, to the nearest tenth of a square centimeter, of the sector formed by the 30° angle?
1) 5.2
2) 6.5
3) 13.1
4) 26.2
336 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.]

337 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

338 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 $54^\circ$ 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 $(M)$.

339 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) $135^\circ$
340 In the figure shown below, quadrilateral $TAEO$ is circumscribed around circle $D$. The midpoint of $TA$ is $R$, and $HO \cong PE$.

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

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

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

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

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

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

1) 5
2) 2
3) 8
4) 11

344 The greenhouse pictured below can be modeled as a rectangular prism with a half-cylinder on top. The rectangular prism is 20 feet wide, 12 feet high, and 45 feet long. The half-cylinder has a diameter of 20 feet.

To the nearest cubic foot, what is the volume of the greenhouse?

1) 17,869
2) 24,937
3) 39,074
4) 67,349
345 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°
2) 68.75°
3) 95°
4) 137.5°

346 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 \( AC \) onto \( XZ \).

Determine and state whether \( BC \cong YZ \). Explain why.

347 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

348 Using a compass and straightedge, construct a regular hexagon inscribed in circle \( O \). [Leave all construction marks.]

349 The regular polygon below is rotated about its center.

Which angle of rotation will carry the figure onto itself?
1) 60°
2) 108°
3) 216°
4) 540°
350 In the diagram of circle A shown below, chords $\overline{CD}$ and $\overline{EF}$ intersect at G, and chords $\overline{CE}$ and $\overline{FD}$ are drawn. Which statement is not always true?

1) $CG \cong FG$
2) $\angle CEG \cong \angle FDG$
3) $\frac{CE}{EG} = \frac{FD}{DG}$
4) $\triangle CEG \sim \triangle FDG$

351 In parallelogram $QRST$ shown below, diagonal $\overline{TR}$ is drawn, U and V are points on $\overline{TS}$ and $\overline{QR}$, respectively, and $\overline{UV}$ intersects $\overline{TR}$ at W. If $\angle S = 60^\circ$, $\angle SRT = 83^\circ$, and $\angle TWU = 35^\circ$, what is $\angle WVQ$?

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

352 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

353 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.]

354 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
355 Using the information given below, which set of triangles can not be proven similar?

1)  

2)  

3)  

4)  

356 Triangles \( RST \) and \( XYZ \) are drawn below. If \( RS = 6, ST = 14, XY = 9, YZ = 21, \) and \( \angle B \cong \angle Y \), is \( \triangle RST \) similar to \( \triangle XYZ \)? Justify your answer.

357 In \( \triangle ABC \), the complement of \( \angle B \) is \( \angle A \). Which statement is always true?

1) \( \tan \angle A = \tan \angle B \)

2) \( \sin \angle A = \sin \angle B \)

3) \( \cos \angle A = \tan \angle B \)

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

358 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.

359 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.
360 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.

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

362 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

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

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

364 Explain why \( \cos(x) = \sin(90 - x) \) for \( x \) such that \( 0 < x < 90 \).
365 Which statement is sufficient evidence that $\triangle DEF$ is congruent to $\triangle ABC$?

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

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

367 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 $6^\circ$. Five minutes later, the observer measured and saw the angle of depression to the front of the canoe had increased by $49^\circ$. Determine and state, to the nearest foot per minute, the average speed at which the canoe traveled toward the lighthouse.
368 Which object is formed when right triangle \( \text{RST} \) shown below is rotated around leg \( \text{RS} \)?

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

369 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.

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

What is the measure of angle \( \theta \), in radians?
1) \( 10 + 2\pi \)
2) \( 20\pi \)
3) \( \frac{\pi}{5} \)
4) \( \frac{5}{\pi} \)

371 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

372 Line segment \( \text{NY} \) has endpoints \( N(-11, 5) \) and \( Y(5, -7) \). What is the equation of the perpendicular bisector of \( \text{NY} \)?
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) \( y - 6 = -\frac{3}{4} (x - 8) \)

373 What is the area of a sector of a circle with a radius of 8 inches and formed by a central angle that measures \( 60^\circ \)?
1) \( \frac{8\pi}{3} \)
2) \( \frac{16\pi}{3} \)
3) \( \frac{32\pi}{3} \)
4) \( \frac{64\pi}{3} \)

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

376 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.

377 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 $\triangle CEB$.

378 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.
379 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.

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

381 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

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

Which sequence of transformations maps triangle $ABC$ onto triangle $DEF$?

1) a reflection over the $x$-axis followed by a reflection over the $y$-axis
2) a 180° rotation about the origin followed by a reflection over the line $y = x$
3) a 90° clockwise rotation about the origin followed by a reflection over the $y$-axis
4) a translation 8 units to the right and 1 unit up followed by a 90° counterclockwise rotation about the origin

383 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.
384 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

385 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) $25\sqrt{2}$

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

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

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

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

389 After a reflection over a line, $\Delta A'B'C'$ is the image of $\Delta ABC$. Explain why triangle $ABC$ is congruent to triangle $A'B'C'$. 
390 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

391 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

392 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.

393 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) \((8.5)^3 - \pi(4)^2(8)\)  
2) \((8.5)^3 - \pi(8)^2(8)\)  
3) \((8.5)^3 - \frac{1}{3}\pi(8)^2(8)\)  
4) \((8.5)^3 - \frac{1}{3}\pi(4)^2(8)\)

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

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

395 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
396 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

397 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

398 Which transformation of \( OA \) would result in an image parallel to \( OA \)?

1) a translation of two units down
2) a reflection over the x-axis
3) a reflection over the y-axis
4) a clockwise rotation of 90° about the origin

400 In the diagram below of circle \( O \) with diameter \( BC \) and radius \( OA \), chord \( DC \) is parallel to chord \( BA \).

If \( m\angle BCD = 30° \), determine and state \( m\angle AOB \).

401 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

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) \( \begin{pmatrix} 4, 5 & \frac{1}{2} \end{pmatrix} \)
2) \( \begin{pmatrix} -\frac{1}{2}, -4 \end{pmatrix} \)
3) \( \begin{pmatrix} -4 & \frac{1}{2}, 0 \end{pmatrix} \)
4) \( \begin{pmatrix} -4, -\frac{1}{2} \end{pmatrix} \)
402 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 \(A'C'\).

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

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

404 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.

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

406 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) \(\sin A = \cos B\)
407 In the diagram of \( \triangle ADC \) below, \( \overline{EB} \parallel \overline{DC} \), \( AE = 9 \), 
\( ED = 5 \), and \( AB = 9.2 \).

What is the length of \( \overline{AC} \), to the nearest tenth? 
1) 5.1 
2) 5.2 
3) 14.3 
4) 14.4

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

If \( TU = 4 \), \( OU = 5 \), and \( OC = 7 \), what is the length 
of \( ST \)? 
1) 5.6 
2) 8.75 
3) 11 
4) 15

409 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) \( m \parallel n \)

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

Which lengths would not produce an altitude that 
measures \( 6\sqrt{2} \)? 
1) \( AD = 2 \) and \( DB = 36 \) 
2) \( AD = 3 \) and \( AB = 24 \) 
3) \( AD = 6 \) and \( DB = 12 \) 
4) \( AD = 8 \) and \( AB = 17 \)
411 In parallelogram $ABCD$, diagonals $\overline{AC}$ and $\overline{BD}$ 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 $\angle DCB$

412 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

413 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) $\tan E = \frac{TM}{JM}$

414 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 $B'(-3,4)$

415 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
416 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

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

418 As graphed on the set of axes below, \(\Delta A'B'C'\) is the image of \(\Delta ABC\) after a sequence of transformations.

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

419 In the diagram below, quadrilateral \(ABCD\) is inscribed in circle \(P\).

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

420 The grid below shows \(\Delta ABC\) and \(\Delta DEF\).

Let \(\Delta A'B'C'\) be the image of \(\Delta ABC\) 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 \(\Delta DEF\) congruent to \(\Delta A'B'C'\)? Explain your answer.
421 In the diagram below, triangles $XYZ$ and $UVZ$ are drawn such that $\angle X \cong \angle U$ and $\angle XZY \cong \angle UZV$.

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

422 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) $BC \parallel DE$

423 In the diagram below, $\overline{DB}$ and $\overline{AF}$ intersect at point $C$, and $\overline{AD}$ and $\overline{FBE}$ 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 $\overline{CB}$?
1) 10
2) 12
3) 17
4) 22.5

424 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
425 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 $x = 1$.

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

1)  

2)  

3)  

4)

427 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

428 In the diagram below, $\overline{DC}$, $\overline{AC}$, $\overline{DOB}$, $\overline{CB}$, and $\overline{AB}$ are chords of circle $O$, $\overrightarrow{FDE}$ 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) $\angle FDB$
429 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

430 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.

431 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) $\frac{5}{\sqrt{21}}$

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

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

433 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) $y = 3x - 1$
434 Prove the sum of the exterior angles of a triangle is $360^\circ$.

435 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) $x + y = 4$

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

437 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

438 Triangle $ABC$ has vertices with $A(x,3)$, $B(-3,-1)$, and $C(-1,-4)$. Determine and state a value of $x$ that would make triangle $ABC$ a right triangle. Justify why $\triangle ABC$ is a right triangle. [The use of the set of axes below is optional.]
439 In the diagram of parallelogram $ABCD$ below, $BE \perp CED$, $DF \perp BFC$, $CE \cong CF$.

Prove $ABCD$ is a rhombus.

440 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.

441 In the diagram below, $\triangle ABE$ is the image of $\triangle ACD$ after a dilation centered at the origin. The coordinates of the vertices are $A(0,0)$, $B(3,0)$, $C(4.5,0)$, $D(0,6)$, and $E(0,4)$.

The ratio of the lengths of $BE$ to $CD$ is

1) $\frac{2}{3}$
2) $\frac{3}{2}$
3) $\frac{3}{4}$
4) $\frac{4}{3}$

442 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.
443 Given: Parallelogram $ABCD$, $EFG$, and diagonal $DFB$

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

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

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

445 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) $(x - 5)^2 + (y + 2)^2 = 25$

446 Triangle $MNP$ is the image of triangle $JKL$ after a $120^\circ$ counterclockwise rotation about point $Q$. If the measure of angle $L$ is $47^\circ$ and the measure of angle $N$ is $57^\circ$, determine the measure of angle $M$. Explain how you arrived at your answer.
447 Aliyah says that when the line $4x + 3y = 24$ is dilated by a scale factor of 2 centered at the point $(3,4)$, the equation of the dilated line is $y = -\frac{4}{3}x + 16$. Is Aliyah correct? Explain why.

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

448 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

449 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.

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

1) 5
2) 10
3) 20
4) 40

451 In the diagram below, secant $\overline{ACD}$ and tangent $\overline{AB}$ are drawn from external point $A$ to circle $O$.

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

452 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
453 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.

454 In the diagram below, radius $OA$ is drawn in circle $O$. Using a compass and a straightedge, construct a line tangent to circle $O$ at point $A$. [Leave all construction marks.]

455 If $A'B'C'$ is the image of $ABC$, 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

456 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?

457 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: $\triangle ABC \cong \triangle DEC$
Given the theorem, “The sum of the measures of the interior angles of a triangle is 180°,” complete the proof for this theorem.

Given: ΔABC
Prove: m∠1 + m∠2 + m∠3 = 180°

Fill in the missing reasons below.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
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<tbody>
<tr>
<td>(1) ΔABC</td>
<td>(1) Given</td>
</tr>
<tr>
<td>(2) Through point C, draw DCE parallel to AB.</td>
<td>(2) __________</td>
</tr>
<tr>
<td>(3) m∠1 = m∠ACD, m∠3 = m∠BCE</td>
<td>(3) __________</td>
</tr>
<tr>
<td>(4) m∠ACD + m∠2 + m∠BCE = 180°</td>
<td>(4) __________</td>
</tr>
<tr>
<td>(5) m∠1 + m∠2 + m∠3 = 180°</td>
<td>(5) __________</td>
</tr>
</tbody>
</table>
459 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

460 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 $\triangle A'B'C' \sim \triangle ABC$.

461 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

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

463 In the diagram below, $m\angle BDC = 100^\circ$, $m\angle A = 50^\circ$, and $m\angle DBC = 30^\circ$.
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.
464 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) \( 6\sqrt{35} \)

465 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 \( EF = 11 \).

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) \( -\frac{5}{2} \)

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

Given: \( \triangle XYZ \), \( \overline{XY} \cong \overline{YZ} \), and \( \overline{YW} \) bisects \( \angle XYZ \)

Prove that \( \angle YWZ \) is a right angle.
468 In the accompanying diagram of right triangle $ABC$, altitude $BD$ is drawn to hypotenuse $AC$.

Which statement must always be true?

1) $\frac{AD}{AB} = \frac{BC}{AC}$

2) $\frac{AD}{AB} = \frac{AB}{AC}$

3) $\frac{BD}{BC} = \frac{AB}{AD}$

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

469 In the diagram of right triangle $ABC$, line $CD$ intersects hypotenuse $AB$ at $D$.

If $AD = 4$ and $DB = 6$, which length of $AC$ makes $CD \perp AB$?

1) $2\sqrt{6}$

2) $2\sqrt{10}$

3) $2\sqrt{15}$

4) $4\sqrt{2}$

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

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

471 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
472 In the diagram below of circle $O$, $OB$ and $OC$ are radii, and chords $AB$, $BC$, and $AC$ are drawn.

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

473 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.

474 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 $CD$.

475 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

476 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) $\frac{2}{3}$
2) $\frac{2}{3}$
3) 11
4) 15
477 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

478 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.

479 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

480 Quadrilateral $ABCD$ has diagonals $AC$ and $BD$. Which information is not sufficient to prove $ABCD$ is a parallelogram?

1) $AC$ and $BD$ bisect each other.  
2) $AB \cong CD$ and $BC \cong AD$  
3) $AB \cong CD$ and $AB \parallel CD$  
4) $AB \cong CD$ and $BC \parallel AD$

481 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

482 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) $3(m\angle C') = m\angle C$

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

Explain why $m\angle NLO$ is 40 degrees.
484 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) $\frac{EA}{EC}$

485 Given: Quadrilateral $ABCD$ with diagonals $AC$ and $BD$ that bisect each other, and $\angle 1 \cong \angle 2$

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

486 In the diagram below, a window of a house is 15 feet above the ground. A ladder is placed against the house with its base at an angle of $75^\circ$ with the ground. Determine and state the length of the ladder to the nearest tenth of a foot.

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

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

1) a rotation of 180 degrees about point $E$ followed by a horizontal translation

2) a counterclockwise rotation of 90 degrees about point $E$ followed by a horizontal translation

3) a rotation of 180 degrees about point $E$ followed by a dilation with a scale factor of 2 centered at point $E$

4) a counterclockwise rotation of 90 degrees about point $E$ followed by a dilation with a scale factor of 2 centered at point $E$
488. The diagram below shows parallelogram $ABCD$ with diagonals $AC$ and $BD$ intersecting at $E$.

What additional information is sufficient to prove that parallelogram $ABCD$ is also a rhombus?
1) $BD$ bisects $AC$.
2) $AB$ is parallel to $CD$.
3) $AC$ is congruent to $BD$.
4) $AC$ is perpendicular to $BD$.

489. 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) $24\pi$

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

491. A 20-foot support post leans against a wall, making a $70^\circ$ angle with the ground. To the nearest tenth of a foot, how far up the wall will the support post reach?
1) 6.8
2) 6.9
3) 18.7
4) 18.8
492 Two stacks of 23 quarters each are shown below. One stack forms a cylinder but the other stack does not form a cylinder.

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

493 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 $\pi$.

494 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

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

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

496 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) $\cos x$

497 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 $BC \parallel AD$
498 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 \(AH\).

499 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

500 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

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

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

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

Which students wrote correct formulas?

1) Amy and Dex
2) Beth and Carl
3) Carl and Amy
4) Dex and Beth
502 Which regular polygon has a minimum rotation of 45° to carry the polygon onto itself?
1) octagon
2) decagon
3) hexagon
4) pentagon

503 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

504 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.

505 Line ℓ is mapped onto line m by a dilation centered at the origin with a scale factor of 2. The equation of line ℓ is 3x − y = 4. Determine and state an equation for line m.

506 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.

507 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

508 In the diagram of ΔABC, points D and E are on AB and CB, respectively, such that AC || DE.

If AD = 24, DB = 12, and DE = 4, what is the length of AC?
1) 8
2) 12
3) 16
4) 72
509 A water glass can be modeled by a truncated right cone (a cone which is cut parallel to its base) as shown below.

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

510 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

511 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 \( \triangle DNC \).

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

Explain why \( AB \) is parallel to \( CD \).

513 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
514 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 $AC = 15$

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

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

516 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

517 Given: $\triangle ABE$ and $\triangle CBD$ shown in the diagram below with $DB \cong BE$.

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

518 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.
519 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) $DE, CE$

520 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.

521 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 $AE \cdot EB = CE \cdot ED$.

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

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

523 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) $\frac{AB}{DE} = \frac{FE}{CB}$

524 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
525 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.

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

526 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 \( \Delta ABC \cong \Delta DEF \).

527 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) 54º
2) 72º
3) 108º
4) 360º

528 If the rectangle below is continuously rotated about side \( w \), which solid figure is formed?

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

529 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) \( y = 3x - 6 \)
530 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.

531 William is drawing pictures of cross sections of the right circular cone below. Which drawing can not be a cross section of a cone?

1) 
2) 
3) 
4) 

532 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) $\overline{BC} \cong \overline{DE}$
2) $\overline{AB} \cong \overline{DF}$
3) $\angle C \cong \angle E$
4) $\angle A \cong \angle D$

533 Construct an equilateral triangle inscribed in circle $T$ shown below. [Leave all construction marks.]
534 A snow cone consists of a paper cone completely filled with shaved ice and topped with a hemisphere of shaved ice, as shown in the diagram below. The inside diameter of both the cone and the hemisphere is 8.3 centimeters. The height of the cone is 10.2 centimeters.

The desired density of the shaved ice is 0.697 g/cm³, and the cost, per kilogram, of ice is $3.83. Determine and state the cost of the ice needed to make 50 snow cones.

535 In the diagram of parallelogram FRED shown below, ED is extended to A, and AF is drawn such that AF ≅ DF.

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

536 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) \( y = 2x - 16 \)

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

538 Line segment EA is the perpendicular bisector of ZT, and ZE and TE are drawn.

Which conclusion can not be proven?
1) EA bisects angle ZET.
2) Triangle EZT is equilateral.
3) EA is a median of triangle EZT.
4) Angle Z is congruent to angle T.
539 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) Cone
2) Pyramid
3) Cylinder
4) Cube

540 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

541 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.]

542 A carpenter leans an extension ladder against a house to reach the bottom of a window 30 feet above the ground. As shown in the diagram below, the ladder makes a \( 70^\circ \) angle with the ground. To the nearest foot, determine and state the length of the ladder.
543 In the diagram below of circle $O$, the area of the shaded sector $LOM$ is $2\pi$ cm$^2$.

If the length of $NL$ is 6 cm, what is $m\angle N$?
1) 10º
2) 20º
3) 40º
4) 80º

544 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

545 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

546 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) $3x - 2y = 5$

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

548 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) $y = 2x + 1$
549  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) $y = 2x + 6$

550  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

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

552  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) $(6,3)$

553  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.
554 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 \( B \).

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

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

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

557 In the diagram below, \( \triangle ABC \) has coordinates \( A(1,1), B(4,1), \) and \( C(4,5) \). Graph and label \( \triangle A''B''C'' \), the image of \( \triangle ABC \) after the translation five units to the right and two units up followed by the reflection over the line \( y = 0 \).
558 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

559 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) $y = \frac{3}{2}x - 8$

560 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 $D$. 

![Diagram of ship heading towards lighthouse]
Geometry Regents at Random
Answer Section

1  ANS: 2
\[
\frac{4}{x} = \frac{6}{9}
\]
\[
x = 6
\]

PTS: 2  REF: 061915geo  NAT: G.SRT.B.5  TOP: Similarity
KEY: basic

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

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

3  ANS: 2
The line \( x = -2 \) will be tangent to the circle at \((-2, -4)\). A segment connecting this point and \((2, -4)\) is a radius of the circle with length 4.

PTS: 2  REF: 012020geo  NAT: G.GPE.A.1  TOP: Equations of Circles
KEY: other

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

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

5  ANS: 1
\( 8 \times 3.5 \times 2.25 \times 1.055 = 66.465 \)

PTS: 2  REF: 011922geo  NAT: G.SRT.C.7  TOP: Cofunctions

6  ANS: 1
\( 8 \times 3.5 \times 2.25 \times 1.055 = 66.465 \)

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

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

PTS: 2  REF: 081906geo  NAT: G.GPE.A.1  TOP: Equations of Circles
KEY: completing the square
8 ANS: 3
Broome: \( \frac{200536}{706.82} \approx 284 \) Dutchess: \( \frac{280150}{801.59} \approx 349 \) Niagara: \( \frac{219846}{522.95} \approx 420 \) Saratoga: \( \frac{200635}{811.84} \approx 247 \)

PTS: 2 REF: 061902geo NAT: G.MG.A.2 TOP: Density

9 ANS: 2
\[ \tan 11.87 = \frac{x}{0.5(5280)} \]
\[ x \approx 555 \]

PTS: 2 REF: 011913geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side

10 ANS: 4
The line \( y = \frac{3}{2}x - 4 \) does not pass through the center of dilation, so the dilated line will be distinct from \( y = \frac{3}{2}x - 4 \). Since a dilation preserves parallelism, the line \( y = \frac{3}{2}x - 4 \) and its image will be parallel, with slopes of \( \frac{3}{2} \). To obtain the \( y \)-intercept of the dilated line, the scale factor of the dilation, \( \frac{3}{4} \), can be applied to the \( y \)-intercept, \( (0, -4) \). Therefore, \( \left\{ 0 \cdot \frac{3}{4}, -4 \cdot \frac{3}{4} \right\} \rightarrow (0, -3) \). So the equation of the dilated line is \( y = \frac{3}{2}x - 3 \).

PTS: 2 REF: 011924geo NAT: G.SRT.A.1 TOP: Line Dilations

11 ANS: 4
\[ \tan A = \frac{\text{opposite}}{\text{adjacent}} = \frac{15}{8} \]

PTS: 2 REF: 011917geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find an Angle

12 ANS:

PTS: 2 REF: 011929geo NAT: G.CO.D.12 TOP: Constructions
KEY: equilateral triangles

13 ANS: 3
\( (6 - 2)180 = 720 \)
\( \frac{720}{6} = 120 \)

PTS: 2 REF: 012011geo NAT: G.CO.A.3 TOP: Mapping a Polygon onto Itself
14 ANS: 4
2x - 1 = 16
x = 8.5

KEY: graphics

15 ANS: 1
m = \frac{-A}{B} = \frac{-3}{2} \quad m_\perp = \frac{2}{3}

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

16 ANS: 2
108\pi = \frac{6^2 \pi h}{3}
\frac{324\pi}{36\pi} = h
9 = h

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

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

PTS: 4 REF: 011933geo NAT: G.GMD.A.3 TOP: Volume
KEY: cylinders

18 ANS:
\[ V = \frac{2}{3} \pi \left( \frac{6.5}{2} \right)^2 \cdot (1) \approx 22 \cdot 7.48 \approx 165 \]

PTS: 4 REF: 061933geo NAT: G.GMD.A.3 TOP: Volume
KEY: cylinders

19 ANS: 2
m = \frac{\frac{-(-2)}{3}}{3} = \frac{2}{3}

PTS: 2 REF: 061916geo NAT: G.GPE.B.5 TOP: Parallel and Perpendicular Lines
KEY: write equation of parallel line
20 ANS: 
\[ \frac{121 - x}{2} = 35 \]
\[ 121 - x = 70 \]
\[ x = 51 \]

PTS: 2  REF: 011927geo  NAT: G.C.A.2  TOP: Chords, Secants and Tangents
KEY: secants drawn from common point, angle

21 ANS: 4  PTS: 2  REF: 081911geo  NAT: G.GMD.B.4
TOP: Rotations of Two-Dimensional Objects

22 ANS: 
\[ \sqrt{40^2 - \left(\frac{64}{2}\right)^2} = 24 \]
\[ V = \frac{1}{3} (64)^2 \cdot 24 = 32768 \]

PTS: 2  REF: 081921geo  NAT: G.GMD.A.3  TOP: Volume
KEY: pyramids

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

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

24 ANS: 
\[ ER = \sqrt{17^2 - 8^2} = 15 \]

PTS: 2  REF: 061917geo  NAT: G.CO.C.11  TOP: Special Quadrilaterals

25 ANS: 
\[ 2 \times (90 \times 10) + (\pi)(30^2) - (\pi)(20^2) \approx 3371 \]

PTS: 2  REF: 011931geo  NAT: G.MG.A.3  TOP: Compositions of Polygons and Circles
KEY: area

26 ANS: 
\[ \tan 56 = \frac{x}{1.3} \]
\[ \sqrt{(1.3 \tan 56)^2 + 1.5^2} \approx 3.7 \]
\[ x = 1.3 \tan 56 \]

PTS: 4  REF: 012033geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find a Side
KEY: advanced
27 ANS:

\[
\begin{align*}
3y + 7 &= 2x \\
y - 6 &= \frac{2}{3} (x - 2) \\
3y &= 2x - 7 \\
y &= \frac{2}{3}x - \frac{7}{3}
\end{align*}
\]

PTS: 2  
REF: 011925geo  
NAT: G.GPE.B.5  
TOP: Parallel and Perpendicular Lines

KEY: write equation of parallel line

28 ANS: 1

\[
\frac{9}{6} = \frac{3}{2}
\]

PTS: 2  
REF: 061905geo  
NAT: G.SRT.A.1  
TOP: Line Dilations

29 ANS: 4

\[
\frac{18}{4.5} = 4
\]

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

30 ANS: 1

\[
-1 + \frac{1}{3} (8 - 1) = -1 + \frac{1}{3} (9) = -1 + 3 = 2 \\
-3 + \frac{1}{3} (9 - 3) = -3 + \frac{1}{3} (6) = -3 + 2 = 1
\]

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

31 ANS: 3

\[
180 - (48 + 66) = 180 - 114 = 66
\]

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

32 ANS:

Yes, because a dilation preserves angle measure.

PTS: 4  
REF: 081932geo  
NAT: G.CO.D.12  
TOP: Constructions

KEY: congruent and similar figures

33 ANS: 2

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

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

KEY: pyramids
34 ANS: 1

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

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

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

PTS: 2 REF: 011920geo NAT: G.GPE.A.1 TOP: Equations of Circles
KEY: write equation, given center and radius

35 ANS: 2


36 ANS: 3 PTS: 2 REF: 061912geo NAT: G.CO.C.11 TOP: Parallelograms

37 ANS: 2 PTS: 1 REF: 012017geo NAT: G.CO.A.5 TOP: Compositions of Transformations KEY: identify

38 ANS:

\[\sin 4.76 = \frac{1.5}{x}\]
\[\tan 4.76 = \frac{1.5}{x}\]
\[18 - \frac{16}{12} \approx 16.7\]

\[x \approx 18.1\]

PTS: 4 REF: 011934geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side

39 ANS:

PTS: 2 REF: 061931geo NAT: G.CO.D.13 TOP: Constructions
40 ANS: 4
\[\sin x = \frac{10}{12}\]
\[x \approx 56\]

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

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

PTS: 2 
REF: 012031geo 
NAT: G.GPE.B.5 
TOP: Parallel and Perpendicular Lines

KEY: write equation of perpendicular line

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

PTS: 2 
REF: 012007geo 
NAT: G.SRT.C.8 
TOP: Using Trigonometry to Find an Angle

43 ANS:
Quadrilateral \(ABCD\), \(E\) and \(F\) are points on \(BC\) and \(AD\), respectively, and \(BGD\) and \(EGF\) are drawn such that
\[\angle ABG \cong \angle CDG, \quad AB \cong CD, \quad CE \cong AF\] (given); \[BD \cong BD\] (reflexive); \[\Delta ABD \cong \Delta CDB\] (SAS); \[BC \cong DA\] (CPCTC); \[BE + CE \cong AF + DF\] (segment addition); \[BE \cong DF\] (segment subtraction); \[\angle BGE \cong \angle DGF\] (vertical angles are congruent); \[\angle CBD \cong \angle ADB\] (CPCTC); \[\Delta EBG \cong \Delta FDG\] (AAS); \[FG \cong EG\] (CPCTC).

PTS: 6 
REF: 012035geo 
NAT: G.SRT.B.5 
TOP: Quadrilateral Proofs

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

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

45 ANS: 1
\[\cos 65 = \frac{x}{15}\]
\[x \approx 6.3\]

PTS: 2 
REF: 081924geo 
NAT: G.SRT.C.8 
TOP: Using Trigonometry to Find a Side

46 ANS: 4 
d) is SSA

PTS: 2 
REF: 061914geo 
NAT: G.CO.B.7 
TOP: Triangle Congruency

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

48 ANS: 4 
PTS: 2 
REF: 081923geo 
NAT: G.CO.A.3 
TOP: Mapping a Polygon onto Itself
49 ANS: 2  PTS: 2  REF: 012012geo  NAT: G.CO.C.10  TOP: Medians, Altitudes and Bisectors

50 ANS: 2


52 ANS: 1  PTS: 2  REF: 011918geo  NAT: G.MG.A.3  TOP: Compositions of Polygons and Circles  KEY: area

53 ANS:

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

55 ANS:
\[ \cos 68 = \frac{10}{x} \]
\[ x \approx 27 \]

56 ANS:
\[ (7^2)18 \pi = 16x^2 \]
\[ \frac{80}{13.2} \approx 6.1 \]
\[ \frac{60}{13.2} \approx 4.5 \]
\[ 6 \times 4 = 24 \]
\[ 13.2 \approx x \]

\[
\frac{72 - 34}{2} = 19
\]

57 ANS: 1

PTS: 2 REF: 061918geo NAT: G.C.A.2 TOP: Chords, Secants and Tangents
KEY: secants drawn from common point, angle

58 ANS: 1

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

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

PTS: 2 REF: 012010geo NAT: G.GMD.A.3 TOP: Volume
KEY: cones

59 ANS:

\[30^\circ \triangle CAD \text{ is an equilateral triangle, so } \angle CAB = 60^\circ. \text{ Since } \overrightarrow{AD} \text{ is an angle bisector, } \angle CAD = 30^\circ.\]

PTS: 2 REF: 081929geo NAT: G.CO.D.12 TOP: Constructions
KEY: equilateral triangles

60 ANS:

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

PTS: 2 REF: 081931geo NAT: G.GMD.A.3 TOP: Volume
KEY: cylinders

61 ANS: 3 PTS: 2 REF: 011903geo NAT: G.CO.A.5 TOP: Compositions of Transformations
KEY: identify

62 ANS:

Quadrilateral \( MATH, HM \cong AT, HT \cong AM, HE \perp MEA, \text{ and } HA \perp AT \) (given); \( \angle HEA \text{ and } \angle TAH \) are right angles (perpendicular lines form right angles); \( \angle HEA \cong \angle TAH \) (all right angles are congruent); \( MATH \) is a parallelogram (a quadrilateral with two pairs of congruent opposite sides is a parallelogram); \( MA \parallel TH \) (opposite sides of a parallelogram are parallel); \( \angle THA \cong \angle EAH \) (alternate interior angles of parallel lines and a transversal are congruent); \( \triangle HEA \sim \triangle TAH \) (AA); \( \frac{HA}{TH} = \frac{HE}{TA} \) (corresponding sides of similar triangles are in proportion); \( TA \cdot HA = HE \cdot TH \) (product of means equals product of extremes).

PTS: 6 REF: 061935geo NAT: G.SRT.B.5 TOP: Quadrilateral Proofs
63 ANS: 2 PTS: 2 REF: 081909geo NAT: G.CO.A.5 TOP: Compositions of Transformations KEY: identify

64 ANS:
17x = 15^2
17x = 225
x \approx 13.2

PTS: 2 REF: 061930geo NAT: G.SRT.B.5 TOP: Similarity KEY: leg

65 ANS: 1
5x = 12 \cdot 7 \quad 16.8 + 7 = 23.8
5x = 84
x = 16.8

PTS: 2 REF: 061911geo NAT: G.SRT.B.5 TOP: Side Splitter Theorem


68 ANS:
Quadrilateral \(ABCD\) with diagonal \(AC\), segments \(GH\) and \(EF\), \(AE \cong CG\), \(BE \cong DG\), \(AH \cong CF\), and \(AD \cong CB\) (given); \(HF \cong HF\), \(AC \cong AC\) (reflexive property); \(AH + HF \cong CF + HF\), \(AE + BE \cong CG + DG\) (segment addition); \(\triangle ABC \cong \triangle CDA\) (SSS); \(\angle EAF \cong \angle GCH\) (CPCTC); \(\triangle AEF \cong \triangle CGH\) (SAS); \(\overline{EF} \cong \overline{GH}\) (CPCTC).

PTS: 6 REF: 011935geo NAT: G.SRT.B.5 TOP: Quadrilateral Proofs

69 ANS: 3
8 \cdot 15 = 16 \cdot 7.5

PTS: 2 REF: 061913geo NAT: G.CO.C.10 TOP: Centroid, Orthocenter, Incenter and Circumcenter

KEY: intersecting chords, length

70 ANS:

\[7.5 + 7 + 10 = 24.5\]
71 ANS:
\[ \triangle ABE \cong \triangle CBD \text{ (given)}; \quad \angle A \cong \angle C \text{ (CPCTC)}; \quad \angle AFD \cong \angle CFE \text{ (vertical angles are congruent)}; \quad \overline{AB} \cong \overline{CB}, \quad \overline{DB} \cong \overline{EB} \text{ (CPCTC)}; \quad \overline{AD} \cong \overline{CE} \text{ (segment subtraction)}; \quad \triangle AFD \cong \triangle CFE \text{ (AAS)} \]

PTS: 4  REF: 081933geo  NAT: G.SRT.B.5  TOP: Triangle Proofs
KEY: proof

72 ANS:
\[ \angle D = 46^\circ \text{ because the angles of a triangle equal 180}^\circ. \quad \angle B = 46^\circ \text{ because opposite angles of a parallelogram are congruent.} \]


73 ANS:
\[ \frac{1}{2} (5)(10) = 25 \]


74 ANS: 4  PTS: 2  REF: 081922geo  NAT: G.C.A.2  TOP: Chords, Secants and Tangents
KEY: intersecting chords, length

75 ANS:
\[ R_{(-5,2),90^\circ} \circ T_{-3,1} \circ r_{x-axis} \]

PTS: 2  REF: 011928geo  NAT: G.CO.A.5  TOP: Compositions of Transformations
KEY: identify

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

77 ANS:
\[ \sin^{-1}\left(\frac{5}{25}\right) \approx 11.5 \]

PTS: 2  REF: 081926geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find an Angle

78 ANS: 2
\[ 8 \times 8 \times 9 + \frac{1}{3} (8 \times 8 \times 3) = 640 \]

PTS: 2  REF: 011909geo  NAT: G.GMD.A.3  TOP: Volume
KEY: compositions
ANS: 
\[
\left(10 \times 6 + \sqrt{7(7-6)(7-4)(7-4)}\right)(6.5) \approx 442
\]

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

80 ANS: 1
A dilation by a scale factor of 4 centered at the origin preserves parallelism and \((0,-2) \to (0,-8)\).

PTS: 2 REF: 081910geo NAT: G.SRT.A.1 TOP: Line Dilations

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

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

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

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

PTS: 2 REF: 012025geo NAT: G.CO.B.7 TOP: Triangle Congruency

83 ANS: 2
The slope of \(-3x + 4y = 8\) is \(\frac{3}{4}\).

PTS: 2 REF: 061907geo NAT: G.SRT.A.1 TOP: Line Dilations

84 ANS:

\[\overline{AN} \cong \overline{AT} \cong \overline{TS} \cong \overline{SN}\]

Quadrilateral \(NATS\) is a rhombus because all four sides are congruent.

\[\sqrt{5^2 + 5^2} = \sqrt{7^2 + 1^2} = \sqrt{5^2 + 5^2} = \sqrt{7^2 + 1^2} = \sqrt{50} = \sqrt{50} = \sqrt{50}\]

PTS: 4 REF: 012032geo NAT: G.GPE.B.4 TOP: Quadrilaterals in the Coordinate Plane
KEY: grids
\[
\left(\frac{360 - 120}{360}\right)(\pi)(9^2) = 54\pi
\]

PTS: 2  REF: 081912geo  NAT: G.C.B.5  TOP: Sectors

86 ANS:

Triangle with vertices \(A(-2,4), B(6,2), \) and \(C(1,-1)\) (given); \(m_{AC} = -\frac{5}{3}, m_{BC} = \frac{3}{5}\), definition of slope; Because the slopes of the legs of the triangle are opposite reciprocals, the legs are perpendicular (definition of perpendicular); \(\angle C\) is a right angle (definition of right angle); \(\triangle ABC\) is a right triangle (if a triangle has a right angle, it is a right triangle); \(AC \cong BC = \sqrt{34}\) (distance formula); \(\triangle ABC\) is an isosceles triangle (an isosceles triangle has two congruent sides).

PTS: 4  REF: 011932geo  NAT: G.GPE.B.4  TOP: Triangles in the Coordinate Plane

87 ANS: 4

\[-8 + \frac{2}{3}(10 - 8) = -8 + \frac{2}{3}(18) = -8 + 12 = 4 \quad 4 + \frac{2}{3}(-2 - 4) = 4 + \frac{2}{3}(-6) = 4 - 4 = 0\]

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

88 ANS: 3

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

PTS: 2  REF: 081903geo  NAT: G.GPE.B.6  TOP: Directed Line Segments

89 ANS: 2  PTS: 2  REF: 012003geo  NAT: G.SRT.B.5  TOP: Similarity  KEY: basic

90 ANS: 1

\(\triangle ABC \sim \triangle RST\)

PTS: 2  REF: 011908geo  NAT: G.SRT.B.5  TOP: Similarity  KEY: basic
91 ANS: 2
\[18^2 = 12(x + 12)\]
\[324 = 12(x + 12)\]
\[27 = x + 12\]
\[x = 15\]

PTS: 2 REF: 081920geo NAT: G.SRT.B.5 TOP: Similarity
KEY: leg

92 ANS: 4
\[\frac{2}{4} = \frac{8}{x + 2}\]
\[14 + 2 = 16\]
\[2x + 4 = 32\]
\[x = 14\]

PTS: 2 REF: 012024geo NAT: G.SRT.B.5 TOP: Side Splitter Theorem

93 ANS: 1
\[h = \sqrt{6.5^2 - 2.5^2} = 6, V = \frac{1}{3} \pi (2.5)^2 6 = 12.5\pi\]

PTS: 2 REF: 011923geo NAT: G.GMD.A.3 TOP: Volume
KEY: cones

94 ANS:
\[r_y = 2 \circ r_{y-axis}\]

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

95 ANS: 3
\[2(2x + 8) = 7x - 2\]
\[AB = 7(6) - 2 = 40. \text{ Since } EF \text{ is a midsegment, } EF = \frac{40}{2} = 20. \text{ Since } \triangle ABC \text{ is equilateral,}\]
\[4x + 16 = 7x - 2\]
\[18 = 3x\]
\[6 = x\]
\[AE = BF = \frac{40}{2} = 20. \text{ } 40 + 20 + 20 + 20 = 100\]

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

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

PTS: 2 REF: 012021geo NAT: G.SRT.C.7 TOP: Cofunctions
97 ANS:
\[ R_{90^\circ} \text{ or } T_{2,-6} \circ R_{(-4,2),90^\circ} \text{ or } R_{270^\circ} \circ r_{x\text{-axis}} \circ r_{y\text{-axis}} \]

PTS: 2  REF: 061929geo  NAT: G.CO.A.5  TOP: Compositions of Transformations

KEY: identify

98 ANS: 3  PTS: 2  REF: 011911geo  NAT: G.GMD.B.4  TOP: Rotations of Two-Dimensional Objects

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

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

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

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

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

PTS: 2  REF: 012005geo  NAT: G.GPE.B.6  TOP: Directed Line Segments

102 ANS: 3
\[ 12^2 = 9 \cdot GM \]
\[ IM^2 = 16 \cdot 25 \]
\[ GM = 16 \]
\[ IM = 20 \]

PTS: 2  REF: 011910geo  NAT: G.SRT.B.5  TOP: Similarity

KEY: leg

103 ANS: 3  PTS: 2  REF: 011904geo  NAT: G.CO.A.3  TOP: Mapping a Polygon onto Itself

104 ANS:
No, because dilations do not preserve distance.

PTS: 2  REF: 061925geo  NAT: G.SRT.A.2  TOP: Dilations

105 ANS: 1  PTS: 2  REF: 012004geo  NAT: G.CO.C.11  TOP: Special Quadrilaterals

106 ANS: 2
\[ \frac{4}{3} \pi \times \left( \frac{1.68}{2} \right)^3 \times 0.6523 \approx 1.62 \]

PTS: 2  REF: 081914geo  NAT: G.MG.A.2  TOP: Density
107 ANS: 2
\[ \frac{x}{15} = \frac{5}{12} \]
\[ x = 6.25 \]
PTS: 2 REF: 011906geo NAT: G.SRT.B.5 TOP: Side Splitter Theorem

108 ANS:
\[ \frac{1}{2} (5)(12) = 30 \]
PTS: 2 REF: 011906geo NAT: G.SRT.B.5 TOP: Side Splitter Theorem

109 ANS: 1
\[ \frac{6.5}{10.5} = \frac{5.2}{x} \]
\[ x = 8.4 \]
PTS: 2 REF: 081928geo NAT: G.GPE.B.7 TOP: Polygons in the Coordinate Plane

110 ANS:
\[ \sin 38 = \frac{24.5}{x} \]
\[ x \approx 40 \]
PTS: 2 REF: 012006geo NAT: G.CO.C.11 TOP: Trapezoids
KEY: graphics

111 ANS: 3
PTS: 2 REF: 081905geo NAT: G.CO.C.10 TOP: Exterior Angle Theorem

112 ANS: 4
PTS: 2 REF: 011905geo NAT: G.C.A.2 TOP: Chords, Secants and Tangents
KEY: inscribed

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

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

\[ m_{BC} = \frac{-1 - 8}{6 - 3} = -3 \]

because it has a pair of parallel sides. \[ AC = \sqrt{(-1 - 6)^2 + (6 - 1)^2} = \sqrt{98} \]

\[ BD = \sqrt{(8 - 0)^2 + (3 - 1)^2} = \sqrt{68} \]

because its diagonals are not congruent.

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

\[ x^2 = 10.2 \times 14.3 \]

\[ x \approx 12.1 \]

PTS: 2 REF: 012016geo NAT: G.SRT.B.5 TOP: Similarity
KEY: leg

ANS: 4

115 ANS: 4

PTS: 2 REF: 061901geo NAT: G.CO.A.5 TOP: Compositions of Transformations
KEY: identify

116 ANS: 4

TOP: Centroid, Orthocenter, Incenter and Circumcenter

117 ANS: 1

TOP: Chords, Secants and Tangents

KEY: secant and tangent drawn from common point, angle
119 ANS:
\[ AB = \sqrt{(-5 - 1)^2 + (3 - 2)^2} = \sqrt{37}, \quad BC = \sqrt{(-5 - 6)^2 + (3 - 3)^2} = \sqrt{37} \]
(because \( AB = BC \), \( \triangle ABC \) is isosceles). (0, -4). 
\[ AD = \sqrt{(1 - 0)^2 + (2 - 4)^2} = \sqrt{37}, \quad CD = \sqrt{(-6 - 0)^2 + (-3 - 4)^2} = \sqrt{37}, \]
\[ m_{\overline{AB}} = \frac{3 - 2}{-5 - 1} = -\frac{1}{6}, \quad m_{\overline{CD}} = \frac{3 - 3}{-5 - 6} = 6 \]
(\( ABCD \) is a square because all four sides are congruent, consecutive sides are perpendicular since slopes are opposite reciprocals and so \( \angle B \) is a right angle).

PTS: 6    REF: 081935geo    NAT: G.GPE.B.4    TOP: Quadrilaterals in the Coordinate Plane
KEY: grids

120 ANS: 2    PTS: 2    REF: 061903geo    NAT: G.GMD.B.4
TOP: Rotations of Two-Dimensional Objects

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

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

122 ANS: 3
\[ \frac{150}{360} \cdot 9^2 \pi = 33.75\pi \]

PTS: 2    REF: 012013geo    NAT: G.C.B.5    TOP: Sectors

123 ANS: 8 \times 3 \times \frac{1}{12} \times 43 = 86

PTS: 2    REF: 012027geo    NAT: G.MG.A.2    TOP: Density

124 ANS:
\[ \tan 30^\circ = \frac{y}{440} \quad \tan 38.8^\circ = \frac{h}{440} \]
\[ 353.8 - 254 \approx 100 \]
\[ y \approx 254 \quad h \approx 353.8 \]

PTS: 4    REF: 061934geo    NAT: G.SRT.C.8    TOP: Using Trigonometry to Find a Side
KEY: advanced

125 ANS: 4    PTS: 2    REF: 012019geo    NAT: G.GMD.B.4
TOP: Cross-Sections of Three-Dimensional Objects
No. The midpoint of $DF$ is $\left(\frac{1+4}{2}, \frac{-1+2}{2}\right) = (2.5, 0.5)$. A median from point $E$ must pass through the midpoint.

\[ 126 \text{ ANS:} \]

\[ \angle N \text{ is the smallest angle in } \triangle NYA, \text{ so side } \overrightarrow{AY} \text{ is the shortest side of } \triangle NYA. \angle VYA \text{ is the smallest angle in } \triangle VYA, \text{ so side } \overrightarrow{VA} \text{ is the shortest side of both triangles.} \]

\[ 127 \text{ ANS:} 3 \]

\[ (8 \times 2) + (3 \times 2) - \left(\frac{18}{12} \times \frac{21}{12}\right) \approx 19 \]

\[ 128 \text{ ANS:} 4 \]

\[ 90 - 35 = 55 \quad 55 \times 2 = 110 \]

\[ 129 \text{ ANS:} 4 \]

\[ x^2 + 8x + 16 + y^2 - 12y + 36 = 144 + 16 + 36 \]

\[ (x + 4)^2 + (y - 6)^2 = 196 \]

\[ 130 \text{ ANS:} 4 \]

\[ \tan 36 = \frac{x}{8} \quad 5.8 + 1.5 \approx 7 \]

\[ x \approx 5.8 \]

\[ 131 \text{ ANS:} 2 \]

\[ \frac{10}{x} = \frac{15}{12} \]

\[ x = 8 \]

\[ 132 \text{ ANS:} 3 \]

\[ 133 \text{ ANS:} 2 \]

\[ \text{KEY: basic} \]

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

\[ \text{TOP: Using Trigonometry to Find a Side} \]

\[ \text{TOP: Similarity} \]
134 ANS:

\[ \sqrt{8^2 + 6^2} = 10 \text{ for one side} \]

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

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

136 ANS: 2

\[ \sqrt{8^2 + 6^2} = 10 \text{ for one side} \]

PTS: 2  REF: 011907geo  NAT: G.CO.C.11  TOP: Special Quadrilaterals

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

138 ANS: 4

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

139 ANS:

\[ x^2 = 8 \times 12.5 \]
\[ x = 10 \]

PTS: 2  REF: 012028geo  NAT: G.C.A.2  TOP: Chords, Secants and Tangents
KEY: secant and tangent drawn from common point, length

140 ANS: 1  PTS: 2  REF: 012022geo  NAT: G.SRT.A.2
TOP: Compositions of Transformations  KEY: grids

141 ANS: 4  PTS: 2  REF: 011704geo  NAT: G.CO.C.10
TOP: Midsegments
The line \(y = -3x + 6\) passes through the center of dilation, so the dilated line is not distinct.

\[
\sin 71 = \frac{x}{20}
\]
\[
x = 20 \sin 71 \approx 19
\]

\[
82.8 = \frac{1}{3} (4.6)(9)h
\]
\[
h = 6
\]
149 ANS: 4
9 \cdot 3 = 27, 27 \cdot 4 = 108

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

150 ANS: 1
\begin{align*}
-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
\end{align*}

PTS: 2  REF: 081717geo  NAT: G.GPE.B.6  TOP: Directed Line Segments

151 ANS: 4  PTS: 2  REF: 011723geo  NAT: G.GMD.B.4
TOP: Cross-Sections of Three-Dimensional Objects

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

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

153 ANS:
\begin{align*}
m_{\overline{MH}} &= \frac{6}{10} = \frac{3}{5}, \\
m_{\overline{AT}} &= \frac{6}{10} = \frac{3}{5}, \\
m_{\overline{MA}} &= \frac{5}{3}, \\
m_{\overline{HT}} &= -\frac{5}{3}; \\
\overline{MH} \parallel \overline{AT} \text{ and } \overline{MA} \parallel \overline{HT}.
\end{align*}

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

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

154 ANS:
A(-2,1) \rightarrow (-3,-1) \rightarrow (-6,-2) \rightarrow (-5,0), B(0,5) \rightarrow (-1,3) \rightarrow (-2,6) \rightarrow (-1,8),
C(4,-1) \rightarrow (3,-3) \rightarrow (6,-6) \rightarrow (7,-4)

PTS: 2  REF: 061826geo  NAT: G.SRT.A.2  TOP: Dilations

155 ANS: 4
\begin{align*}
\frac{1}{2} (360 - 268) &= 46
\end{align*}

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

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

Because $\overline{AB} \cong \overline{AC}$, $\triangle ABC$ has two congruent sides and is isosceles. Because $\overline{AB} \cong \overline{BC}$ is not true, $\triangle ABC$ has sides that are not congruent and $\triangle ABC$ is not equilateral.

PTS: 4 REF: 061832geo NAT: G.GPE.B.4 TOP: Triangles in the Coordinate Plane

158 ANS:

Yes, as translations do not change angle measurements.


159 ANS: 2

$\triangle ACB \sim \triangle AED$

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


162 ANS:

Parallelogram $ABCD$, $\overline{BF} \perp \overline{AFD}$, and $\overline{DE} \perp \overline{BEC}$ (given); $\overline{BC} \parallel \overline{AD}$ (opposite sides of a $\square$ are $\parallel$); $\overline{BE} \parallel \overline{FD}$ (parts of $\parallel$ lines are $\parallel$); $\overline{BF} \parallel \overline{DE}$ (two lines $\perp$ to the same line are $\parallel$); $BEDF$ is $\square$ (a quadrilateral with both pairs of opposite sides $\parallel$ is a $\square$); $\angle DEB$ is a right $\angle$ ($\perp$ lines form right $\angle$s); $BEDF$ is a rectangle (a $\square$ with one right $\angle$ is a rectangle).


163 ANS: 4

$C = 12\pi \frac{120}{360} (12\pi) = \frac{1}{3} (12\pi)$

PTS: 2 REF: 061822geo NAT: G.C.B.5 TOP: Arc Length

KEY: arc length
164 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

166 ANS:

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

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

167 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
168 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

169 ANS: 4

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

\[ y = \frac{1}{2}x + 0 \]
\[ 2y = x \]
\[ 2y - x = 0 \]

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

KEY: perpendicular bisector

170 ANS:

Quadrilateral \(ABCD, \overline{AB} \cong \overline{CD}, \overline{AB} \parallel \overline{CD}\), and \(\overline{BF}\) and \(\overline{DE}\) are perpendicular to diagonal \(\overline{AC}\) 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). \(\overline{AD} \parallel \overline{BC}\) (Opposite sides of a parallelogram are parallel). \(\angle DAE \cong \angle BCF\) (Parallel lines cut by a transversal form congruent alternate interior angles). \(\triangle ADE \cong \triangle CBF\) (AAS). \(\overline{AE} \cong \overline{CF}\) (CPCTC).

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

171 ANS: 1

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

PTS: 2 REF: 011708geo NAT: G.MG.A.3 TOP: Area of Polygons

172 ANS: 3

\[ \frac{x}{6.3} = \frac{3}{5} \]
\[ \frac{y}{9.4} = \frac{6.3}{6.3 + 3.78} \]

\[ x = 3.78 \]
\[ y \approx 5.9 \]

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

173 ANS:

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

PTS: 2 REF: 011825geo NAT: G.SRT.B.5 TOP: Quadrilateral Proofs
\( v = \pi r^2 h \) (1) \( 6^2 \cdot 10 = 360 \)
\[ 150\pi = \pi r^2 h \] (2) \( 10^2 \cdot 6 = 600 \)
\[ 150 = r^2 h \] (3) \( 5^2 \cdot 6 = 150 \)
\[ 3^2 \cdot 10 = 900 \]

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

\( V = \frac{1}{3} \pi \left( \frac{1.5}{2} \right)^2 \left( \frac{4}{2} \right) \approx 1.2 \)

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

\( \sin 16.5 = \frac{8}{x} \)
\[ x \approx 28.2 \]

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

\[ 3 + \frac{2}{5}(8 - 3) = 3 + \frac{2}{5}(5) = 3 + 2 = 5 \]
\[ 5 + \frac{2}{5}(-5 - 5) = 5 + \frac{2}{5}(-10) = 5 - 4 = 1 \]

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

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

PTS: 2 REF: 061724geo NAT: G.SRT.B.5 TOP: Similarity

\[ x^2 = 12(12 - 8) \]
\[ x^2 = 48 \]
\[ x = 4\sqrt{3} \]

PTS: 2 REF: 011823geo NAT: G.SRT.B.5 TOP: Similarity

\( x \) leg

PTS: 2 REF: 061706geo NAT: G.SRT.A.1 TOP: Line Dilations
183 ANS: 4 PTS: 2 REF: 081801geo NAT: G.CO.C.9
TOP: Lines and Angles
184 ANS: 3 PTS: 2 REF: 061802geo NAT: G.CO.C.9
TOP: Lines and Angles
185 ANS: 1 PTS: 2 REF: 011703geo NAT: G.SRT.B.5
TOP: Triangle Congruency
186 ANS: 4 PTS: 2 REF: 081803geo NAT: G.GMD.B.4
TOP: Rotations of Two-Dimensional Objects
187 ANS:
rotation 180º about the origin, translation 2 units down; rotation 180º about B, translation 6 units down and 6 units left; or reflection over x-axis, translation 2 units down, reflection over y-axis
PTS: 2 REF: 081828geo NAT: G.CO.A.5 TOP: Compositions of Transformations
KEY: identify
188 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
189 ANS: 1
The slope of \(3x + 2y = 12\) is \(-\frac{3}{2}\), which is the opposite reciprocal of \(\frac{2}{3}\).
PTS: 2 REF: 081811geo NAT: G.GPE.B.5 TOP: Parallel and Perpendicular Lines
KEY: identify perpendicular lines
190 ANS:
\[10 \cdot 6 = 15x\]
\[x = 4\]
PTS: 2 REF: 061828geo NAT: G.C.A.2 TOP: Chords, Secants and Tangents
KEY: secants drawn from common point, length
191 ANS: 3
NYSED has stated that all students should be awarded credit regardless of their answer to this question.
PTS: 2 REF: 061722geo NAT: G.CO.B.7 TOP: Triangle Congruency
192 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
The line is on the center of dilation, so the line does not change. $p: 3x + 4y = 20$

194 ANS: 2

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

195 ANS: 3

$4\sqrt{(-1-3)^2 + (5-1)^2} = 4\sqrt{20}$

196 ANS: 2

KEY: leg

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

198 ANS: 3

$\frac{24}{40} = \frac{15}{x}$  
$24x = 600$  
$x = 25$

199 ANS:  

$\frac{40}{360} \cdot \pi (4.5)^2 = 2.25\pi$
200 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

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

PTS: 2 REF: 081829geo NAT: G.SRT.B.5 TOP: Similarity

202 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

203 ANS:
C: \[ V = \pi(26.7)^2(750) - \pi(24.2)^2(750) = 95,437.5\pi \]
\[ 95,437.5\pi \text{ cm}^3 \left( \frac{2.7 \text{ g}}{\text{cm}^3} \right) \left( \frac{1 \text{ kg}}{1000 \text{ g}} \right) \left( \frac{\$0.38}{\text{kg}} \right) = \$307.62 \]

P: \[ V = 40^2(750) - 35^2(750) = 281,250 \]
\[ 281,250 \text{ cm}^3 \left( \frac{2.7 \text{ g}}{\text{cm}^3} \right) \left( \frac{1 \text{ kg}}{1000 \text{ g}} \right) \left( \frac{\$0.38}{\text{kg}} \right) = \$288.56 \]

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

204 ANS: 4
\[ \frac{360^\circ}{10} = 36^\circ 252^\circ \text{ is a multiple of } 36^\circ \]

PTS: 2 REF: 081722geo NAT: G.CO.A.3 TOP: Mapping a Polygon onto Itself
205 ANS: 1
Illinois: $\frac{12830632}{231.1} \approx 55520$ Florida: $\frac{18801310}{350.6} \approx 53626$ New York: $\frac{19378102}{411.2} \approx 47126$ Pennsylvania: $\frac{12702379}{283.9} \approx 44742$

PTS: 2 REF: 081720geo NAT: G.MG.A.2 TOP: Density

206 ANS: 4 PTS: 2 REF: 081810geo NAT: G.SRT.B.5
TOP: Triangle Proofs KEY: statements

207 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

208 ANS: 3
In (1) and (2), $ABCD$ could be a rectangle with non-congruent sides. (4) is not possible

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

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

PTS: 4 REF: 061833geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side KEY: advanced

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

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

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

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

212 ANS: 2
$-4 + \frac{2}{5} (1 - 4) = -4 + \frac{2}{5} (5) = -4 + 2 = -2$ 
$-2 + \frac{2}{5} (8 - 2) = -2 + \frac{2}{5} (10) = -2 + 4 = 2$

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

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

PTS: 2 REF: 061730geo NAT: G.CO.A.5 TOP: Compositions of Transformations KEY: identify
214 ANS: 3
\[6x - 40 + x + 20 = 180 - 3x \quad m\angle BAC = 180 - (80 + 40) = 60\]
\[10x = 200\]
\[x = 20\]

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

215 ANS: 3
\[6 \cdot 3^2 = 54 \quad 12 \cdot 3 = 36\]

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

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

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

217 ANS: 2  PTS: 2  REF: 011805geo  NAT: G.GMD.B.4
TOP: Cross-Sections of Three-Dimensional Objects

218 ANS: 4
\[\frac{5}{7} = \frac{x}{x + 5}\]
\[12 \frac{1}{2} + 5 = 17 \frac{1}{2}\]
\[5x + 25 = 7x\]
\[2x = 25\]
\[x = 12 \frac{1}{2}\]

PTS: 2  REF: 061821geo  NAT: G.SRT.B.5  TOP: Side Splitter Theorem

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


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

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

KEY: graph  proof
221 ANS: 3

\[ \triangle CFB \sim \triangle CAD \quad \frac{CB}{CF} = \frac{CD}{CA} \]

\[ \frac{x}{21.6} = \frac{7.2}{9.6} \]

\[ x = 16.2 \]

PTS: 2 REF: 061804geo NAT: G.SRT.B.5 TOP: Similarity

KEY: basic

222 ANS:

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

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

223 ANS: 1

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

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

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

KEY: completing the square

224 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

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

KEY: statements

226 ANS: 3 PTS: 2 REF: 081805geo NAT: G.GMD.B.4 TOP: Cross-Sections of Three-Dimensional Objects

227 ANS:

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

\[ 31.416 = 2\pi \]

\[ 5 \approx r \]

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

KEY: cones

228 ANS: 3

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

PTS: 2 REF: 011719geo NAT: G.GPE.B.4 TOP: Quadrilaterals in the Coordinate Plane
229 \[ \frac{152 - 56}{2} = 48 \]

PTS: 2 \hspace{1em} REF: 011728geo \hspace{1em} NAT: G.C.A.2 \hspace{1em} TOP: Chords, Secants and Tangents

KEY: secant and tangent drawn from common point, angle

230 \[ \frac{2}{4} = \frac{9-x}{x} \]
\[ 36 - 4x = 2x \]
\[ x = 6 \]

PTS: 2 \hspace{1em} REF: 061705geo \hspace{1em} NAT: G.SRT.B.5 \hspace{1em} TOP: Side Splitter Theorem

231 \[ x^2 + y^2 - 6x + 2y = 6 \]
\[ (x - 3)^2 + (y + 1)^2 = 16 \]

PTS: 2 \hspace{1em} REF: 011812geo \hspace{1em} NAT: G.GPE.A.1 \hspace{1em} TOP: Equations of Circles

KEY: completing the square

232 \[ V = \frac{1}{3} \left( \frac{60}{12} \right)^2 \left( \frac{84}{12} \right) \approx 58 \]

PTS: 2 \hspace{1em} REF: 081819geo \hspace{1em} NAT: G.GMD.A.3 \hspace{1em} TOP: Volume

KEY: pyramids

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

PTS: 2 \hspace{1em} REF: 011806geo \hspace{1em} NAT: G.GPE.B.6 \hspace{1em} TOP: Directed Line Segments

234 \[ -8 + \frac{3}{5} (7 - -8) = -8 + 9 = 1 \]
\[ 7 + \frac{3}{5} (-13 - 7) = 7 - 12 = -5 \]

PTS: 2 \hspace{1em} REF: 081815geo \hspace{1em} NAT: G.GPE.B.6 \hspace{1em} TOP: Directed Line Segments
237 ANS:
Circle $O$, tangent $\overline{EC}$ to diameter $\overline{AC}$, chord $\overline{BC}$ || secant $\overline{ADE}$, and chord $\overline{AB}$ (given); $\angle B$ is a right angle (an angle inscribed in a semi-circle is a right angle); $\overline{EC} \perp \overline{OC}$ (a radius drawn to a point of tangency is perpendicular to the tangent); $\angle ECA$ is a right angle (perpendicular lines form right angles); $\angle B \cong \angle ECA$ (all right angles are congruent); $\angle BCA \cong \angle CAE$ (the transversal of parallel lines creates congruent alternate interior angles); $\triangle ABC \sim \triangle ECA$ (AA); $\frac{BC}{CA} = \frac{AB}{EC}$ (Corresponding sides of similar triangles are in proportion).

PTS: 4 REF: 081733geo NAT: G.SRT.B.5 TOP: Circle Proofs

238 ANS: 4 PT: 2 REF: 081702geo NAT: G.CO.A.2 TOP: Identifying Transformations KEY: basic

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

PTS: 2 REF: 061710geo NAT: G.CO.C.10 TOP: Interior and Exterior Angles of Triangles KEY: secant and tangent drawn from common point, length

240 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: segment bisectors create two congruent segments; $\angle TXR \cong \angle VXS$ (vertical angles are congruent); $\triangle TXR \cong \triangle VXS$ (SAS); $\angle T \cong \angle V$ (CPCTC); $\overline{TR} || \overline{SV}$ (a transversal that creates congruent alternate interior angles cuts parallel lines).

241 ANS:
$\frac{4\pi}{3} (2^3 - 1.5^3) \approx 19.4 \ 19.4 \cdot 1.308 \cdot 8 \approx 203$

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

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

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

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

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

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

\[(x - 3)^2 + (y + 4)^2 = 81\]

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

245 ANS: 1

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

\[ O \approx 68.6 \]

PTS: 2    REF: 011804geo    NAT: G.SRT.C.8    TOP: Using Trigonometry to Find a Side

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

247 ANS: 1    PTS: 2    REF: 011811geo    NAT: G.SRT.A.2
TOP: Dilations

248 ANS:

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

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

250 ANS: 4

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

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

251 ANS: 3

\[ \frac{s_c}{s_s} = \frac{6\theta}{4\theta} = 1.5 \]

KEY: arc length

15
252 ANS:

\[ \begin{array}{c}
\includegraphics{diagram}
\end{array} \]

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

253 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

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

255 ANS: 1

\[ 2x + 4 + 46 = 90 \]

\[ 2x = 40 \]

\[ x = 20 \]

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

256 ANS:

\[ V = (\pi)(4^2)(9) + \left(\frac{1}{2}\right)\left(\frac{4}{3}\right)(\pi)(4^3) \approx 586 \]

PTS: 4 REF: 011833geo NAT: G.GMD.A.3 TOP: Volume
KEY: compositions

257 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

258 ANS:

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

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

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

260 ANS: 4  PTS: 2  REF: 081716geo  NAT: G.CO.C.10
TOP: Midsegments

261 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

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

263 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

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

265 ANS:

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

PTS: 2  REF: 081729geo  NAT: G.SRT.A.1  TOP: Line Dilations

266 ANS: 4

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

PTS: 2  REF: 081721geo  NAT: G.SRT.C.7  TOP: Cofunctions
Reflections are rigid motions that preserve distance, so \( \triangle ABC \cong \triangle DEF \).

\[ r_{x=-1} \]

\[ m = \frac{3}{2} \]

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

\[ \cos B = \frac{17.6}{26} \]

\[ B \approx 47 \]

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

Yes. The bases of the cylinders have the same area and the cylinders have the same height.
274 ANS:

\[ 29.5 \approx \frac{4}{3} \pi \cdot \left( \frac{29.5}{2\pi} \right)^3 \approx 434 \]

\[ r = \frac{29.5}{2\pi} \]

PTS: 2 REF: 061831geo NAT: G.GMD.A.3 TOP: Volume
KEY: spheres

275 ANS: 1 PTS: 2 REF: 011814geo NAT: G.SRT.A.1
TOP: Line Dilations

276 ANS: 2

\[ 2x + 7 + 4x - 7 = 90 \]

\[ 6x = 90 \]

\[ x = 15 \]

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

277 ANS: 4

Opposite angles of an inscribed quadrilateral are supplementary.

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

278 ANS:

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

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

\[ 23325.3 - 4883 = 18442 \]

\[ \frac{60}{1\text{ min}} \left( \frac{1\text{ mi}}{5280\text{ ft}} \right) \approx 210 \]

\[ x \approx 23325.3 \]

\[ y \approx 4883 \]

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

279 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

280 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

281 ANS: 3 PTS: 2 REF: 081817geo NAT: G.CO.A.3
TOP: Mapping a Polygon onto Itself
282 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

283 ANS:

\[ \frac{Q}{360} (\pi) \left( 25^2 \right) = (\pi) \left( 25^2 \right) - 500 \pi \]

\[ Q = \frac{125 \pi (360)}{625 \pi} \]

\[ Q = 72 \]

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

284 ANS: 1

\[ m = \frac{-4}{-6} = \frac{2}{3} \]

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

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

285 ANS: 4

\[ x^2 + 4x + 4 + y^2 - 8y + 16 = -16 + 4 + 16 \]

\[ (x + 2)^2 + (y - 4)^2 = 4 \]

PTS: 2 REF: 081821geo NAT: G.GPE.A.1 TOP: Equations of Circles KEY: completing the square

286 ANS: 2

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

PTS: 2 REF: 011822geo NAT: G.GMD.A.3 TOP: Volume KEY: pyramids

287 ANS: 4 PTS: 2 REF: 011817geo NAT: G.SRT.B.5 TOP: Similarity KEY: basic
288 \( \text{ANS: } 2 \)
\( 8(x + 8) = 6(x + 18) \)
\( 8x + 64 = 6x + 108 \)
\( 2x = 44 \)
\( x = 22 \)

PTS: 2 \( \text{REF: } \text{011715geo} \) \( \text{NAT: } \text{G.C.A.2} \) \( \text{TOP: } \text{Chords, Secants and Tangents} \)
KEY: secants drawn from common point, length

289 \( \text{ANS: } 180 - 2(25) = 130 \)

PTS: 2 \( \text{REF: } \text{011730geo} \) \( \text{NAT: } \text{G.CO.C.10} \) \( \text{TOP: } \text{Centroid, Orthocenter, Incenter and Circumcenter} \)

290 \( \text{ANS: } 3 \)
The x-axis and line \( x = 4 \) are lines of symmetry and \( (4,0) \) is a point of symmetry.

PTS: 2 \( \text{REF: } \text{081706geo} \) \( \text{NAT: } \text{G.CO.A.3} \) \( \text{TOP: } \text{Mapping a Polygon onto Itself} \)

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

PTS: 4 \( \text{REF: } \text{011832geo} \) \( \text{NAT: } \text{G.SRT.A.2} \) \( \text{TOP: } \text{Dilations} \)

292 \( \text{ANS: } 4 \)

PTS: 2 \( \text{REF: } \text{081711geo} \) \( \text{NAT: } \text{G.CO.C.10} \) \( \text{TOP: } \text{Exterior Angle Theorem} \)

293 \( \text{ANS: } 4 \)

PTS: 2 \( \text{REF: } \text{061717geo} \) \( \text{NAT: } \text{G.CO.C.10} \) \( \text{TOP: } \text{Interior and Exterior Angles of Triangles} \)

294 \( \text{ANS: } 4 \) \( \text{PTS: } 2 \) \( \text{REF: } \text{011705geo} \) \( \text{NAT: } \text{G.CO.C.11} \)
TOP: Special Quadrilaterals
\[ \frac{x}{x+3} = \frac{14}{21} \]
\[ 14 - 6 = 8 \]
\[ 21x = 14x + 42 \]
\[ 7x = 42 \]
\[ x = 6 \]

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

\[ \triangle PAT \] is an isosceles triangle because sides \( \overline{AP} \) and \( \overline{AT} \) are congruent (\( \sqrt{3^2 + 11^2} = \sqrt{7^2 + 9^2} = \sqrt{130} \)). 
\( R(2,9) \). Quadrilateral \( PART \) is a parallelogram because the opposite sides are parallel since they have equal slopes.

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

PTS: 6  
REF: 011835geo  
NAT: G.GPE.B.4  
TOP: Quadrilaterals in the Coordinate Plane

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

PTS: 6  
REF: 081736geo  
NAT: G.GMD.A.3  
TOP: Volume

KEY: compositions
300 ANS: 4  
\[
\frac{6.6}{x} = \frac{4.2}{5.25}  
\]
\[
4.2x = 34.65  
\]
\[
x = 8.25  
\]
PTS: 2  REF: 081705geo  NAT: G.SRT.B.5  TOP: Similarity  
KEY: basic

301 ANS:  
\[
2 \left( \frac{36}{12} \times \frac{36}{12} \times \frac{4}{12} \right) \times 3.25 = 19.50  
\]
PTS: 2  REF: 081831geo  NAT: G.GMD.A.3  TOP: Volume  
KEY: prisms

302 ANS: 

PTS: 2  REF: 081825geo  NAT: G.CO.D.12  TOP: Constructions  
KEY: parallel and perpendicular lines

303 ANS: 1  PTS: 2  REF: 081804geo  NAT: G.SRT.A.2  
TOP: Compositions of Transformations  KEY: grids

304 ANS:  
\[
\tan 36 = \frac{x}{10}  
\]
\[
\cos 36 = \frac{10}{y}  
\]
\[
x \approx 7.3  
\]
\[
y \approx 12.3607  
\]
PTS: 4  REF: 081833geo  NAT: G.SRT.C.8  TOP: Using Trigonometry to Find a Side

305 ANS:  
The four small triangles are 8-15-17 triangles.  \(4 \times 17 = 68\)

PTS: 2  REF: 081726geo  NAT: G.CO.C.11  TOP: Special Quadrilaterals
306 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

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

308 ANS:
Yes, because 28° and 62° angles are complementary. The sine of an angle equals the cosine of its complement.

PTS: 2 REF: 011727geo NAT: G.SRT.C.7 TOP: Cofunctions

309 ANS:
\[ R_{180^\circ} \text{ about } \left(\frac{1}{2}, \frac{1}{2}\right) \]

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

310 ANS:

![Diagram](image)

PTS: 2 REF: 081826geo NAT: G.CO.C.11 TOP: Parallelograms

311 ANS: 2
\[ (x - 5)^2 + (y - 2)^2 = 16 \]
\[ x^2 - 10x + 25 + y^2 - 4y + 4 = 16 \]
\[ x^2 - 10x + y^2 - 4y = -13 \]

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

312 ANS: 1
Distance and angle measure are preserved after a reflection and translation.

KEY: basic
313 ANS:

\[ V = \pi (10)^2 (18) = 1800\pi \text{ in}^3 \quad 1800\pi \text{ in}^3 \left(\frac{1 \text{ ft}^3}{12^3 \text{ in}^3}\right) = \frac{25}{24} \pi \text{ ft}^3 \quad 25 \frac{\pi (95.46)(0.85)}{24} \approx 266 \quad 266 + 270 = 536 \]

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

314 ANS:

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

\[ r \approx 4.967 \]

\[ d \approx 9.9 \]

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

KEY: cylinders

315 ANS: 1

\[ \cos x = \frac{12}{13} \]

\[ x \approx 23 \]

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

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

TOP: Identifying Transformations

KEY: graphics

317 ANS:

\[ x^2 + x^2 = 58^2 \]

\[ a = (\sqrt{1682} + 8)^2 \approx 2402.2 \]

\[ 2x^2 = 3364 \]

\[ x = \sqrt{1682} \]

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

318 ANS: 4

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

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

319 ANS: 1    PTS: 2    REF: 061801geo    NAT: G.CO.B.6

TOP: Properties of Transformations

KEY: graphics

320 ANS: 2

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

PTS: 2    REF: 081723geo    NAT: G.C.B.5    TOP: Sectors
321 ANS: 1
\[ \tan x = \frac{1}{12} \]
\[ x \approx 4.76 \]

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

322 ANS: 1
\[ 24x = 10^2 \]
\[ 24x = 100 \]
\[ x \approx 4.2 \]

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

323 ANS: 1
Parallel chords intercept congruent arcs. \[ \frac{180 - 130}{2} = 25 \]

PTS: 2 REF: 081704geo NAT: G.C.A.2 TOP: Chords, Secants and Tangents

324 ANS:
\[ PQ \sqrt{(8-3)^2 + (3-2)^2} = \sqrt{50} \]
\[ QR \sqrt{(1-8)^2 + (4-3)^2} = \sqrt{50} \]
\[ RS \sqrt{(-4-1)^2 + (-1-4)^2} = \sqrt{50} \]
\[ PS \sqrt{(-4-3)^2 + (-1-2)^2} = \sqrt{50} \]
\[ PORS \text{ is a rhombus because all sides are congruent.} \]
\[ m_{\overline{PQ}} = \frac{8-3}{3-2} = \frac{5}{1} = 1 \]
\[ m_{\overline{QR}} = \frac{1-8}{4-3} = -7 \text{ Because the slopes of adjacent sides are not opposite reciprocals, they are not perpendicular} \]

and do not form a right angle. Therefore \( PORS \) is not a square.

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

325 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
326  ANS: 3  
\[
\frac{x + 72}{2} = 58
\]
\[
x + 72 = 116
\]
\[
x = 44
\]

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

327  ANS: 2
\[
m = \frac{3}{2}  \quad 1 = -\frac{2}{3}(-6) + b
\]
\[
m = \frac{2}{3}  \quad 1 = 4 + b
\]
\[-3 = b
\]

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

328  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

329  ANS: 1

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

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

330  ANS:

Isosceles trapezoid \(ABCD\), \(\angle CDE \cong \angle DCE\), \(AE \perp DE\), and \(BE \perp CE\) (given); \(AD \cong BC\) (congruent legs of isosceles trapezoid); \(\angle DEA\) and \(\angle CEB\) are right angles (perpendicular lines form right angles); \(\angle DEA \cong \angle CEB\) (all right angles are congruent); \(\angle CDA \cong \angle DCB\) (base angles of an isosceles trapezoid are congruent); \(\angle CDA - \angle CDE \cong \angle DCB - \angle DCE\) (subtraction postulate); \(\triangle ADE \cong \triangle BCE\) (AAS); \(EA \cong EB\) (CPCTC);
\(\angle EDA \cong \angle ECB\)

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

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

331 ANS:

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

332 ANS: 3 PTS: 2 REF: 061702geo NAT: G.GPE.B.7 TOP: Polygons in the Coordinate Plane

333 ANS:

\[\frac{30}{360} (5\pi) \approx 6.5\]


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

\[
\begin{align*}
\text{PTS: } & 2 \quad \text{REF: 011731geo} \quad \text{NAT: G.GPE.B.4} \quad \text{TOP: Quadrilaterals in the Coordinate Plane} \\
\text{KEY: grids} \\
\end{align*}
\]

337 ANS: 4

\[
\begin{align*}
1 & = \frac{x}{3.5} = \frac{18-x}{18} \\
3.5x & = 18-x \\
4.5x & = 18 \\
x & = 4
\end{align*}
\]

PTS: 2 REF: 081707geo NAT: G.SRT.B.5 TOP: Side Splitter Theorem

338 ANS:

\[
\begin{align*}
\cos 54 & = \frac{4.5}{m} \quad \tan 54 = \frac{h}{4.5} \\
m & \approx 7.7 \quad h \approx 6.2
\end{align*}
\]

PTS: 4 REF: 011834geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side

339 ANS: 4

\[
\begin{align*}
\text{PTS: } & 2 \quad \text{REF: 081708geo} \quad \text{NAT: G.CO.C.11} \quad \text{TOP: Interior and Exterior Angles of Polygons}
\end{align*}
\]
340 ANS: 2

![Diagram](image)

**PTS:** 2  
**REF:** 081814geo  
**NAT:** G.C.A.2  
**TOP:** Chords, Secants and Tangents

**KEY:** tangents drawn from common point, length

341 ANS: 4  
**PTS:** 2  
**REF:** 011808geo  
**NAT:** G.CO.A.2

**TOP:** Analytical Representations of Transformations

**KEY:** basic

342 ANS:

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

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

**KEY:** spheres

343 ANS: 3

\[x(x - 6) = 4^2\]
\[x^2 - 6x - 16 = 0\]
\[(x - 8)(x + 2) = 0\]
\[x = 8\]

**PTS:** 2  
**REF:** 081807geo  
**NAT:** G.SRT.B.5  
**TOP:** Similarity

**KEY:** altitude

344 ANS: 1

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

**PTS:** 2  
**REF:** 061807geo  
**NAT:** G.GMD.A.3  
**TOP:** Volume

**KEY:** compositions
345 ANS: 2

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

346 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

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

348 ANS:

PTS: 2 REF: 081728geo NAT: G.CO.D.13 TOP: Constructions

349 ANS: 3

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

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

Answer Section

TOP:  Chords, Secants and Tangents  KEY:  inscribed

351  ANS:  3

352  ANS:  3

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

353  ANS:

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

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

354  ANS:  2  PTS:  2  REF:  081501geo  NAT:  G.CO.C.11
TOP:  Special Quadrilaterals

355  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
356 \text{ANS:} \quad \frac{6}{14} = \frac{9}{21} \quad \text{SAS} \\
126 = 126

\text{PTS: 2} \quad \text{REF: 081529geo} \quad \text{NAT: G.SRT.B.5} \quad \text{TOP: Similarity} \\
\text{KEY: basic}

357 \text{ANS: 4} \quad \text{PTS: 2} \quad \text{REF: 011609geo} \quad \text{NAT: G.SRT.C.7} \\
\text{TOP: Cofunctions}

\text{PTS: 2} \quad \text{REF: 081531geo} \quad \text{NAT: G.SRT.B.5} \quad \text{TOP: Similarity} \\
\text{KEY: basic}

358 \text{ANS:} \\
\begin{align*}
\tan 45^\circ & = \frac{1.65}{4.15} = \frac{x}{16.6} \\
4.15x & = 27.39 \\
x & = 6.6
\end{align*}

\text{PTS: 2} \quad \text{REF: 011634geo} \quad \text{NAT: G.SRT.B.5} \quad \text{TOP: Similarity} \\
\text{KEY: leg}

359 \text{ANS:} \\
x = \sqrt{.55^2 - .25^2} \approx 0.49 \quad \text{No, } .49^2 = .25 \quad .9604 + .25 < 1.5 \\
.9604 = y

\text{PTS: 4} \quad \text{REF: 061534geo} \quad \text{NAT: G.SRT.B.5} \quad \text{TOP: Similarity} \\
\text{KEY: leg}

360 \text{ANS:} \\
r = 25 \text{ cm} \left( \frac{1 \text{ m}}{100 \text{ cm}} \right) = 0.25 \text{ m} \quad V = \pi (0.25 \text{ m})^2 (10 \text{ m}) = 0.625\pi \text{ m}^3 \\
W = 0.625\pi \text{ m}^3 \left( \frac{380 \text{ K}}{1 \text{ m}^3} \right) \approx 746.1 \text{ K} \\
n = \left( \frac{\$50,000}{\text{K}} \right)(746.1 \text{ K}) = 14.1 \quad 15 \text{ trees}

\text{PTS: 4} \quad \text{REF: spr1412geo} \quad \text{NAT: G.MG.A.2} \quad \text{TOP: Density}

361 \text{ANS: 2} \quad \text{PTS: 2} \quad \text{REF: 081602geo} \quad \text{NAT: G.CO.A.2} \\
\text{TOP: Identifying Transformations} \quad \text{KEY: basic}
362 ANS: 2
\[ V = \frac{1}{3} \cdot 6^2 \cdot 12 = 144 \]

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

363 ANS:

Since the square is inscribed, each vertex of the square is on the circle and the diagonals of the square are diameters of the circle. Therefore, each angle of the square is an inscribed angle in the circle that intercepts the circle at the endpoints of the diameters. Each angle of the square, which is an inscribed angle, measures 90 degrees. Therefore, the measure of the arc intercepted by two adjacent sides of the square is 180 degrees because it is twice the measure of its inscribed angle.

PTS: 4 REF: fall1412geo NAT: G.CO.D.13 TOP: Constructions

364 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

365 ANS: 3 PTS: 2 REF: 061524geo NAT: G.CO.B.7 TOP: Triangle Congruency

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

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

367 ANS:
x represents the distance between the lighthouse and the canoe at 5:00; y represents the distance between the lighthouse and the canoe at 5:05. \[ \tan 6 = \frac{112 - 1.5}{x} \quad \tan(49 + 6) = \frac{112 - 1.5}{y} \]
\[ \frac{1051.3 - 77.4}{5} \approx 195 \]
\[ x \approx 1051.3 \quad y \approx 77.4 \]

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

368 ANS: 4 PTS: 2 REF: 061501geo NAT: G.GMD.B.4 TOP: Rotations of Two-Dimensional Objects
369 ANS:
\[
\frac{360}{6} = 60
\]
PTS: 2 REFl: 081627geo NAT: G.CO.A.3 TOP: Mapping a Polygon onto Itself

370 ANS: 3
\[
\theta = \frac{s}{r} = \frac{2\pi}{10} = \frac{\pi}{5}
\]
PTS: 2 REFl: fall1404geo NAT: G.C.B.5 TOP: Arc Length
KEY: angle

371 ANS: 3
\[
x^2 + 4x + 4 + y^2 - 6y + 9 = 12 + 4 + 9
\]
\[
(x + 2)^2 + (y - 3)^2 = 25
\]
PTS: 2 REFl: 081509geo NAT: G.GPE.A.1 TOP: Equations of Circles
KEY: completing the square

372 ANS: 1
\[
m = \left( -\frac{11 + 5}{2}, \frac{5 + -7}{2} \right) = (-3, -1)
\]
\[
m = \frac{5 - -7}{-11 - 5} = \frac{12}{-16} = -\frac{3}{4} m_{\perp} = \frac{4}{3}
\]
PTS: 2 REFl: 061612geo NAT: G.GPE.B.5 TOP: Parallel and Perpendicular Lines
KEY: perpendicular bisector

373 ANS: 3
\[
\frac{60}{360} \cdot 8^2 \pi = \frac{1}{6} \cdot 64\pi = \frac{32\pi}{3}
\]
PTS: 2 REFl: 061624geo NAT: G.C.B.5 TOP: Sectors

374 ANS: 4
\[
4\sqrt{(-1 - 2)^2 + (2 - 3)^2} = 4\sqrt{10}
\]
PTS: 2 REFl: 081808geo NAT: G.GPE.B.7 TOP: Polygons in the Coordinate Plane

375 ANS: 1
\[
\frac{6}{8} = \frac{9}{12}
\]
PTS: 2 REFl: 011613geo NAT: G.SRT.B.5 TOP: Similarity
KEY: basic
376 ANS:
\[ \tan 47 = \frac{x}{8.5} \]
Cone: \[ V = \frac{1}{3} \pi (8.5)^2 (9.115) \approx 689.6 \]
Cylinder: \[ V = \pi (8.5)^2 (25) \approx 5674.5 \]
Hemisphere:
\[ V = \frac{1}{2} \sqrt[3]{\frac{4}{3} \pi (8.5)^3} \approx 1286.3 \]
\[ 689.6 + 5674.5 + 1286.3 \approx 7650 \]
No, because \[ 7650 \cdot 62.4 = 477,360 \]
\[ 477,360 \cdot 0.85 = 405,756 \], which is greater than 400,000.


377 ANS:
Quadrilateral \( ABCD \) is a parallelogram with diagonals \( AC \) and \( BD \) intersecting at \( E \) (Given). \( \overline{AD} \cong \overline{BC} \) (Opposite sides of a parallelogram are congruent). \( \angle AED \cong \angle CEB \) (Vertical angles are congruent). \( \overline{BC} \parallel \overline{DA} \) (Definition of parallelogram). \( \angle DBC \cong \angle BDA \) (Alternate interior angles are congruent). \( \triangle AED \cong \triangle CEB \) (AAS). 180° rotation of \( \triangle AED \) around point \( E \).

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

378 ANS:
\[ \sin x = \frac{4.5}{11.75} \]
\[ x \approx 23 \]

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

379 ANS:
\[ \frac{40000}{\pi \left( \frac{51}{2} \right)^2} \approx 19.6 \]
\[ \frac{72000}{\pi \left( \frac{75}{2} \right)^2} \approx 16.3 \]
Dish \( A \)

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

380 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

381 ANS: 2
\[ 14 \times 16 \times 10 = 2240 \]
\[ 2240 - 1680 = 0.25 \]
\[ \frac{2240}{2240} = 0.25 \]

PTS: 2 KEY: prisms REF: 011604geo NAT: G.GMD.A.3 TOP: Volume
ANS: 1

PTS: 2

REF: 011608geo

TOP: Compositions of Transformations

KEY: identify

NAT: G.CO.A.5

383 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

384 ANS: 1

PTS: 2

REF: 081507geo

NAT: G.CO.A.5

TOP: Compositions of Transformations

KEY: identify

385 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

386 ANS:

\(\frac{2}{5} \cdot (16 - 1) = 6\)

\(\frac{2}{5} \cdot (14 - 4) = 4\)

\((1 + 6, 4 + 4) = (7, 8)\)

PTS: 2

REF: 081531geo

NAT: G.GPE.B.6

TOP: Directed Line Segments

387 ANS:

\(\frac{120}{230} = \frac{x}{315}\)

\(x = 164\)

PTS: 2

REF: 081527geo

NAT: G.SRT.B.5

TOP: Similarity

KEY: basic

388 ANS:

Reflections are rigid motions that preserve distance.

PTS: 2

REF: 061525geo

NAT: G.CO.A.13

TOP: Constructions

389 ANS:

Reflections are rigid motions that preserve distance.
\[
\frac{1}{2} \left(\frac{4}{3}\right) \pi \cdot 5^3 \cdot 62.4 \approx 16,336
\]

PTS: 2  
REF: 061620geo  
NAT: G.MG.A.2  
TOP: Density

391 ANS: 1
\[x^2 - 4x + 4 + y^2 + 8y + 16 = -11 + 4 + 16\]
\[(x - 2)^2 + (y + 4)^2 = 9\]

PTS: 2  
REF: 081616geo  
NAT: G.GPE.A.1  
TOP: Equations of Circles  
KEY: completing the square

392 ANS: 1
The other statements are true only if \(AD \perp BC\).

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

393 ANS: 4
\[x = -6 + \frac{1}{6}(6 - (-6)) = -6 + 2 = -4\]
\[y = -2 + \frac{1}{6}(7 - (-2)) = -2 + \frac{9}{6} = -\frac{1}{2}\]

KEY: statements

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

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

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

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

KEY: graphics

399 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
400 ANS: 

\[ 180 - 2(30) = 120 \]

PTS: 2  REF: 011626geo  NAT: G.C.A.2  TOP: Chords, Secants and Tangents
KEY: parallel lines

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

402 ANS: 

The length of \( A'C \) is twice \( AC \).

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

403 ANS: 1

Alternate interior angles

PTS: 2  REF: 061517geo  NAT: G.CO.C.9  TOP: Lines and Angles

404 ANS: 1

\[ 3^2 = 9 \]

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

405 ANS:

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

\[ x = 360 \cdot \frac{12}{36} \]

\[ x = 120 \]

PTS: 2  REF: 061529geo  NAT: G.C.B.5  TOP: Sectors

406 ANS: 4  PTS: 2  REF: 061512geo  NAT: G.SRT.C.7
TOP: Cofunctions
\[
\frac{9}{5} = \frac{9.2}{x} \quad 5.1 + 9.2 = 14.3
\]

\[
9x = 46
\]

\[
x \approx 5.1
\]

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

\[
\frac{12}{4} = \frac{x}{5} \quad 15 - 4 = 11
\]

\[
x = 15
\]

**PTS:** 2  
**REF:** 011624geo  
**NAT:** G.SRT.B.5  
**TOP:** Similarity  
**KEY:** basic

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

\[
\sqrt{3.21} = \sqrt{63} = 3\sqrt{7}
\]

**PTS:** 2  
**REF:** 011622geo  
**NAT:** G.SRT.B.5  
**TOP:** Similarity  
**KEY:** altitude

**ANS:** 1  
1) opposite sides; 2) adjacent sides; 3) perpendicular diagonals; 4) diagonal bisects angle

**PTS:** 2  
**REF:** 061609geo  
**NAT:** G.CO.C.11  
**TOP:** Special Quadrilaterals

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

\[
\frac{4}{3} \pi \left( \frac{2.5}{2} \right)^3 \approx 55
\]

**PTS:** 2  
**REF:** 011614geo  
**NAT:** G.GMD.A.3  
**TOP:** Volume  
**KEY:** spheres

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

**ANS:** 4  
**PTS:** 2  
**REF:** 011611geo  
**NAT:** G.CO.B.6  
**TOP:** Properties of Transformations  
**KEY:** graphics

\[
tan 34 = \frac{T}{20}
\]

\[
T \approx 13.5
\]

**PTS:** 2  
**REF:** 061505geo  
**NAT:** G.SRT.C.8  
**TOP:** Using Trigonometry to Find a Side  
**KEY:** graphics
416 ANS: 1
\[
\frac{1000}{20\pi} \approx 15.9
\]
PTS: 2 REF: 011623geo NAT: G.GMD.A.1 TOP: Circumference

417 ANS: 3 PTS: 2 REF: 011605geo NAT: G.CO.A.2
TOP: Analytical Representations of Transformations KEY: basic

418 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

419 ANS: \(ABC \mapsto A'B'C'\) because \(\triangle DEF \cong \triangle A'B'C'\) because \(\triangle DEF\) is a reflection of \(\triangle A'B'C'\) and reflections preserve distance.


420 ANS: \(A(2, -3) - (2, -3) = (0, 0) \rightarrow (0, 0) + (2, -3) = A'(2, -3)\)
\(B(6, -8) - (2, -3) = (4, -5) \rightarrow (5, 4) + (2, -3) = B'(7, 1)\)
\(C(2, -9) - (2, -3) = (0, -6) \rightarrow (6, 0) + (2, -3) = C'(8, -3)\)
\(\triangle A'B'C'\) and reflections preserve distance.

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

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


422 ANS: 1
\[
\frac{f}{4} = \frac{15}{6}
\]
\(f = 10\)

PTS: 2 REF: 061617geo NAT: G.CO.C.9 TOP: Lines and Angles
424 ANS: 4
\[ \frac{7}{12} \cdot 30 = 17.5 \]

PTS: 2  REF: 061521geo  NAT: G.SRT.B.5  TOP: Similarity
KEY: perimeter and area

425 ANS:

\[ \begin{array}{c}
\text{A} \\
\text{B} \\
\text{C} \\
\text{D}
\end{array} \]

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

426 ANS: 2  PTS: 2  REF: 061506geo  NAT: G.GMD.B.4
TOP: Cross-Sections of Three-Dimensional Objects

427 ANS: 2  PTS: 2  REF: 061603geo  NAT: G.GPE.A.1
TOP: Equations of Circles  KEY: find center and radius | completing the square

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

429 ANS: 4
\[ \frac{-2-1}{-1-3} = \frac{3-2}{0-5} = \frac{1}{-5} = \frac{3-1}{0-3} = \frac{2}{3} = \frac{2-2}{5-1} = \frac{4}{6} = \frac{2}{3} \]

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

430 ANS:
\[ \tan 3.47 = \frac{M}{6336} \]
\[ M \approx 384 \]
\[ 4960 + 384 = 5344 \]

\[ \tan 0.64 = \frac{A}{20,493} \]
\[ A \approx 229 \]
\[ 5344 - 229 = 5115 \]

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

431 ANS: 1  PTS: 2  REF: 081606geo  NAT: G.SRT.C.7
TOP: Cofunctions
12

\[ 5 \cdot \frac{10}{4} = \frac{50}{4} = 12.5 \]

PTS: 2  REF: 081512geo  NAT: G.C.A.2  TOP: Chords, Secants and Tangents
KEY: common tangents

433  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

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

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

435  ANS: 1  PTS: 2  REF: 081505geo  NAT: G.CO.A.3
TOP: Mapping a Polygon onto Itself

436  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

437  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
ANS:
The slopes of perpendicular line are opposite reciprocals. Since the lines are perpendicular, they form right angles and a right triangle. 

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

\[ m_\perp = \frac{2}{3} \quad -1 = -2 + b \quad -\frac{12}{3} = \frac{-2}{3} + b \]

\[ 1 = b \quad \frac{-10}{3} = b \]

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

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

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

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

\[ 9.5 = x \]

PTS: 4 REF: 081533geo NAT: G.GPE.B.4 TOP: Triangles in the Coordinate Plane

439 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).

PTS: 6 REF: 081535geo NAT: G.SRT.B.5 TOP: Quadrilateral Proofs

440 ANS:
\[
\tan 52.8 = \frac{h}{x} \quad x \tan 52.8 = x \tan 34.9 + 8 \tan 34.9 \quad \tan 52.8 \approx \frac{h}{9} \quad 11.86 + 1.7 \approx 13.6
\]

\[
h = x \tan 52.8 \quad x \tan 52.8 - x \tan 34.9 = 8 \tan 34.9 \quad x \approx 11.86
\]

\[
\tan 34.9 = \frac{h}{x + 8} \quad x(\tan 52.8 - \tan 34.9) = 8 \tan 34.9
\]

\[
h = (x + 8) \tan 34.9 \quad x = \frac{8 \tan 34.9}{\tan 52.8 - \tan 34.9}
\]

\[
x \approx 9
\]

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

KEY: advanced
\[
\frac{4}{6} = \frac{3}{4.5} = \frac{2}{3}
\]

PTS: 2  REF: 081523geo  NAT: G.SRT.A.2  TOP: Dilations

442 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

443 ANS:
Parallelogram \(ABCD, EFG,\) and diagonal \(DFB\) (given); \(\angle DFE \cong \angle BFG\) (vertical angles); \(\overline{AD} \parallel \overline{CB}\) (opposite sides of a parallelogram are parallel); \(\angle EDF \cong \angle GBF\) (alternate interior angles are congruent); \(\triangle DEF \sim \triangle BGF\) (AA).

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

444 ANS:
Since linear angles are supplementary, \(m \angle GIH = 65^\circ\). Since \(\overline{GH} \cong \overline{IH}\), \(m \angle GHI = 50^\circ\) \((180 - (65 + 65))\). Since \(\angle EGB \cong \angle GHI\), the corresponding angles formed by the transversal and lines are congruent and \(\overline{AB} \parallel \overline{CD}\).

PTS: 4  REF: 061532geo  NAT: G.CO.C.9  TOP: Lines and Angles

445 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

446 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
ANS: 
No, the line \(4x + 3y = 24\) passes through the center of dilation, so the dilated line is not distinct. 
\[4x + 3y = 24\] 
\[3y = -4x + 24\] 
\[y = -\frac{4}{3}x + 8\]

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

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

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

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

ANS: 4 
\[\sqrt{(32 - 8)^2 + (28 - 4)^2} = \sqrt{576 + 1024} = \sqrt{1600} = 40\]

PTS: 2  REF: 081621geo   NAT: G.SRT.A.1  TOP: Line Dilations

ANS: 
Circle \(O\), secant \(ACD\), tangent \(AB\) (Given). Chords \(BC\) and \(BD\) are drawn (Auxiliary lines). \(\angle A \cong \angle A\), \(BC \cong BC\) (Reflexive property). \(m\angle BDC = \frac{1}{2}m\angle BC\) (The measure of an inscribed angle is half the measure of the intercepted arc). \(m\angle CBA = \frac{1}{2}m\angle BC\) (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

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
\[
\frac{16}{9} = \frac{x}{20.6} \quad D = \sqrt{36.6^2 + 20.6^2} \approx 42
\]

\[x \approx 36.6\]

PTS: 4 \hspace{1cm} REF: 011632geo \hspace{1cm} NAT: G.SRT.B.5 \hspace{1cm} TOP: Similarity

454 ANS:

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

PTS: 6 \hspace{1cm} REF: 081536geo \hspace{1cm} NAT: G.MG.A.2 \hspace{1cm} TOP: Density

457 ANS:

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

PTS: 6 \hspace{1cm} REF: spr1414geo \hspace{1cm} NAT: G.CO.B.7 \hspace{1cm} TOP: Triangle Congruency

458 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

PTS: 4 \hspace{1cm} REF: 011633geo \hspace{1cm} NAT: G.CO.C.10 \hspace{1cm} TOP: Triangle Proofs
17

459  ANS: 4
\[
\frac{1}{2} = \frac{x + 3}{3x - 1} \quad GR = 3(7) - 1 = 20
\]
\[3x - 1 = 2x + 6\]
\[x = 7\]

PTS: 2  REF: 011620geo  NAT: G.SRT.B.5  TOP: Similarity
KEY: basic

460  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

461  ANS: 2
\[
\frac{4}{3} \pi \cdot 4^3 + 0.075 = 20
\]

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

462  ANS: 2  PTS: 2  REF: 081519geo  NAT: G.SRT.B.5
TOP: Similarity  KEY: basic

463  ANS: 2

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

464  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

TOP: Compositions of Transformations  KEY: grids

466  ANS: 4
The slope of \( \overline{BC} \) is \( \frac{2}{3} \). Altitude is perpendicular, so its slope is \( \frac{-5}{2} \).

PTS: 2  REF: 061614geo  NAT: G.GPE.B.4  TOP: Triangles in the Coordinate Plane
\[ \Delta XYZ, \overline{XY} \cong \overline{ZY}, \text{ and } \overline{YW} \text{ bisects } \angle XYZ \text{ (Given). } \Delta XYZ \text{ is isosceles (Definition of isosceles triangle). } \overline{YW} \text{ is an altitude of } \Delta XYZ \text{ (The angle bisector of the vertex of an isosceles triangle is also the altitude of that triangle). } \overline{YW} \perp \overline{XZ} \text{ (Definition of altitude). } \angle YWZ \text{ is a right angle (Definition of perpendicular lines).} \]

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

\[ AB = 10 \text{ since } \Delta ABC \text{ is a 6-8-10 triangle. } 6^2 = 10x \]

\[ 3.6 = x \]

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

\[ x^2 = 4 \cdot 10 \]

\[ x = \sqrt{40} \]

\[ x = 2\sqrt{10} \]

PTS: 2  REF: 081610geo  NAT: G.SRT.B.5  TOP: Similarity

KEY: leg

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

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

471 ANS: 4  PTS: 2 REF: 061608geo  NAT: G.SRT.A.2

TOP: Compositions of Transformations  KEY: grids


TOP: Chords, Secants and Tangents  KEY: inscribed
473 ANS:
4x − .07 = 2x + .01 SinA 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

474 ANS:
3/8 · 56 = 21

PTS: 2 REF: 081625geo NAT: G.C.A.2 TOP: Chords, Secants and Tangents

475 ANS: 2 PTS: 2

TOP: Identifying Transformations

KEY: common tangents

476 ANS: 3

\[
x \frac{6}{10} = \frac{4}{4} CD = 15 - 4 = 11
\]

x = 15

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

KEY: basic

477 ANS: 3 PTS: 2

TOP: Identifying Transformations

KEY: graphics

478 ANS:

\[
tan x = \frac{10}{4}
\]

x ≈ 68

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

479 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

481 ANS: 2
\[s^2 + s^2 = 7^2\]
\[2s^2 = 49\]
\[s^2 = 24.5\]
\[s \approx 4.9\]

PTS: 2 REF: 081511geo NAT: G.C.A.3 TOP: Inscribed Quadrilaterals

482 ANS: 2
PTS: 2 REF: 061516geo NAT: G.SRT.A.2

TOP: Dilations

483 ANS:
Opposite angles in a parallelogram are congruent, so \(m\angle O = 118^\circ\). The interior angles of a triangle equal 180°.
\[180 - (118 + 22) = 40.\]


484 ANS: 1
PTS: 2 REF: 061518geo NAT: G.SRT.A.1

TOP: Line Dilations

485 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); \(AE \perp BE\) (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).


486 ANS:
\[\sin 75 = \frac{15}{x}\]
\[x = \frac{15}{\sin 75}\]
\[x \approx 15.5\]

PTS: 2 REF: 081631geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find a Side KEY: graphics

487 ANS: 4
PTS: 2 REF: 081609geo NAT: G.SRT.A.2

TOP: Compositions of Transformations KEY: grids

488 ANS: 4
PTS: 2 REF: 061813geo NAT: G.CO.C.11

TOP: Special Quadrilaterals

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

PTS: 2 REF: 081518geo NAT: G.C.B.5 TOP: Sectors
490 ANS: 
\[ \triangle ABC \sim \triangle DEF \]

PTS: 4     REF: 011634geo     NAT: G.CO.D.12    TOP: Constructions
KEY: congruent and similar figures

491 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

492 ANS: Each quarter in both stacks has the same base area. Therefore, each corresponding cross-section of the stacks will have the same area. Since the two stacks of quarters have the same height of 23 quarters, the two volumes must be the same.

PTS: 2     REF: spr1405geo     NAT: G.GMD.A.1    TOP: Volume

493 ANS: 
\[
\left( \frac{180 - 20}{2} \right) \times \frac{\pi}{2} \times 6^2 = \frac{80}{360} \times 36\pi = 8\pi
\]


494 ANS: 2

\[
\frac{11}{1.2 oz} \left( \frac{16 oz}{1 lb} \right) = \frac{13.31}{lb} \left( \frac{1 g}{3.785 lb} \right) \approx \frac{3.5 g}{1 lb}
\]

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

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

496 ANS: 1     PTS: 2     REF: 081504geo     NAT: G.SRT.C.7
TOP: Cofunctions

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

PTS: 2     REF: 081607geo     NAT: G.CO.C.11    TOP: Parallelograms
498 ANS:
\[
M \left( \frac{4 + 0}{2}, \frac{6 - 1}{2} \right) = M \left( \frac{2 + 5}{2} \right) 
\]
\[
m = \frac{6 - 1}{4 - 0} = \frac{7}{4} \quad m_x = \frac{4}{7} \quad y - 2.5 = -\frac{4}{7}(x - 2)
\]
The diagonals, \(MT\) and \(AH\), of rhombus \(MATH\) are perpendicular bisectors of each other.

PTS: 4
REF: falling141geo
NAT: G.GPE.B.4
TOP: Quadrilaterals in the Coordinate Plane
KEY: grids

499 ANS: 2
\[x = \frac{1}{2} \text{ the circumference.} \quad \frac{C}{2} = \frac{10\pi}{2} \approx 16\]

PTS: 2
REF: 061523geo
NAT: G.GMD.A.1
TOP: Circumference

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

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

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

502 ANS: 1
\[
\frac{360^\circ}{45^\circ} = 8
\]

PTS: 2
REF: 061510geo
NAT: G.CO.A.3
TOP: Mapping a Polygon onto Itself

503 ANS: 2
\[
C = \pi d \quad V = \pi \left( \frac{2.25}{\pi} \right)^2 \cdot 8 \approx 12.8916 \quad W = 12.8916 \cdot 752 \approx 9694
\]
\[
4.5 = \pi d
\]
\[
\frac{4.5}{\pi} = d
\]
\[
\frac{2.25}{\pi} = r
\]

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

504 ANS:
No, the weight of the bricks is greater than 900 kg. \(500 \times (5.1 \text{ cm} \times 10.2 \text{ cm} \times 20.3 \text{ cm}) = 528,003 \text{ cm}^3\). 
\[
528,003 \text{ cm}^3 \times \frac{1 \text{ m}^3}{1000000 \text{ cm}^3} = 0.528003 \text{ m}^3 \quad \frac{1920 \text{ kg}}{\text{m}^3} \times 0.528003 \text{ m}^3 \approx 1013 \text{ kg}
\]

PTS: 2
REF: falling1406geo
NAT: G.MG.A.2
TOP: Density
505 ANS:
$\ell: y = 3x - 4$

$m: y = 3x - 8$

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

506 ANS:
$\pi \cdot \frac{11.25^2 \cdot 33.5}{231} \approx 57.7$

PTS: 4  REF: 011632geo  NAT: G.GMD.A.3  TOP: Volume  KEY: cylinders


508 ANS: 2
\[
\frac{12}{4} = \frac{36}{x}
\]

\[
12x = 144
\]

\[
x = 12
\]

PTS: 2  REF: 011621geo  NAT: G.SRT.B.5  TOP: Side Splitter Theorem

509 ANS:
Similar triangles are required to model and solve a proportion.
\[
\frac{x + 5}{1.5} = \frac{x}{1} - \frac{1}{3} \pi (1.5)^2 (15) - \frac{1}{3} \pi (1)^2 (10) \approx 24.9
\]

\[
x + 5 = 1.5x
\]

\[
5 = 0.5x
\]

\[
10 = x
\]

\[
10 + 5 = 15
\]


510 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

511 ANS:
$\overline{LA} \cong \overline{DN}$, $\overline{CA} \cong \overline{CN}$, 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). $\triangle LAC \cong \triangle DNC$ (HL). $\triangle LAC$ will map onto $\triangle DNC$ after rotating $\triangle LAC$ counterclockwise 90° about point $C$ such that point $L$ maps onto point $D$.

PTS: 4  REF: spr1408geo  NAT: G.CO.B.8  TOP: Triangle Congruency
\[ \frac{3.75}{5} = \frac{4.5}{6} \]

\( AB \) is parallel to \( CD \) because \( AB \) divides the sides proportionately.

\[ 39.375 = 39.375 \]

513 ANS: 2

\[ x^2 + y^2 + 6y + 9 = 7 + 9 \]

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

514 ANS: 4

515 ANS: 1

\[ 180 - (68 \cdot 2) \]

516 ANS: 2

517 ANS: 3

518 ANS:

\[ s = \theta \cdot r \quad s = \theta \cdot r \]

Yes, both angles are equal.

\[ \pi = A \cdot 4 \]

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

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

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

519 ANS: 4
ANS:
Parallelogram $\overline{ANDR}$ 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). $AE = \frac{1}{2} AR$, $WD = \frac{1}{2} DN$, 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). $RE = \frac{1}{2} AR$, $NW = \frac{1}{2} DN$, 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).

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).

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).

ANS: 3
\[
\frac{AB}{BC} = \frac{DE}{EF}
\]
\[
\frac{9}{15} = \frac{6}{10}
\]
\[
90 = 90
\]

ANS: 3
\[
\sqrt{20^2 - 10^2} \approx 17.3
\]

ANS:
\[
\frac{137.8}{6^3} \approx 0.638 \text{ Ash}
\]

ANS: 3
\[
\frac{\text{Area}}{\text{Volume}} = 3
\]
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

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.

PTS: 2  REF: spr1402geo  NAT: G.CO.A.3  TOP: Mapping a Polygon onto Itself

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

$\triangle MNO$ is congruent to $\triangle PNO$ by SAS. Since $\triangle MNO \cong \triangle PNO$, then $\overline{MO} \cong \overline{PO}$ by CPCTC. So $\overline{NO}$ must divide $\overline{MP}$ in half, and $MO = 8$.

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

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

\[ 333.65 \times 50 = 16682.7 \text{ cm}^3 \]

\[ 16682.7 \times 0.697 = 11627.8 \text{ g} \]

\[ 11.6278 \times 3.83 = $44.53 \]

534 ANS:

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

\[ 333.65 \times 50 = 16682.7 \text{ cm}^3 \]

\[ 16682.7 \times 0.697 = 11627.8 \text{ g} \]

\[ 11.6278 \times 3.83 = $44.53 \]

535 ANS: 3

536 ANS: 4

\[ m = -\frac{1}{2} \]

\[ -4 = 2(6) + b \]

\[ m_1 = 2 \]

\[ -4 = 12 + b \]

\[ -16 = b \]

537 ANS: 1

\[ m_{TA} = -1 \]

\[ y = mx + b \]

\[ m_{EM} = 1 \]

\[ 1 = 1(2) + b \]

\[ -1 = b \]
Since the slopes of $TS$ and $SR$ are opposite reciprocals, they are perpendicular and form a right angle. $\triangle RST$ is a right triangle because $\angle S$ is a right angle. $P(0,9) \quad m_{PR} = \frac{-10}{6} = \frac{5}{3} \quad m_{PT} = \frac{3}{5} \quad m_{TS} = \frac{-10}{6} \quad m_{SR} = \frac{3}{5}$ Since the slopes of all four adjacent sides ($TS$, $SR$, $RP$, $PT$, and $TS$, $RP$, $PT$) are opposite reciprocals, they are perpendicular and form right angles. Quadrilateral $RSTP$ is a rectangle because it has four right angles.

$\sin 70 = \frac{30}{L}$

$L \approx 32$

$\frac{x}{360} \cdot 3^2 \pi = 2\pi 
180 - 80 = 100
x = 80 \frac{180 - 100}{2} = 40$
544 ANS: 3  PTS: 2  REF: 081613geo  NAT: G.GMD.B.4  TOP: Cross-Sections of Three-Dimensional Objects

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

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

545 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

546 ANS: 1

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

547 ANS:

\[
\begin{align*}
-6 + \frac{2}{5} (4 - 6) & \quad -5 + \frac{2}{5} (0 - 5) \quad (-2, -3) \\
-6 + \frac{2}{5} (10) & \quad -5 + \frac{2}{5} (5) \\
-6 + 4 & \quad -5 + 2 \\
-2 & \quad -3
\end{align*}
\]
549 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

550 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

551 ANS:

\[
\begin{align*}
A &= \frac{1}{2}ab \\
3 - 6 &= -3 = x \\
24 &= \frac{1}{2}a(8) \\
24 &= \frac{4 + 12}{2} = 8 = y \\
a &= 6
\end{align*}
\]

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

552 ANS: 3
\[ \tan x = \frac{12}{75} \quad \tan y = \frac{72}{75} \quad 43.83 - 9.09 \approx 34.7 \]
\[ x \approx 9.09 \quad y \approx 43.83 \]

PTS: 2 REF: 081615geo NAT: G.GPE.B.7 TOP: Polygons in the Coordinate Plane

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

PTS: 4 REF: 081634geo NAT: G.SRT.C.8 TOP: Using Trigonometry to Find an Angle

554 ANS: 1 PTS: 2 REF: 011606geo NAT: G.CO.C.9 TOP: Lines and Angles
555 ANS:

PTS: 2 REF: 081628geo NAT: G.CO.D.12 TOP: Constructions
KEY: line bisector

556 ANS:
Translations preserve distance. If point $D$ is mapped onto point $A$, point $F$ would map onto point $C$. $	riangle DEF \cong \triangle ABC$ as $AC \cong DF$ and points are collinear on line $\ell$ and a reflection preserves distance.

PTS: 4 REF: 081534geo NAT: G.CO.B.7 TOP: Triangle Congruency

557 ANS:

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

558 ANS: 4
$3 \times 6 = 18$

PTS: 2 REF: 061602geo NAT: G.SRT.A.1 TOP: Line Dilations

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

PTS: 2 REF: 081510geo NAT: G.GPE.B.5 TOP: Parallel and Perpendicular Lines
KEY: write equation of parallel line
\[ \tan 7 = \frac{125}{x} \quad \tan 16 = \frac{125}{y} \quad 1018 - 436 \approx 582 \]

\[ x \approx 1018 \quad y \approx 436 \]

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