Introduction - Geometry

The following released test questions are taken from the Geometry Standards Test. This test is one of the California Standards Tests administered as part of the Standardized Testing and Reporting (STAR) Program under policies set by the State Board of Education.

All questions on the California Standards Tests are evaluated by committees of content experts, including teachers and administrators, to ensure their appropriateness for measuring the California academic content standards in Geometry. In addition to content, all items are reviewed and approved to ensure their adherence to the principles of fairness and to ensure no bias exists with respect to characteristics such as gender, ethnicity, and language.

This document contains released test questions from the California Standards Test forms in 2003, 2004, 2005, 2006, 2007, and 2008. First on the pages that follow are lists of the standards assessed on the Geometry Test. Next are released test questions. Following the questions is a table that gives the correct answer for each question, the content standard that each question is measuring, and the year each question last appeared on the test.

The following table lists each reporting cluster, the number of items that appear on the exam, and the number of released test questions that appear in this document. Some of the released test questions for Geometry are the same test questions found in different combinations on the Integrated Mathematics 1, 2, and 3 California Standards Tests and the Summative High School Mathematics California Standards Test.

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<td>65</td>
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In selecting test questions for release, three criteria are used: (1) the questions adequately cover a selection of the academic content standards assessed on the Geometry Test; (2) the questions demonstrate a range of difficulty; and (3) the questions present a variety of ways standards can be assessed. These released test questions do not reflect all of the ways the standards may be assessed. Released test questions will not appear on future tests.

For more information about the California Standards Tests, visit the California Department of Education’s Web site at http://www.cde.ca.gov/ta/tg/sr/resources.asp.
THE LOGIC AND GEOMETRIC PROOFS REPORTING CLUSTER

The following seven California content standards are included in the Logic and Geometric Proofs reporting cluster and are represented in this booklet by 32 test questions. These questions represent only some ways in which these standards may be assessed on the Geometry California Mathematics Standards Test.

CALIFORNIA CONTENT STANDARDS IN THIS REPORTING CLUSTER

<table>
<thead>
<tr>
<th>Geometry</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>GE1.0*</td>
<td>Students demonstrate understanding by identifying and giving examples of undefined terms, axioms, theorems, and inductive and deductive reasoning.</td>
</tr>
<tr>
<td>GE2.0*</td>
<td>Students write geometric proofs, including proofs by contradiction.</td>
</tr>
<tr>
<td>GE3.0*</td>
<td>Students construct and judge the validity of a logical argument and give counterexamples to disprove a statement.</td>
</tr>
<tr>
<td>GE4.0*</td>
<td>Students prove basic theorems involving congruence and similarity.</td>
</tr>
<tr>
<td>GE5.0</td>
<td>Students prove that triangles are congruent or similar, and they are able to use the concept of corresponding parts of congruent triangles.</td>
</tr>
<tr>
<td>GE6.0</td>
<td>Students know and are able to use the triangle inequality theorem.</td>
</tr>
<tr>
<td>GE7.0*</td>
<td>Students prove and use theorems involving the properties of parallel lines cut by a transversal, the properties of quadrilaterals, and the properties of circles.</td>
</tr>
</tbody>
</table>

* Denotes key standards
THE VOLUME AND AREA FORMULAS REPORTING CLUSTER

The following four California content standards are included in the Volume and Area Formulas reporting cluster and are represented in this booklet by 17 test questions. These questions represent only some ways in which these standards may be assessed on the Geometry California Mathematics Standards Test.

CALIFORNIA CONTENT STANDARDS IN THIS REPORTING CLUSTER

<table>
<thead>
<tr>
<th>Geometry</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE8.0*</td>
<td>Students know, derive, and solve problems involving perimeter, circumference, area, volume, lateral area, and surface area of common geometric figures.</td>
</tr>
<tr>
<td>GE9.0</td>
<td>Students compute the volumes and surface areas of prisms, pyramids, cylinders, cones, and spheres; and students commit to memory the formulas for prisms, pyramids, and cylinders.</td>
</tr>
<tr>
<td>GE10.0*</td>
<td>Students compute areas of polygons, including rectangles, scalene triangles, equilateral triangles, rhombi, parallelograms, and trapezoids.</td>
</tr>
<tr>
<td>GE11.0</td>
<td>Students determine how changes in dimensions affect the perimeter, area, and volume of common geometric figures and solids.</td>
</tr>
</tbody>
</table>

* Denotes key standards
THE ANGLE RELATIONSHIPS, CONSTRUCTIONS, AND LINES REPORTING CLUSTER

The following six California content standards are included in the Angle Relationships, Constructions, and Lines reporting cluster and are represented in this booklet by 24 test questions. These questions represent only some ways in which these standards may be assessed on the Geometry California Mathematics Standards Test.

CALIFORNIA CONTENT STANDARDS IN THIS REPORTING CLUSTER

<table>
<thead>
<tr>
<th>Geometry</th>
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</thead>
<tbody>
<tr>
<td>GE12.0*</td>
</tr>
<tr>
<td>GE13.0</td>
</tr>
<tr>
<td>GE14.0*</td>
</tr>
<tr>
<td>GE15.0</td>
</tr>
<tr>
<td>GE16.0*</td>
</tr>
<tr>
<td>GE17.0*</td>
</tr>
</tbody>
</table>

* Denotes key standards

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THE TRIGONOMETRY REPORTING CLUSTER

The following five California content standards are included in the Trigonometry reporting cluster and are represented in this booklet by 23 test questions. These questions represent only some ways in which these standards may be assessed on the Geometry California Mathematics Standards Test.

CALIFORNIA CONTENT STANDARDS IN THIS REPORTING CLUSTER

<table>
<thead>
<tr>
<th>Geometry</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE18.0*</td>
<td>Students know the definitions of the basic trigonometric functions defined by the angles of a right triangle. They also know and are able to use elementary relationships between them. For example, ( \tan(x) = \frac{\sin(x)}{\cos(x)} ), ( (\sin(x))^2 + (\cos(x))^2 = 1 ).</td>
</tr>
<tr>
<td>GE19.0*</td>
<td>Students use trigonometric functions to solve for an unknown length of a side of a right triangle, given an angle and a length of a side.</td>
</tr>
<tr>
<td>GE20.0</td>
<td>Students know and are able to use angle and side relationships in problems with special right triangles, such as 30°, 60°, and 90° triangles and 45°, 45°, and 90° triangles.</td>
</tr>
<tr>
<td>GE21.0*</td>
<td>Students prove and solve problems regarding relationships among chords, secants, tangents, inscribed angles, and inscribed and circumscribed polygons of circles.</td>
</tr>
<tr>
<td>GE22.0*</td>
<td>Students know the effect of rigid motions on figures in the coordinate plane and space, including rotations, translations, and reflections.</td>
</tr>
</tbody>
</table>

* Denotes key standards
1 Which of the following best describes deductive reasoning?
A using logic to draw conclusions based on accepted statements
B accepting the meaning of a term without definition
C defining mathematical terms to correspond with physical objects
D inferring a general truth by examining a number of specific examples

2 In the diagram below, \( \angle 1 \cong \angle 4 \).

\[ \text{Diagram} \]

Which of the following conclusions does not have to be true?
A \( \angle 3 \) and \( \angle 4 \) are supplementary angles.
B Line \( l \) is parallel to line \( m \).
C \( \angle 1 \cong \angle 3 \)
D \( \angle 2 \cong \angle 3 \)

3 Consider the arguments below.
I. Every multiple of 4 is even. 376 is a multiple of 4. Therefore, 376 is even.
II. A number can be written as a repeating decimal if it is rational. Pi cannot be written as a repeating decimal. Therefore, pi is not rational.

Which one(s), if any, use deductive reasoning?
A I only
B II only
C both I and II
D neither I nor II

4 Theorem: A triangle has at most one obtuse angle.

Eduardo is proving the theorem above by contradiction. He began by assuming that in \( \triangle ABC \), \( \angle A \) and \( \angle B \) are both obtuse. Which theorem will Eduardo use to reach a contradiction?
A If two angles of a triangle are equal, the sides opposite the angles are equal.
B If two supplementary angles are equal, the angles each measure 90°.
C The largest angle in a triangle is opposite the longest side.
D The sum of the measures of the angles of a triangle is 180°.
5 Use the proof to answer the question below.

Given: \(AB \cong BC\); \(D\) is the midpoint of \(AC\)
Prove: \(\triangle ABD \cong \triangle CBD\)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (AB \cong BC); (D) is the midpoint of (AC)</td>
<td>1. Given</td>
</tr>
<tr>
<td>2. (AD \cong CD)</td>
<td>2. Definition of Midpoint</td>
</tr>
<tr>
<td>3. (BD \cong BD)</td>
<td>3. Reflexive Property</td>
</tr>
<tr>
<td>4. (\triangle ABD \cong \triangle CBD)</td>
<td>4. ?</td>
</tr>
</tbody>
</table>

What reason can be used to prove that the triangles are congruent?

A AAS
B ASA
C SAS
D SSS
6 In the figure below, \( AB > BC \).

If we assume that \( m\angle A = m\angle C \), it follows that \( AB = BC \). This contradicts the given statement that \( AB > BC \). What conclusion can be drawn from this contradiction?

A \( m\angle A = m\angle B \)

B \( m\angle A \neq m\angle B \)

C \( m\angle A = m\angle C \)

D \( m\angle A \neq m\angle C \)
Use the proof to answer the question below.

Given: \( \angle 2 \cong \angle 3 \)
Prove: \( \angle 1 \cong \angle 4 \)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ( \angle 2 \cong \angle 3 )</td>
<td>1. Given</td>
</tr>
<tr>
<td>2. ( \angle 1 \cong \angle 2; \angle 3 \cong \angle 4 )</td>
<td>2. ?</td>
</tr>
<tr>
<td>3. ( \angle 1 \cong \angle 4 )</td>
<td>3. Transitive Property</td>
</tr>
</tbody>
</table>

What reason can be used to justify statement 2?

A. Complements of congruent angles are congruent.
B. Vertical angles are congruent.
C. Supplements of congruent angles are congruent.
D. Corresponding angles are congruent.
8. “Two lines in a plane always intersect in exactly one point.”

Which of the following best describes a counterexample to the assertion above?

A. coplanar lines
B. parallel lines
C. perpendicular lines
D. intersecting lines

9. Which figure can serve as a counterexample to the conjecture below?

If one pair of opposite sides of a quadrilateral is parallel, then the quadrilateral is a parallelogram.

A. rectangle
B. rhombus
C. square
D. trapezoid

10. Given: TRAP is an isosceles trapezoid with diagonals RP and TA. Which of the following must be true?

A. \( RP \perp TA \)
B. \( RP \parallel TA \)
C. \( RP \cong TA \)
D. \( RP \) bisects \( TA \)

11. A conditional statement is shown below.

If a quadrilateral has perpendicular diagonals, then it is a rhombus.

Which of the following is a counterexample to the statement above?

A
B
C
D
12 Students in a class rewrote theorems in their own words. One student wrote the following statement.

The area of a parallelogram is the product of any base ($b$) and any height ($h$).

Which figure shows a counterexample to prove the statement false?

A

B

C

D

13 Which triangles must be similar?

A two obtuse triangles
B two scalene triangles with congruent bases
C two right triangles
D two isosceles triangles with congruent vertex angles

14 Which of the following facts would be sufficient to prove that triangles $ABC$ and $DBE$ are similar?

A $CE$ and $BE$ are congruent.
B $\angle ACE$ is a right angle.
C $\overline{AC}$ and $\overline{DE}$ are parallel.
D $\angle A$ and $\angle B$ are congruent.
15 Parallelogram $ABCD$ is shown below.

Which pair of triangles can be established to be congruent to prove that $\angle DAB \cong \angle BCD$?

A $\triangle ADC$ and $\triangle BCD$
B $\triangle AED$ and $\triangle BEC$
C $\triangle DAB$ and $\triangle BCD$
D $\triangle DEC$ and $\triangle BEA$

16 If $\triangle ABC$ and $\triangle XYZ$ are two triangles such that $\frac{AB}{XY} = \frac{BC}{YZ}$, which of the following would be sufficient to prove the triangles are similar?

A $\angle A \cong \angle X$
B $\angle B \cong \angle Y$
C $\angle C \cong \angle Z$
D $\angle X \cong \angle Y$

17 In parallelogram $FGHI$, diagonals $\overline{FG}$ and $\overline{HI}$ are drawn and intersect at point $M$. Which of the following statements must be true?

A $\triangle FGI$ must be an obtuse triangle.
B $\triangle HIG$ must be an acute triangle.
C $\triangle FMG$ must be congruent to $\triangle HMG$.
D $\triangle GMH$ must be congruent to $\triangle IMF$.

18 Which of the following best describes the triangles shown below?

A both similar and congruent
B similar but not congruent
C congruent but not similar
D neither similar nor congruent
19. Which of the following statements must be true if \( \triangle GHI \sim \triangle JKL \)?

A. The two triangles must be scalene.
B. The two triangles must have exactly one acute angle.
C. At least one of the sides of the two triangles must be parallel.
D. The corresponding sides of the two triangles must be proportional.

20. Which method listed below could not be used to prove that two triangles are congruent?

A. Prove all three sets of corresponding sides congruent.
B. Prove all three sets of corresponding angles congruent.
C. Prove that two sides and an included angle of one triangle are congruent to two sides and an included angle of the other triangle.
D. Prove that two angles and an included side of one triangle are congruent to two angles and an included side of the other triangle.

21. In the figure below, \( \overline{AC} \cong \overline{DF} \) and \( \angle A \cong \angle D \).

Which additional information would be enough to prove that \( \triangle ABC \cong \triangle DEF \)?

A. \( \overline{AB} \cong \overline{DE} \)
B. \( \overline{AB} \cong \overline{BC} \)
C. \( \overline{BC} \cong \overline{EF} \)
D. \( \overline{BC} \cong \overline{DE} \)
22. Given: $AB$ and $CD$ intersect at point $E$; \[ \angle 1 \cong \angle 2 \]

Which theorem or postulate can be used to prove $\triangle AED \sim \triangle BEC$?

A. AA
B. SSS
C. ASA
D. SAS

23. Given: $E$ is the midpoint of $CD$; \( \angle C \cong \angle D \)

Which of the following statements must be true?

A. $\angle A \cong \angle D$
B. $\angle B \cong \angle C$
C. $\overline{CE} \cong \overline{BE}$
D. $\overline{AC} \cong \overline{BD}$

24. In the figure below, $n$ is a whole number. What is the smallest possible value for $n$?

A. 1
B. 7
C. 8
D. 14

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25 Which of the following sets of numbers could represent the lengths of the sides of a triangle?

A  2, 2, 5
B  3, 3, 5
C  4, 4, 8
D  5, 5, 15

26 In the accompanying diagram, parallel lines \( l \) and \( m \) are cut by transversal \( t \).

\[ t \]
\[ \begin{array}{c}
1 \\
2 \\
m \\
l
\end{array} \]

Which statement about angles 1 and 2 must be true?

A  \( \angle 1 \cong \angle 2 \).
B  \( \angle 1 \) is the complement of \( \angle 2 \).
C  \( \angle 1 \) is the supplement of \( \angle 2 \).
D  \( \angle 1 \) and \( \angle 2 \) are right angles.

27 What values of \( a \) and \( b \) make quadrilateral \( MNOP \) a parallelogram?

A  \( a = 1, b = 5 \)
B  \( a = 5, b = 1 \)
C  \( a = \frac{11}{7}, b = \frac{34}{7} \)
D  \( a = \frac{34}{7}, b = \frac{11}{7} \)

28 Quadrilateral \( ABCD \) is a parallelogram. If adjacent angles are congruent, which statement must be true?

A  Quadrilateral \( ABCD \) is a square.
B  Quadrilateral \( ABCD \) is a rhombus.
C  Quadrilateral \( ABCD \) is a rectangle.
D  Quadrilateral \( ABCD \) is an isosceles trapezoid.
29 For the quadrilateral shown below, what is \( m\angle a + m\angle c \)?

\[
\begin{align*}
B & \quad 95^\circ \\
C & \quad \angle c^\circ \\
A & \quad a^\circ \\
D & \quad 32^\circ
\end{align*}
\]

A 53°  
B 137°  
C 180°  
D 233°

30 If \( ABCD \) is a parallelogram, what is the length of segment \( BD \)?

\[
\begin{align*}
A & \quad 7 \\
B & \quad 5 \\
C & \quad 6 \\
D & \quad 10
\end{align*}
\]

A 10  
B 11  
C 12  
D 14

31 The diameter of a circle is 12 meters. If point \( P \) is in the same plane as the circle, and is 6 meters from the center of the circle, which best describes the location of point \( P \)?

A Point \( P \) must be on the circle.  
B Point \( P \) must be inside the circle.  
C Point \( P \) may be either outside the circle or on the circle.  
D Point \( P \) may be either inside the circle or on the circle.

32 Given:
\[
\begin{align*}
p & \parallel q; \\
m & \parallel n; \\
m\angle 1 & = 75^\circ
\end{align*}
\]

What is \( m\angle 2 \)?

A 15°  
B 75°  
C 90°  
D 105°
33. A right circular cone has radius 5 inches and height 8 inches.

What is the lateral area of the cone? (Lateral area of cone = \( \pi rl \), where \( l \) = slant height)

A. \( 40\pi \) sq in.
B. \( 445\pi \) sq in.
C. \( 5\pi \sqrt{39} \) sq in.
D. \( 5\pi \sqrt{89} \) sq in.

34. Figure \( ABCD \) is a kite.

What is the area of figure \( ABCD \), in square centimeters?

A. 120
B. 154
C. 168
D. 336

35. If a cylindrical barrel measures 22 inches in diameter, how many inches will it roll in 8 revolutions along a smooth surface?

A. \( 121\pi \) in.
B. \( 168\pi \) in.
C. \( 176\pi \) in.
D. \( 228\pi \) in.
36. A sewing club is making a quilt consisting of 25 squares with each side of the square measuring 30 centimeters. If the quilt has five rows and five columns, what is the perimeter of the quilt?

A 150 cm  
B 300 cm  
C 600 cm  
D 900 cm

37. The minute hand of a clock is 5 inches long. What is the area of the circle, in square inches, created as the hand sweeps an hour?

A $10\pi$  
B $20\pi$  
C $25\pi$  
D $100\pi$

38. The four sides of this figure will be folded up and taped to make an open box.

What will be the volume of the box?

A 50 cm$^3$  
B 75 cm$^3$  
C 100 cm$^3$  
D 125 cm$^3$
39 A classroom globe has a diameter of 18 inches.

Which of the following is the approximate surface area, in square inches, of the globe? \((\text{Surface Area} = 4\pi r^2)\)

A 113.0  
B 226.1  
C 254.3  
D 1017.4

40 Vik is constructing a spherical model of Earth for his science fair project. His model has a radius of 24 inches. Since roughly 75% of Earth’s surface is covered by water, he wanted to paint 75% of his model blue to illustrate this fact. Approximately how many square inches on his model will be painted blue? \((\text{Surface Area} = 4\pi r^2)\)

A 5426  
B 7235  
C 43,407  
D 57,877

41 The rectangle shown below has length 20 meters and width 10 meters.

If four triangles are removed from the rectangle as shown, what will be the area of the remaining figure?

A 136 m²  
B 144 m²  
C 168 m²  
D 184 m²

42 If \(\triangle WXT\) is a rhombus, what is the area of \(\triangle WXT\)?

A \(18\sqrt{3}\)  
B \(36\sqrt{3}\)  
C 36  
D 48
43. What is the area, in square units, of the trapezoid shown below?

![Trapezoid Diagram]

A. 37.5
B. 42.5
C. 50
D. 100

44. The figure below is a square with four congruent parallelograms inside.

![Parallelogram Diagram]

What is the area, in square units, of the shaded portion?

A. 60
B. 84
C. 114
D. 129

45. What is the area, in square meters (m), of the trapezoid shown below?

![Trapezoid Diagram (meters)]

A. 28
B. 36
C. 48
D. 72

46. What is the area, in square inches (in.), of the triangle below?

![Triangle Diagram]

A. 25
B. $25\sqrt{3}$
C. 50
D. $50\sqrt{3}$
47. What is the area, in square centimeters, of rhombus $RSTV$ if $RT = 16$ cm and $SV = 12$ cm?

A 40  
B 48  
C 96  
D 192

48. The perimeters of two squares are in a ratio of 4 to 9. What is the ratio between the areas of the two squares?

A 2 to 3  
B 4 to 9  
C 16 to 27  
D 16 to 81

49. Lea made two candles in the shape of right rectangular prisms. The first candle is 15 cm high, 8 cm long, and 8 cm wide. The second candle is 5 cm higher but has the same length and width. How much additional wax was needed to make the taller candle?

A $320\text{ cm}^3$  
B $640\text{ cm}^3$  
C $960\text{ cm}^3$  
D $1280\text{ cm}^3$

50. Two angles of a triangle have measures of 55° and 65°. Which of the following could not be a measure of an exterior angle of the triangle?

A 115°  
B 120°  
C 125°  
D 130°

51. The sum of the interior angles of a polygon is the same as the sum of its exterior angles. What type of polygon is it?

A quadrilateral  
B hexagon  
C octagon  
D decagon
52 What is $m\angle x$?

A 35°  
B 60°  
C 85°  
D 95°

53 If the measure of an exterior angle of a regular polygon is 120°, how many sides does the polygon have?

A 3  
B 4  
C 5  
D 6

54 In the figure below, $AB \parallel CD$.

What is the value of $x$?

A 40  
B 50  
C 80  
D 90

55 The measures of the interior angles of a pentagon are $2x$, $6x$, $4x - 6$, $2x - 16$, and $6x + 2$. What is the measure, in degrees, of the largest angle?

A 28  
B 106  
C 170  
D 174

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56. A regular polygon has 12 sides. What is the measure of each exterior angle?
   A. 15°
   B. 30°
   C. 45°
   D. 60°

57. What is \( m\angle 1 \)?

58. What is \( m\angle WZX \)?

59. What is the measure of an exterior angle of a regular hexagon?
   A. 30°
   B. 60°
   C. 120°
   D. 180°
60 A diagram from a proof of the Pythagorean theorem is pictured below.

A diagram showing a right triangle with sides labeled \(a\), \(b\), and \(c\).

Which statement would not be used in the proof of the Pythagorean theorem?

A  The area of a triangle equals \(\frac{1}{2}ab\).
B  The four right triangles are congruent.
C  The area of the inner square is equal to half of the area of the larger square.
D  The area of the larger square is equal to the sum of the areas of the smaller square and the four congruent triangles.

61 A right triangle’s hypotenuse has length 5. If one leg has length 2, what is the length of the other leg?

A  3
B  \(\sqrt{21}\)
C  \(\sqrt{29}\)
D  7

62 A new pipeline is being constructed to re-route its oil flow around the exterior of a national wildlife preserve. The plan showing the old pipeline and the new route is shown below.

A new pipeline diagram showing old pipeline with lengths 60 miles and 32 miles, and new pipeline.

About how many extra miles will the oil flow once the new route is established?

A  24
B  68
C  92
D  160

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63 What is the height of this rectangle?

![Rectangle with sides 8 and 7]

A 1 unit  
B 6 units  
C \(\sqrt{15}\) units  
D \(\sqrt{113}\) units

64 Marsha is using a straightedge and compass to do the construction shown below.

![Construction diagram]

Which best describes the construction Marsha is doing?

A a line through \(P\) parallel to line \(l\)  
B a line through \(P\) intersecting line \(l\)  
C a line through \(P\) congruent to line \(l\)  
D a line through \(P\) perpendicular to line \(l\)

65 Given: angle \(A\)

What is the first step in constructing the angle bisector of angle \(A\)?

![Angle bisector diagram]

A Draw ray \(AD\).  
B Draw a line segment connecting points \(B\) and \(C\).  
C From points \(B\) and \(C\), draw equal arcs that intersect at \(D\).  
D From point \(A\), draw an arc that intersects the sides of the angle at points \(B\) and \(C\).
66. Scott is constructing a line perpendicular to line $l$ from point $P$. Which of the following should be his first step?

A  
\[ \begin{array}{c}
\text{A} \\
\text{B} \\
\text{C} \\
\text{D}
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67. Which triangle can be constructed using the following steps?

1. Put the tip of the compass on point $A$.
2. Open the compass so that the pencil tip is on point $B$.
3. Draw an arc above $AB$.
4. Without changing the opening, put the metal tip on point $B$ and draw an arc intersecting the first arc at point $C$.
5. Draw $AC$ and $BC$.

A  right  
B  obtuse  
C  scalene  
D  equilateral
68. What geometric construction is shown in the diagram below?

A  an angle bisector
B  a line parallel to a given line
C  an angle congruent to a given angle
D  a perpendicular bisector of a segment

69. The diagram shows \( \triangle ABC \).

Which statement would prove that \( \triangle ABC \) is a right triangle?

A  \( \left( \text{slope } \overline{AB} \right) \left( \text{slope } \overline{BC} \right) = 1 \)
B  \( \left( \text{slope } \overline{AB} \right) \left( \text{slope } \overline{BC} \right) = -1 \)
C  distance from \( A \) to \( B \) = distance from \( B \) to \( C \)
D  distance from \( A \) to \( B \) = \(-\) (distance from \( B \) to \( C \))
Figure $ABCO$ is a parallelogram.

What are the coordinates of the point of intersection of the diagonals?

A $\left(\frac{a}{2}, \frac{b}{2}\right)$

B $\left(\frac{c}{2}, \frac{b}{2}\right)$

C $\left(\frac{a+c}{2}, \frac{b}{2}\right)$

D $\left(\frac{a+c}{2}, \frac{a+b}{2}\right)$

What type of triangle is formed by the points $A(4, 2)$, $B(6, -1)$, and $C(-1, 3)$?

A right

B equilateral

C isosceles

D scalene

The point $(-3, 2)$ lies on a circle whose equation is $(x + 3)^2 + (y + 1)^2 = r^2$. Which of the following must be the radius of the circle?

A 3

B $\sqrt{10}$

C 9

D 10
73. What is the length of line segment $PQ$ shown below?

![Graph showing points P and Q with coordinates (0, 1) and (8, 7) respectively.]

- A 9 units
- B 10 units
- C 13 units
- D 14 units

74. In the figure below, if $\sin x = \frac{5}{13}$, what are $\cos x$ and $\tan x$?

![Right triangle with angle x and sides labeled 5, 12, and 13.]

- A $\cos x = \frac{12}{13}$ and $\tan x = \frac{5}{12}$
- B $\cos x = \frac{12}{13}$ and $\tan x = \frac{12}{5}$
- C $\cos x = \frac{13}{12}$ and $\tan x = \frac{5}{12}$
- D $\cos x = \frac{13}{12}$ and $\tan x = \frac{13}{5}$

75. In the figure below, $\sin A = 0.7$.

![Right triangle with angle A and sides labeled 21 and unknown side AC.]

What is the length of $AC$?

- A 14.7
- B 21.7
- C 30
- D 32

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76. Approximately how many feet tall is the streetlight?

\[ h = \frac{\sin 40^\circ}{\cos 40^\circ} \times 20 \text{ ft} \]

\[
\begin{align*}
\sin 40^\circ & \approx 0.64 \\
\cos 40^\circ & \approx 0.77 \\
\tan 40^\circ & \approx 0.84
\end{align*}
\]

A 12.8  
B 15.4  
C 16.8  
D 23.8

77. Right triangle \( ABC \) is pictured below.

Which equation gives the correct value for \( BC \)?

A. \[ \sin 32^\circ = \frac{BC}{8.2} \]
B. \[ \cos 32^\circ = \frac{BC}{10.6} \]
C. \[ \tan 58^\circ = \frac{8.2}{BC} \]
D. \[ \sin 58^\circ = \frac{BC}{10.6} \]
78. A 13-foot ladder is leaning against a brick wall. The top of the ladder touches the wall 12 feet (ft) above the ground. The bottom of the ladder is 5 ft from the bottom of the wall. What is the sine of the angle formed by the ground and the base of the ladder?

\[
\frac{5}{12} \quad \text{A} \\
\frac{5}{13} \quad \text{B} \\
\frac{12}{13} \quad \text{C} \\
\frac{13}{5} \quad \text{D}
\]

79. In the accompanying diagram, \( m\angle A = 32^\circ \) and \( AC = 10 \). Which equation could be used to find \( x \) in \( \triangle ABC \)?

\[
\begin{align*}
\text{A} & \quad x = 10 \sin 32^\circ \\
\text{B} & \quad x = 10 \cos 32^\circ \\
\text{C} & \quad x = 10 \tan 32^\circ \\
\text{D} & \quad x = \frac{10}{\cos 32^\circ}
\end{align*}
\]
80. The diagram shows an 8-foot ladder leaning against a wall. The ladder makes a $53^\circ$ angle with the wall. Which is closest to the distance up the wall the ladder reaches?

\[
\sin 53^\circ \approx 0.80 \\
\cos 53^\circ \approx 0.60 \\
\tan 53^\circ \approx 1.33
\]

A. 3.2 ft 
B. 4.8 ft 
C. 6.4 ft 
D. 9.6 ft

81. Triangle $JKL$ is shown below.

Which equation should be used to find the length of $JK$?

A. $\sin 24^\circ = \frac{JK}{28}$ 
B. $\sin 24^\circ = \frac{28}{JK}$ 
C. $\cos 24^\circ = \frac{JK}{28}$ 
D. $\cos 24^\circ = \frac{28}{JK}$
82. What is the approximate height, in feet, of the tree in the figure below?

- **Diagram**: A tree with a height marked as 100 ft and an angle of 50°.

- **Trigonometric Ratios**:
  - \( \sin 50° \approx 0.766 \)
  - \( \cos 50° \approx 0.643 \)
  - \( \tan 50° \approx 1.192 \)

- **Options**:
  - A. 64.3
  - B. 76.6
  - C. 119.2
  - D. 130.5

83. What is the approximate value of \( x \) in the triangle below?

- **Diagram**: A right triangle with an angle of 35° and a side of 6 units.

- **Trigonometric Ratios**:
  - \( \sin 35° \approx 0.57 \)
  - \( \cos 35° \approx 0.82 \)
  - \( \tan 35° \approx 0.7 \)

- **Options**:
  - A. 3.4 units
  - B. 4.2 units
  - C. 4.9 units
  - D. 7.3 units
84 If $a = 3\sqrt{3}$ in the right triangle below, what is the value of $b$?

85 What is the value of $x$ in the triangle below?

- A 5
- B $5\sqrt{2}$
- C $10\sqrt{3}$
- D 20
86. What is the value of $x$, in inches?

![Triangle with angles and side lengths]

- A $7\sqrt{3}$
- B 14
- C $14\sqrt{3}$
- D 21

87. A square is circumscribed about a circle. What is the ratio of the area of the circle to the area of the square?

![Circle with chord lengths]

If $AE = 5$, $BE = 12$, and $CE = 6$, what is the length of $DE$?

- A 7
- B 9
- C 10
- D 13
89. \( \overline{RB} \) is tangent to a circle, whose center is \( A \), at point \( B \). \( \overline{BD} \) is a diameter.

What is \( m\angle CBR \)?

A 50°  
B 65°  
C 90°  
D 130°

90. In the figure below, \( \overline{AB} \) is tangent to circle \( O \) at point \( A \), secant \( \overline{BD} \) intersects circle \( O \) at points \( C \) and \( D \), \( m\angle AC = 70^\circ \), and \( m\angle CD = 110^\circ \).

What is \( m\angle ABC \)?

A 20°  
B 40°  
C 55°  
D 70°
91. In the circle shown below, the measure of \( \overarc{PR} = 140^\circ \) and the measure of \( \angle RPQ = 50^\circ \).

What is the measure of \( \overarc{PQ} \)?

A. 50°
B. 60°
C. 70°
D. 120°

92. \( \overline{QS} \) is a diameter of the circle below, and \( \overline{QS} \perp \overline{PR} \).

If \( m\overarc{PQR} = 106^\circ \), what is \( m\overarc{PS} \)?

A. 53°
B. 74°
C. 106°
D. 127°

93. The vertices of \( \triangle ABC \) are \( A(2, 1), B(3, 4), \) and \( C(1, 3) \). If \( \triangle ABC \) is translated 1 unit down and 3 units to the left to create \( \triangle DEF \), what are the coordinates of the vertices of \( \triangle DEF \)?

A. \( D(0, 1), E(1, 2), F(1, 3) \)
B. \( D(0, -1), E(0, 3), F(-2, -2) \)
C. \( D(-2, 2), E(0, 3), F(-1, 0) \)
D. \( D(-1, 0), E(0, 3), F(-2, 2) \)
94 If triangle $ABC$ is rotated 180 degrees about the origin, what are the coordinates of $A'$?

A $(-5, -4)$
B $(-5, 4)$
C $(-4, 5)$
D $(-4, -5)$

95 Trapezoid $ABCD$ below is to be translated to trapezoid $A'B'C'D'$ by the following motion rule.

$$(x, y) \rightarrow (x + 3, y - 4)$$

What will be the coordinates of vertex $C'$?

A $(1, -3)$
B $(2, 1)$
C $(6, 1)$
D $(8, -3)$
Which expression describes the translation of a point from \((-3, 4)\) to \((4, -1)\)?

- A 7 units left and 5 units up
- B 7 units right and 5 units up
- C 7 units left and 5 units down
- D 7 units right and 5 units down
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