1. 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

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

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

3. On the set of axes below, $\triangle ABC$ has vertices at $A(-2,0)$, $B(2,-4)$, $C(4,2)$, and $\triangle DEF$ has vertices at $D(4,0)$, $E(-4,8)$, $F(-8,-4)$.

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

5. 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.

6. 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
7. 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

8. 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) $\frac{AB}{AC} = \frac{RS}{RT}$

9. 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
10. 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  3) 20
2) 16  4) 25

11. 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

12. 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.

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

14. 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) $72^\circ$  3) $144^\circ$
2) $120^\circ$  4) $180^\circ$

15. 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) $(2, 1)$  3) $(5, 5)$
2) $\left(\frac{5}{3}, 0\right)$  4) $\left(\frac{23}{3}, 8\right)$
16  In the diagram below of triangle $ABC$, $\overline{AC}$ is extended through point $C$ to point $D$, and $\overline{BE}$ is drawn to $\overline{AC}$.

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) $\angle 7 = \angle 3 + \angle 2$

17  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) $\tan A = \frac{15}{8}$
18 Francisco needs the three pieces of glass shown below to complete a stained glass window. The shapes, two triangles and a trapezoid, are measured in inches.

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

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

19 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}

20 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) \(x^2 + 2x + y^2 + 8y = 83\)
21 On the set of axes below, $\triangle ABC$, altitude $\overline{CG}$, and median $\overline{CM}$ 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) $\frac{(GC)(AB)}{2}$

22 In right triangle $ABC$, $\angle C = 90^\circ$ and $AC \neq BC$. Which trigonometric ratio is equivalent to $\sin B$?

1) $\cos A$

2) $\cos B$

3) $\tan A$

4) $\tan B$

23 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$\pi$

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

25 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).
26  Parallelogram $ABCD$ is adjacent to rhombus $DEFG$, as shown below, and $\overline{FC}$ intersects $\overline{AGD}$ at $H$.

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

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

If $\angle RPS = 35^\circ$ and $\overarc{RS} = 121^\circ$, determine and state $\overarc{WT}$. 
28 On the set of axes below, \( \triangle ABC \) is graphed with coordinates \( A(-2,-1), B(3,-1), \) and \( C(-2,-4) \). Triangle \( QRS \), the image of \( \triangle ABC \), is graphed with coordinates \( Q(-5,2), R(-5,7), \) and \( S(-8,2) \).

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

29 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.]
30 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.

31 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.
32 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.]

33 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. [1ft$^3$ water = 7.48 gallons]

34 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°, 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.
35 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: $EF \cong GH$
0119geo

Answer Section

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

PTS: 2 \hspace{1em} REF: 011901geo \hspace{1em} NAT: G.SRT.A.1 \hspace{1em} TOP: Line Dilations

2 \[ 2x - 1 = 16 \]

\[ x = 8.5 \]

PTS: 2 \hspace{1em} REF: 011902geo \hspace{1em} NAT: G.CO.B.6 \hspace{1em} TOP: Properties of Transformations

KEY: graphics

3 \[ 3 \]

PTS: 2 \hspace{1em} REF: 011903geo \hspace{1em} NAT: G.CO.A.5 \hspace{1em} TOP: Compositions of Transformations

KEY: identify

4 \[ 4 \]

PTS: 2 \hspace{1em} REF: 011904geo \hspace{1em} NAT: G.CO.A.3 \hspace{1em} TOP: Mapping a Polygon onto Itself

5 \[ 5 \]

PTS: 2 \hspace{1em} REF: 011905geo \hspace{1em} NAT: G.C.A.2

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

\[ x = 6.25 \]

PTS: 2 \hspace{1em} REF: 011906geo \hspace{1em} NAT: G.SRT.B.5 \hspace{1em} TOP: Side Splitter Theorem

7 \[ \sqrt{8^2 + 6^2} = 10 \text{ for one side} \]

PTS: 2 \hspace{1em} REF: 011907geo \hspace{1em} NAT: G.CO.C.11 \hspace{1em} TOP: Special Quadrilaterals

8 \[ \triangle ABC \sim \triangle RST \]

PTS: 2 \hspace{1em} REF: 011908geo \hspace{1em} NAT: G.SRT.B.5 \hspace{1em} TOP: Similarity

KEY: basic

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

PTS: 2 \hspace{1em} REF: 011909geo \hspace{1em} NAT: G.GMD.A.3 \hspace{1em} TOP: Volume

KEY: compositions
10 ANS: 3
\[ 12^2 = 9 \cdot GM \quad IM^2 = 16 \cdot 25 \]
\[ GM = 16 \quad IM = 20 \]

PTS: 2 \hspace{1em} REF: 011910geo \hspace{1em} NAT: G.SRT.B.5 \hspace{1em} TOP: Similarity

11 ANS: 3

TOP: Rotations of Two-Dimensional Objects

12 ANS: 2

TOP: Parallelograms

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

PTS: 2 \hspace{1em} REF: 011913geo \hspace{1em} NAT: G.SRT.C.8 \hspace{1em} TOP: Using Trigonometry to Find a Side

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

PTS: 2 \hspace{1em} REF: 011914geo \hspace{1em} NAT: G.C.B.5 \hspace{1em} TOP: Sectors

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

PTS: 2 \hspace{1em} REF: 011915geo \hspace{1em} NAT: G.GPE.B.6 \hspace{1em} TOP: Directed Line Segments

16 ANS: 4

TOP: Exterior Angle Theorem

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

PTS: 2 \hspace{1em} REF: 011917geo \hspace{1em} NAT: G.SRT.C.8 \hspace{1em} TOP: Using Trigonometry to Find an Angle

18 ANS: 1

TOP: Compositions of Polygons and Circles

19 ANS: 3
\[ \angle N \text{ is the smallest angle in } \triangle NYA, \text{ so side } \overline{AY} \text{ is the shortest side of } \triangle NYA. \]
\[ \angle VYA \text{ is the smallest angle in } \triangle VYA, \text{ so side } \overline{VA} \text{ is the shortest side of both triangles.} \]

PTS: 2 \hspace{1em} REF: 011919geo \hspace{1em} NAT: G.CO.C.10 \hspace{1em} TOP: Angle Side Relationship
20 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

21 ANS: 4 PTS: 2 REF: 011921geo NAT: G.GPE.B.4

TOP: Triangles in the Coordinate Plane

22 ANS: 1 PTS: 2 REF: 011922geo NAT: G.SRT.C.7

TOP: Cofunctions

23 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

24 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, \(\left(0, \frac{3}{4}, -4, \frac{3}{4}\right) \rightarrow (0, -3)\). 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

25 ANS:

\[3y + 7 = 2x\]

\[y - 6 = \frac{2}{3}(x - 2)\]

\[3y = 2x - 7\]

\[y = \frac{2}{3}x - \frac{7}{3}\]

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

KEY: write equation of parallel line
26 ANS:

\[ \begin{align*}
\angle BAC & = 20^\circ \\
\end{align*} \]


27 ANS:

\[ \begin{align*}
121 - x &= 35 \\
121 - x &= 70 \\
x &= 51
\end{align*} \]

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

28 ANS:

\[ \begin{align*}
R_{(-5,2),90^\circ} & \ T_{-3,1} \ r_{x-axis}\end{align*} \]

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

29 ANS:

\[ \begin{align*}
\end{align*} \]

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

30 ANS:

No. The midpoint of \( \overline{DF} \) is \( \left( \frac{1+4}{2}, \frac{-1+2}{2} \right) = (2.5,0.5) \). A median from point \( E \) must pass through the midpoint.

PTS: 2 REF: 011930geo NAT: G.GPE.B.4 TOP: Triangles in the Coordinate Plane

31 ANS:

\[ \begin{align*}
2 \times (90 \times 10) + \pi (30^2) - \pi (20^2) & \approx 3371
\end{align*} \]

PTS: 2 REF: 011931geo NAT: G.MG.A.3 TOP: Compositions of Polygons and Circles
KEY: area
Triangle with vertices $A(-2,4), B(6,2)$, and $C(1,-1)$ (given); $m_{\overline{AC}} = \frac{5}{3}, m_{\overline{BC}} = \frac{3}{5}$, 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); $\overline{AC} \cong \overline{BC} = \sqrt{34}$ (distance formula); $\triangle ABC$ is an isosceles triangle (an isosceles triangle has two congruent sides).

33 ANS:

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

34 ANS:

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

$x \approx 18.1, x \approx 18$

35 ANS:

Quadrilateral $ABCD$ with diagonal $\overline{AC}$, segments $GH$ and $EF$, $\overline{AE} \cong \overline{CG}, \overline{BE} \cong \overline{DG}, \overline{AH} \cong \overline{CF}$, and $\overline{AD} \cong \overline{CB}$ (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).